The quest for organizational flexibility

Driving changes in business processes through the identification of relevant context

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Abstract

Purpose – The purpose of this paper is to propose a method for identifying business process-relevant contextual information that is likely to impact on the process goal. The ORGANON method describes a semi-structured procedural guide alongside with a set of criteria and a matrix for analyzing ontological transactions, which can be used to identify which context information can be considered relevant to a business process.

Design/methodology/approach – The authors report on an evaluation of the ORGANON method through a case study conducted in an organization that works in the social security domain.

Findings – The results provide evidences of the feasibility of the method application in this scenario.

Originality/value – Our research contributes to the literature on business processes flexibility, specifically through a proposal for context identification that can be extended to current techniques for business process modeling and in turn forms the basis for existing approaches for making business processes more flexible. The work has implications for the strategic management of organizations, by suggesting a method that provides informational support to decision makers about when, where and why business processes need to be adapted.

Keywords Strategic management, Process management, Context, Process design, Business process, Process flexibility, Contextual element, Internal context, Immediate context, Context awareness

Paper type Research paper

1. Introduction

Supporting business feasibility and competitiveness has been a major challenge in today's corporate world in the face of constant changes that arise within and outside an organization. The traditional strive for operational efficiency has long been replaced by a need for exploiting an organization's ability to flexibly change in reaction to changes in their environment (Monteiro and Macdonald, 1996; O'Reilly and Tushman, 2004). The need for organizational flexibility has become more and more prevalent as, among other aspects, laws, rules, technology, environment, strategies, norms, culture, behaviors and decisions have become increasingly difficult to be monitored, and are continuously affecting business processes and impacting operational and strategic goals. In fact, as early as in 1999 were environmental changes found to be key drivers for business process change projects (Kallio *et al.*, 1999).

The literature classifies these and other aspects in the wider environment of a business organization as its context (Rosemann *et al.*, 2008). Vieira (2008) defines context as the basis for differentiating one situation from another, and characterize

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entities and events. The emergence of understanding context in the implementation of process-aware information systems (IS), such as ERP technology as well as the effects of some variables within a business process structure, has been stressed in IS literature since a long time (e.g. Kallio *et al.*, 1999; Avgerou, 2001; Urquhart, 2001; Kirsch, 2004; Nandhakumar *et al.*, 2005; Srivardhana and Pawlowski, 2007; Staehr *et al.*, 2012). Venkatesh *et al.* (2011) contend that there is a strong interest in IS and Business Management research "to give a richer treatment to context in theorizing," since, for example, users apply different decision-making processes depending on the context and the design of IS could be improved including contextual variables.

Kallio *et al.* (1999) studied results from business process reengineering projects and one of their conclusions was about how external and uncontrollable drivers, as for example, tighter economic conditions, new legislation or advances in technology, could be traced by changes in business and operations strategies. Urquhart (2001) emphasized the relevance of context variables in early IS requirements gathering. Among other outcomes, her studies concluded that the process is totally dependent of context. While discussing the relationship between process innovation and ERP systems, Srivardhana and Pawlowski (2007) recognize the importance to reflect adaptations occurred in processes into IS. Even so, some types of changes in business processes are also possible without modifications to the system itself.

In business process management, the quest for organizational flexibility has been encompassed in the notion of context-aware business process management (Rosemann *et al.*, 2008), which subsumes approaches for monitoring all relevant information that are required for, and support, flexible business processes, and in context-aware process mining, which subsumes approaches that capture and analyze information about running processes within their context (Günther *et al.*, 2008). A context-aware business process can be understood as a process that can sense and react to changes in the context that force a business process execution to vary (Rosemann *et al.*, 2008).

A key technique in context-aware management of business processes is process modeling (Recker *et al.*, 2009), which is a practice used to visualize and formally describe current (as-is) and redesigned (to-be) business processes. Traditional approaches to modeling (such as BPMN, EPC, UML and others), however, tend to be limited to the representation of the most common occurrence scenarios of the process, in turn underestimating the need to keep the models updated based on the monitoring of process instances, so as to represent the dynamic characteristic of a business process in relation to its wider environment. Research carried out in this field (e.g. Saidani and Nurcan, 2007) has repeatedly argued that business processes modeling should go further, pointing out the need to also take into account environmental elements that impact process goals in real time – under the assumption that these elements, somehow, can be identified and monitored.

In this paper, we present a method to identify the contextual elements of a business process that might impact on business goal. Our ORGANON method is fundamentally based on the analysis of a process model, and consists of a set of systematic steps aimed at putting in evidence context information considered relevant to a business process. First, the essential activities are discovered, and then their main attributes are examined in face of the definition of variation provided by the method.

We also report on an evaluation of the ORGANON method through a case study conducted in an organization that works in the social security domain. The results provide some indication of the feasibility of the method application in this scenario.

Our approach can be distinguished from others in the literature (e.g. Saidani and Nurcan, 2007; Rosemann *et al.*, 2008; Heravizadeh and Edmond, 2008; Ploesser *et al.*, 2009; Ramos *et al.*, 2011), which typically propose to manage context within a business process under the assumption that contextual information is already known. Our work addresses this assumption explicitly, providing a method to identify those contextual elements. We argue that the identification contributes both to the formalization as to the management of context information for flexible business processes, and in turn, our method provides input required by other approaches in the literature.

The paper is organized as follows: Section 2 reviews the background for our research; Section 3 presents the method ORGANON; Section 4 describes the results from the case study; Section 5 discusses related work that we compare with our approach; and, finally, Section 6 concludes with final remarks and outlook to future work.

2. Background

Four areas of work are relevant to the development of the ORGANON method. First, we need to understand the mechanisms organizations employ to identify, formalize and analyze their business processes. Second, we need to understand which context of an organization might be relevant to the execution of such business processes. Third, we need to understand how context itself can be modeled and analyzed. Finally, we need to understand the building blocks of context and processes (what we will call the process essence) to be able to relate these notions. We discuss each element, in turn.

2.1 Formalization of business processes

According to Weske (2007), business processes describe sets of activities performed in a coordinated/collaborative manner in a (multi-) organizational and technical environment with the view to achieve a dedicated business goal. These business processes are typically identified and formalized using process modeling techniques – semi-formal grammars that express graphically relevant aspects of business processes, such as the tasks that have to be performed, the actors that are involved in the execution of these tasks, relevant data and, notably, the control flow logic that describes the logical and temporal order in which tasks are to be performed (Mendling *et al.*, 2012).

Current approaches to process modeling typically consider only internal aspects of business process – internal actors, internal IT systems, internal data and other elements within an organization. However, Melão and Pidd (2000) proposed a taxonomy of business process viewpoints, in which the interaction of internal components and the interaction of the process with its environment is highlighted. In turn, flexibility of a business process is limited to changes in those (internal) variables that were considered during the design of a process model. Rosemann *et al.* (2008) and Schönenberg *et al.* (2008) have recently argued that flexibility is an important requirement in business process design. Rosemann *et al.* (2008) state that extrinsic drivers, which they classify as context, are the root cause that really stimulates the demand for more flexible processes. The literature indicates context as a source of information that should be taken into account in the modeling of business processes in order to contribute to their flexibility when in the execution phase.

2.2 Analysis of relevant organizational context

Theodorakis *et al.* (2002) highlighted the relevance of the concept of context in many research areas such as cognitive psychology, linguistics, IS and computer science. One key

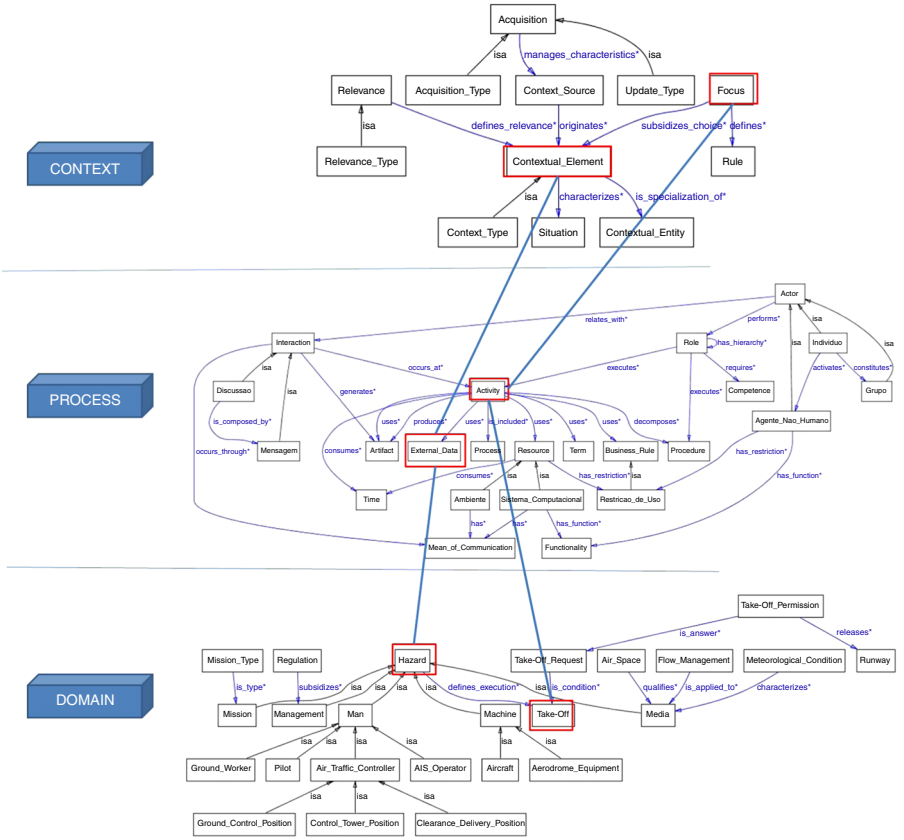
conclusion was that there are a number of formal or informal expressions of a notion of context have appeared. While discoursing about situated work practices and the ubiquitous computing environments, Lindgren *et al.* (2008) identify the concern of context, by arguing that acquisition, interpretation and meaningful use of context information is challenging, as a result of the interactive processes performed by individuals or groups who might consistently make over such information into action. Moreover, the authors conclude that a central issue for IS research and practice is to advance the current understanding of how IT systems can allow such organizations to be sensitive to the contextual settings in which they operate, so that their operations can be attuned to these variations.

Through an analysis of 150 context definitions, Bazire and Brézillon (2005) concluded that the content of all can be analyzed in terms of parameters such as restriction influence, behavior, nature, structure and system. In this paper, we use the definition proposed by Brézillon and Pomerol (1999), who established a conceptual model where context is always related to a focus of attention. The focus, not isolated from the context, determines what is relevant, and might represent a task, or a stage while solving a problem or making a decision. The context is then classified into three distinct parts: contextual knowledge, external knowledge and proceduralized knowledge. Contextual knowledge is the relevant knowledge that has a strong relationship with the focus. External knowledge is the part of the knowledge that has no relevance to the focus, it is not necessary to support a task. Proceduralized knowledge is the subset of contextual knowledge that is invoked, organized, structured and situated according to the focus, being used to support the focus.

In accordance with the concepts proposed by Brézillon, Vieira *et al.* (2007) distinguished between the concepts of contextual element (CE) and context. Contextual element represents data, information or knowledge that characterizes something within a domain. Context is the set of instantiated contextual elements that have some sort of link characterizing a situation in relation to this focus. As so, contextual element is a type of data (contextual knowledge) related to a focus, and, the general concept of context is proceduralized knowledge, i.e. a real case. Therefore, the identification of the context of a process activity (as a focus of attention) involves the distinction of which contextual elements characterize it. For example, "Location" and "Time" can be considered as contextual elements for the activity "Attend class," while "Room 1202" and "13:00" combined together characterize the context for one specific instance of that activity, that might help a student to decide what time to leave home to arrive in time that class.

2.3 Definition of context

Mattos *et al.* (2014) proposed a formal description for the concepts defined by Brézillon and reviewed by Vieira, to characterize specifically the context of a business process in a given domain. The approach is based on conceptual metamodels, represented by ontologies structured in layers: Context, Business Process and Domain (Figure 1). The first and second layers are independent of the domain. The Context metamodel defines the semantics of the core concepts used to build context models. The Business Process metamodel describes the elements that should be used to represent a process. The Domain metamodel layer includes defining data structure, functions, relationships and constraints of a specific knowledge area (which implies that for each domain, a different model is built). Figure 1 shows an example in the Air Traffic Control domain, where the concept Harzard, which was modeled within the process as External Data, was considered as a contextual element.



Source: Mattos *et al*. (2014)

Figure 1.
Metamodel for context in business process

The work of Mattos *et al.* (2014) was taken as background for this research since it defines formally the concept of contextual element related to Context, and moreover explicitly links it to some process attribute (such as the External Data, in this case). From this point, it is still necessary to provide foundation for two issues: the type of contextual element to be considered, and the activities of the process to be analyzed.

Rosemann *et al.* (2008) proposed a framework for a better understanding of the different types of context and its impact on business processes. The so-called Onion framework distinguishes four types of context: immediate (e.g. organizational resources responsible for the execution of the activities), internal (e.g. resources, rules, values, concepts, interests, strategies, structure and culture), external (e.g. vendors, investors, competitors and customers) and environmental (e.g. society, nature, technology and economics). Consistent with this classification, we are restricting our investigation to the immediate and internal context of a process.

2.4 Ontological building blocks of context and processes

According to the conceptual model of context adopted here, the process activity should be taken as focus to which context will be related to. Nevertheless, a process can have a

great number of activities making it difficult to determine an adequate focus of attention. Thus, another conceptual reference was considered in our research to support this issue: the definition of the process essence.

Sharp and McDermott (2010) claim that it is important to identify those activities that impact on the business process goal, considering them as essential to business. In this sense, the works of Ould (2005) and Reijswoud *et al.* (1999) provide insights on what to consider while designing a process.

Ould (2005) discusses the concept of process architecture, and shows the different types of process in an organization and its dynamic. He claims that an inefficient organization of activities might critically compromise the process design. Thus, it is necessary to find the natural paths and units of work that are essential business processes. He starts from the Essential Business Entity (EBE). An EBE is the physical or abstract characterization of the business in which the organization operates, i.e., the essential elements of the business, which should necessarily be handled by the processes. To discover the EBEs, the author presents a method that begins with the application of a brainstorming session, during which, a structured, objective and non-exhaustive set of questions are presented to lead the discussion. A preliminary list of potential EBE is obtained and then, filters are applied to clean the big list and concentrate in those items which are really essential.

Another approach was established by Reijswoud *et al.* (1999) and Dietz and Hoogervorst (2008): a methodology that indicates the essential structure of business processes through the identification of ontological building blocks (Figure 2).

Ontological building blocks are composed of two actors: the initiator (client/applicant) and the executor, who basically acts performing roles of coordination (C-acts: decision-making) and production (P-acts: production of "new things"); they relate to each other through four phases of an ontological transaction:

(1) Request – C-act to request, require, demand, induce, encourage, invite or claim something to someone. Such activities are typical of the initiator. Example: activity "Send complaint."

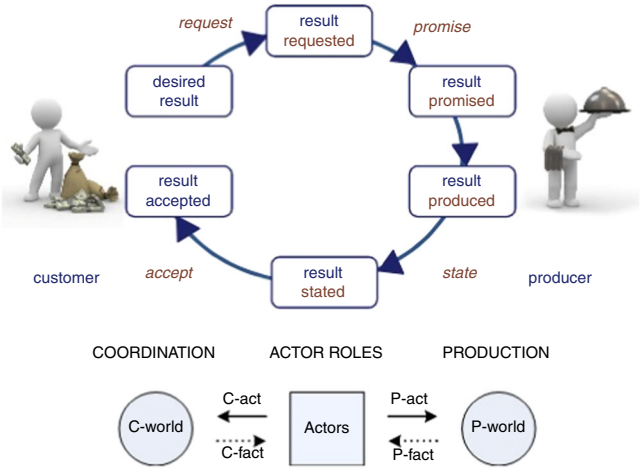


Figure 2.
Ontological transaction pattern

Source: Adapted from Dietz and Hoogervorst (2008)

(2) Promise – C-act to ensure, commit to running or performing other activities. In general, they are activities that require decisions. Such activities are typical of the executor, often with the participation of the initiator to reach consensus on what the P-act will produce. Example: activity "Check if the complaint received proceeds."

(3) State – P-act to perform/execute activities. Such activities are typical of the executor. Example: activity "Prepare response to the complaint received."

(4) Accept – C-act to address or receive the result of an activity execution. Such activities are typical from the executor, often with the participation of the initiator to reach consensus on what the P-act actually produced. Example: activity "Accept answer to the complaint".

According to Dietz and Hoogervorst (2008), through the basic transaction pattern (the ontological building blocks or workflow loop), it is possible, in a concise manner, to reveal the essential model of an organization (the main aspects of its construction and operation). The activities that perform the essence of a process seem to be good candidates to be the focus of attention for this process as we propose in the method described in next section.

3. The ORGANON method

This section presents the ORGANON method, which we propose for the identification of immediate and internal contextual elements in business processes, through the analysis of available process models. The method is based on the following concepts:

- essential activity, derived from Sharp and McDermott (2010);
- EBE, derived from Ould (2005); and
- ontological transactions, from the work of Dietz and Hoogervorst (2008).

We specify the method in terms of a semi-structured procedural model, which comprises two main steps: identify the business process essential activities and analyze the impact of their attributes on a business process goal. The method aims at distinguishing, among the number of types of information provided in a process model, the set of attributes that could potentially undermine the goal of this process, and which should thus be classified as context. We use the term "attribute" here as an element associated with an activity in a process model (e.g. business rule, artifact, system and input/output data).

Our method is based on two main assumptions: the business process is specified in a process model as an instantiation of the Business Process metamodel presented by Mattos *et al.* (2014); the purpose of the business process must be explicit, at least in natural language format. Both assumptions are realistic, and can be achieved through simple model transformation and goal specification activities in terms of violations.

The method is intended to be applied by a business analyst. Figure 3 provides a graphical model of the ORGANON method in the form of process tasks, and describes the two steps alongside with relevant inputs and the outputs produced.

A semi-structured guide (see the list below) was designed to support the execution of the method, stimulating the analysis of the business process model. The questions were adapted from the work of Ould (2005), in order to discover the EBE. A list of EBE candidate is obtained at first, and then, filters also adapted from Ould (2005) are applied to end up with the essential items.

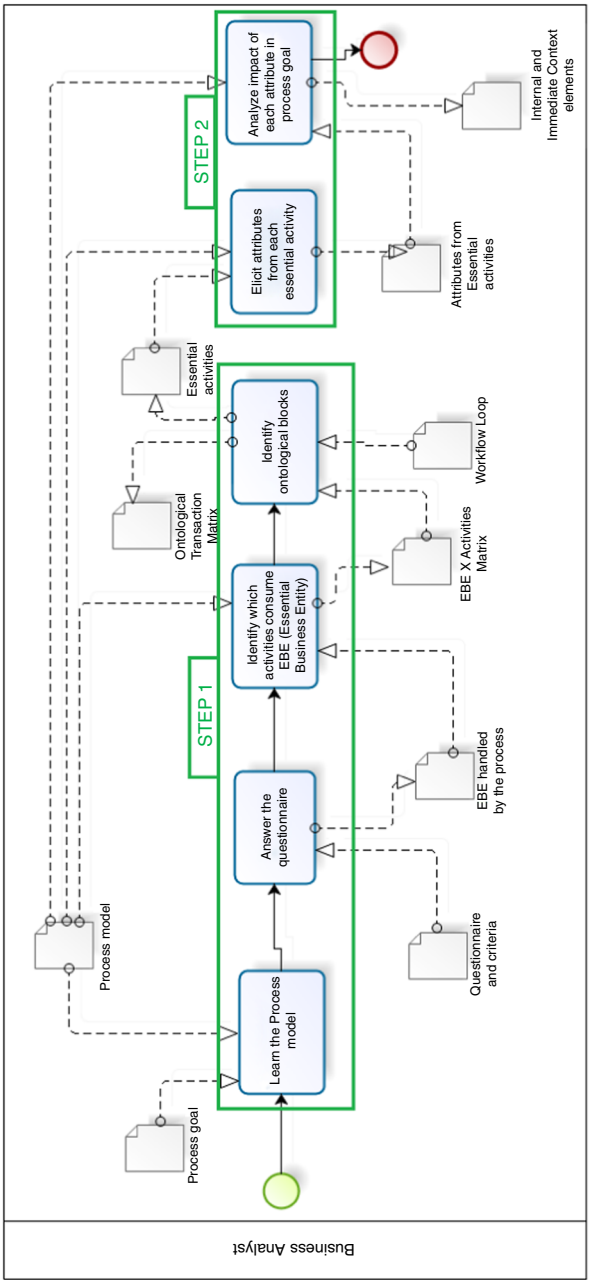


Figure 3.
ORGANON method procedural model

Semi-structured guide developed based on Ould (2005):

- What is the final outcome expected by the process?
- Which business rules, from the process information perspective, are necessary to the process?
- Which are the criteria to be followed in order to execute the process?
- What resources are necessary to the process?
- Which are the intermediate outputs generated by the process?
- What are the inputs to the process?
- What events from external environment need to be answered by the process?
- Are there conditions, artifacts, products, services, information, that the clients need, that could be key to the process?
- Which items does the process deal with during its execution?

The steps of ORGANON are described in detail as follows.

3.1 Step 1 – identify the essential activities of a business process

In the ontology proposed by Mattos *et al.* (2014), the activity class represents the work to be done. Sharp and McDermott (2010) indicate that a business process is composed of many activities, but only some of which are deemed essential, because they have a direct influence on its goal. Accordingly, the method proposed here takes as a starting point of the essential activities, thus establishing the route to reach the critical elements potentially impacting the goal of a business process. To identify such activities, the method uses the concept of EBE established by Ould (2005), as well as the Enterprise Ontology defined by Dietz and Hoogervorst (2008).

This step includes the first four activities from ORGANON. The first and second activity of this step provide the answer to the set of questions (see "Semi-structured guide") from the process model; the result being a preliminary list of EBE candidate. The list, which reproduces a first hint of the objects handled by the process, needs to be revised for eliminating all items that are not related to the essence of the process, according to the approach adopted here. In this sense, the method makes use of five criteria (filters), to be applied sequentially over the entire EBE candidate list. To perform this activity, the business analyst should apply one criterion at a time, in each EBE list. The set of five criteria comprises three filters already defined by Ould (2005), and two new criteria:

(1) Application of a definite or indefinite article at the beginning of each EBE to exclude everything not regarded as a noun (thing) from the preliminary list (Ould, 2005).

(2) Inquiry about each EBE remaining, if they are a quality or constrain of the process and exclude it (Ould, 2005).

(3) Verification whether each EBE features a resource for the process, and if so, should be excluded from the list.

(4) Verification whether each EBE represents a role to be assigned to activities in the process. If so, they should be excluded from the list (Ould, 2005).

(5) Verification whether each EBE remaining in the list represents an input or output of any activity. If so, they should remain on the list.

Each EBE in the final list should now be associated to the activities of the process in the third activity of Step1. Then, it is necessary to observe, among those activities, the existence of ontological transactions representing essential structures of the process.

The business analyst performs the fourth and final activity of Step 1, returning to the process model to highlight the activities identified previously and analyze them against the ontological building blocks model, trying to observe the existence of ontological transactions. Then, he/she builds an ontological transaction matrix, registering the relationship that keeps these activities together. Thus, it is necessary to consider whether these activities form clusters that represent complete cycles of an ontological transaction. A complete cycle of an ontological transaction is characterized by at least one activity in each phase. Activities that do not comprise a complete cycle should be eliminated.

Table I illustrates an example of ontological transaction matrix for a fictitious process of "Analysis of accident" that includes the activities "Submit request for payment of a claim," "Check data and information for grant claims," "Generate analysis of accidents," "Accept answer about the accident," "Confirm receipt of Occurrence Document" and "Calculate loss." Notice the presence of a complete cycle of the ontological transaction is related to activities "Submit request for payment of a claim," "Check data and information for grant claims," "Generate analysis of accidents" and "Accept response on accidents," since each of these belong to one of the four phases and form together a cycle that aims to achieve the goal "to get consistent advice in cases of confirmation or denial of payment of claims." Therefore, these activities should be considered essential activities of this process. Activities "Confirm receipt of Occurrence Document" and "Calculate loss" can be considered as complementary activities. Therefore, according to our proposal, they should be discarded.

At the end of Step 1, the essential activities of a business process are identified. These activities will now be used as the focus for monitoring relevant contextual elements; therefore their attributes should be examined in detail.

3.2 Step 2: analyze the impact of business process attributes on the process goal

Knowing the essential activities of the business process identified in Step 1, it is possible to start the search for immediate and internal attributes potentially impacting on the goal of this process. This step includes the last two process activities from ORGANON. In the first activity of Step 2, the business process model is again examined by a business analyst, in order to list inner attributes related to each of the activities identified in Step 1 (e.g. all the inputs and outputs in the business process activities modeled, external data, artifacts, business rules, among others classified by Mattos *et al.*, 2014). Then the business analyst performs the second activity, analyzing the impact that these attributes have on the goal of the process. The impact analysis

Table I. Ontological transaction matrix example

	Ontological transaction – analysis of accident process activities			
	C-ACT		P-ACT	C-ACT
Actor	Phase: request	Phase: promise	Phase: state	Phase: accept
Initiator (insured person)	Submit request for payment of a claim			Accept response on accidents
Executor (insurance company)		Check data and information for grant claims	Confirm receipt of occurrence document generate analysis of accidents calculate loss	

verifies what may occur with the goal of process (achieved/not achieved) if the value of an attribute varies in an unpredictable way. If a variation of an attribute characterizes a new unforeseen situation for this process and prevent the achievement of its goal, then this attribute should be considered an immediate or internal contextual element. At this stage, the business analyst should build a table, following the model presented in Table II, in order to assist him/her in organizing the analysis.

It was necessary to introduce the concept of "variation" for all the attributes in a process model in order to perform the impact analysis, i.e., to be able to evaluate them against the process goal. Creating those definitions would make it possible to ensure, the same understanding of attributes variation for every analyst, and so, decrease different interpretations about the same issue analyzed. Examples of the definitions of variation are given for some attributes:

(1) Artifact

- Description: concrete product resulting from the execution of an activity that can serve as input to other activities (Nunes *et al.*, 2009). It may be material (like something manufactured) or immaterial (as a concession of a claim, or a digital record of customers), requiring a technical specification.
- Domain (possible values): any non-compliance against the specification of the artifact.
- Variation: an artifact may vary when one of its properties (completeness, correctness and consistency) changes in a given process instance.
- Example: using artifact "Customer digital record" as an example, the variation must be considered for completeness, correctness and consistency of the data for a given customer. That is, if in a given instance of a client record is incomplete, incorrect or inconsistent, then, this fact should be considered as a variation of this attribute.

(2) Business rule

- Description: information that defines or constrains some aspect of the business. It might concern to the organization as a whole or to a specific domain. The business rules ensure the business structure or influences its behavior. It can match internal constraints, as productivity standards, or meet the goals or the external constraints, such as laws and regulations (Nunes *et al.*, 2009). Its nature is immaterial (as a set of criteria, restrictions or definitions).
- Domain (possible values): changes in the content (statement) of a business rule.
- Variation: a business rule can vary when the statement that describes it might alter a normal path of given process instance.

Essential activity	Attributes related to the activity	Attribute class	If the value of the attribute varies, the goal of the process will be affected?
< Activity name >	< Attribute name >	< Class name >	< Yes or No >
Check data and information for grant claims	Insurance payment request	Artifact	Yes

Table II.
Impact analysis matrix model

- Example: using the business rule "regulation" that includes a set of criteria, the change should be considered as the revision of these criteria (inclusion, exclusion or modification of criteria). That is, if during a given instance execution, a "regulation" is revised, then this fact should be considered as a variation of this attribute.

Consider the above example of the process. The attribute "Insurance payment request," classified as an artifact, consumed by the essential activity "Check data and information for grant claims" can include, for example, some data or information unexpected by the process. For example, this artifact is expected to provide the approximate time of the accident occurrence. However, when filling out the request, the informant forgot to inform that time was during the daylight saving period. This means that these data are not consistent (consistency is one of the possible variations of artifact as defined above), and might provoke problems with the evidence checking during the process execution (which this way might not achieve its goal). Therefore, it is considered as a variation of this attribute that, due to preventing the achievement of the process goal, should be classified as a contextual element and should be monitored (Line 3 of Table II).

Table III summarizes the relevant information/data that a business analyst needs to gather when instantiating this method, i.e., all the inputs necessary.

Having described the key elements of the ORGANON method, we now proceed to a preliminary evaluation of the method through a case study in real organization. This way, we can also illustrate the application of the method as well as discuss the limitations of the proposal.

4. Method evaluation

We conducted a case study following established guidelines (Yin, 2009) in order to apply the method ORGANON in a real setting, and obtain evidence for its validity and applicability. To strengthen the data from the case study, we further obtained data

	Details	Explanation
Relevant information/data for the method		
Process model	Diagrammatic view	The model could be designed in any notation as far as the information about activities and their attributes is provided
Process goal definition	Description	The process goal could be described in any language
For each activity, at least the following attributes		
Description	Textual or diagrammatic view	The description of the activity is necessary so that the analyst can understand it and decide if it is part of an ontological transaction
Business rules	Textual or diagrammatic view	Business rules should be described in an unambiguous format
Inputs/outputs (data, artifacts)	Textual or diagrammatic view	The specification of the expected content should be provided
Resources	Textual or diagrammatic view	The specification of the expected content should be provided
Events (initial, intermediary, final)	Textual or diagrammatic view	Events are placed as part of the model diagram

Table III.
Inputs for the method commented

through *post hoc* interviews with four professionals in the field: three managers and one senior technician who carry out activities related to the process within the case organization. They all work in the business for at least 15 years and thus, may be considered subject matter experts. In general, the interviews lasted about two hours and were supported by a script, which served as a guide to investigate issues about the knowledge modeling process and the process in question. The statements and responses were tabulated and compared in order to be identified coincident relations between: situations where the process does not reach its goal and those attributes identified as immediate/internal contextual elements when applying the ORGANON.

The method was applied to a particular business process model, for which there were a number of instances already performed, characterizing the study as a single case study. Data collected for analysis, i.e., the essential activities and contextual elements identified, as well as the responses from the interviews were obtained, respectively, from the analysts that were asked to perform the method, and process managers who were interviewed. The evaluation was done by comparing the results obtained by applying the method with the impressions collected in the interviews.

4.1 Case description

The company, called from now on FPC for reasons of confidentiality, operates in the area of social security (pension funding). FPC is a medium-sized non-for-profit organization headquartered in Rio de Janeiro, Brazil, and has been in existence for over 35 years. In its early days, it started its activities by offering a single pension plan, restricted to employees of a particular business conglomerate. Accompanying the growth and evolution of the insurance market during the last decades, it has expanded its range of products through various marketing plans for companies other than those belonging to the initial cluster.

4.2 Process description

In order to enable a meaningful evaluation of ORGANON, we needed to identify a suitable process from the set of operations ran by FPC to fulfill its mission: "To provide products and services with a focus on security, adequate to the expectations of its participants, sponsors and founders, managed with efficiency, transparency and social responsibility."

We selected the process "Grant DC/VC retirement" from the main business processes of FPC. DC and VC are two types of pension plans: Defined contribution and Variable contribution. In both cases the contribution value is determined in advance, but the benefit is determined only at the time of retirement according to the accumulated funds in the account of the participant. However, in VC mode, a minimum benefit value is guaranteed. The process model was designed using the System Architect tool[1], using the industry-standard BPMN notation (Recker, 2010). The model describes the process with 18 activities. Basically, the process is run by calculation and grant of benefits sector experts, except for the activities of approval/rejection of requests for benefits, which are run by managers. For each benefit request, the process runs an instance.

The process has also an interface with two other processes, also modeled:

(1) "Controlling input and output of benefits," in which the requests are gathered and are filed for applications and retirement benefit; and

(2) "close payroll benefit," in which requests for deferred pensions required are effectively paid.

The process is partially automated, supported by a configurable system that integrates key business processes of the company. The process model is mainly accompanied by the following documents: process diagram (as-is), regulations and VC and DC plans, and a textual procedure. Although the goal of the process is nowhere explicitly stated, it was known by all the process stakeholders. For our purposes, we formalized it and validated with the former process manager as: "to ensure an efficient and correct analysis to grant retirement DC/VC plans." The company has an impressive variety of plans for both modalities, which makes the process complex due to the specific rules for each pension plan contemplated. The final result is the approval or rejection of a request for a specific retirement plan.

For the purposes of this case study, we considered two activities of the process "Control input and output of benefits," because these activities provide the input and output attributes for the process studied. That is, the attribute "Concession request for DC/VC benefit" of the activity "Request retirement benefit" from the process "Control input and output of benefits" is registered and routed through the system that supports the process to the Calculation of Benefit Department, which starts the process "Grant DC/VC retirement." In other hand, the attribute "Approval/rejection retirement letter," produced in the process studied is also input for the activity "Forward letter of Approval/rejection letter and standard letter" for the process "Control input and output of benefits."

4.3 Method application

The proposed method was applied to the "Grant DC/VC retirement" process by two analysts: the first is an expert in data management and the second is a system analyst. Both had participated in the modeling of the process selected. The analysts were trained by the researcher, who also provided written guidelines for the application of the method, highlighting two points: consider the two activities that were not directly spelled out in the process model and observe the process goal stated. The researcher did not participate directly in the application of method but instead remained an independent observer; interactions with the analysts were only made via telephone, for purposes of clarification and instruction, where required:

- Step 1: Findings

The Step 1 refers to the identification of the essential activities. It is initiated through a list of questions regarding the process; the responses are filtered through the application of five criteria, until the list of EBE and their associated activities is obtained. Tables IV and V show the list of EBE and associated activities produced by each analyst.

At the end of the Step 1, the activities associated with each EBE are analyzed against the ontology building blocks model in order to identify the essential activities of the business process. Tables VI and VII show the ontological transaction matrix created by the Analyst 1 and Analyst 2, respectively. The activities listed in these tables are considered essential to the process.

- Step 2: Findings

Step 2 refers to the impact analysis that the attributes of the essential activities have on the business process goal. Each analyst has examined once more the process model, listed and classified the attributes of each activity, and then inferred what would happen in relation to the goal if the value of these attributes varies in a process instance, characterizing a new situation. In order to minimize subjectivity, the analysis was based on the definitions proposed in Section 3.2. For instance, the rationale applied,

EBE list	Activities related
Income tax option	Generate retirement calculation statement
Partial balance redemption option	Check retirement calculation statement
Period for receiving the benefit option	Forward retirement calculation statement and acceptance/rejection letter
Types of accounts where there is balance	
Dependent considered for determining the actuarial factor	
Bank details	
Participant personal data	
Participant professional data	
Account balance	
Contributions historical	
Benefit application	
Participant's dependent personal data	
History of contributions to the plan	
Contract account balance	
Benefit application	Check eligibility for retirement
	Update participant information in the GNP/ACB
Participant personal information	Check eligibility for retirement
	Update participant information in the GNP/ACB
	Generate retirement calculation statement
	Check retirement calculation statement
	Sign retirement approval/rejection
	Forward retirement calculation statement and acceptance/rejection letter
Compliance plan contract	Check eligibility for retirement
	Update participant information in the GNP/ACB

Table IV.
EBE list – Analyst 1

EBE list	Activities related
Benefit application	Check eligibility for retirement
	Update participant information in the GNP/ACB
Retirement application	Check eligibility for retirement
Calculation statement	Generate retirement calculation statement
	Check retirement calculation statement
	Make adjustments to the retirement calculation statement
	Forward retirement calculation statement and acceptance/rejection letter
INSS Grant letter	Check eligibility for retirement
Contractual cessation of employment	Check eligibility for retirement
Participant registry	Check eligibility for retirement
	Update participant information in the GNP/ACB
Quota registration	Check for quota implemented in GNP
	Wait for the quota release by CON/CT

Table V.
EBE list – Analyst 2

by both analysts to the artifact "Participant registry" is based on its variation on completeness, correctness and consistency of a given participant data. It means that if the registration of a particular participant is incomplete, incorrect or inconsistent in a given instance (e.g. her/his date of birth is missing), then it will be considered as a variation of this attribute. Further analysis is necessary in order to decide whether this

Actor	Ontological transaction – process activities: C-ACT Phase: request	C-ACT Phase: promise	P-ACT Phase: state	C-ACT Phase: accept
Initiator (participant)	Request application for retirement benefit			
Executor (FPC)		Check eligibility for retirement	Generate retirement calculation statement Check retirement calculation statement Forward retirement calculation statement and acceptance/rejection letter Update participant information in the GNP/ACB for retirement Sign retirement approval/rejection	Forward acceptance/rejection letter and sponsor letter

Table VI.
Ontological transaction matrix – Analyst 1

Actor	Ontological transaction – process activities: C-ACT Phase: request	C-ACT Phase: promise	P-ACT Phase: state	C-ACT Phase: accept
Initiator (participant)	Request application for retirement benefit			
Executor (FPC)		Request application for retirement benefit Check for quota implemented in GNP	Wait for the quota release by CON/CT Generate retirement calculation statement Check retirement calculation statement Forward retirement calculation statement and acceptance/rejection letter Update participant information in the GNP/ACB	Forward acceptance/rejection letter and sponsor letter

Table VII.
Ontological transaction matrix – Analyst 2

variation could affect the process negatively, compromising the achievement of its goal. In this case, the analyst considered that the variation would cause injuries to the process, and as so, she marked "Yes" on Table VIII.

The attributes impacting the goal of the process were identified as elements of the immediate/internal context. Tables VIII and IX show the contextual elements identified by each analyst, respectively.

The results showed the analysts together have identified five immediate/internal contextual elements: Participant registration, DC/VC plans regulation; Sponsor letter; Approval/rejection retirement letter; and Retirement process. Comparing both results, we observed the existence of simultaneity only in two of the five contextual elements:

Essential activity	Attributes related to the activity	Attribute class	If the value of the attribute varies, the goal of the process will be affected?
Request application for retirement benefit	Request DC/VC benefit	External data	No
Check eligibility for retirement	Participant registry	Artifact	Yes
Check eligibility for retirement	DC/VC plans regulation	Business rule	Yes
Check eligibility for retirement	Retirement application form	External data	No
Check eligibility for retirement	CPF/RG	External data	No
Check eligibility for retirement	INSS grant letter	External data	No
Check eligibility for retirement	Contractual cessation of employment	External data	No
Check eligibility for retirement	Bank statement	External data	No
Forward acceptance/rejection letter and standard letter to participant/sponsor	Sponsor letter	Artifact	Yes
Forward acceptance/rejection letter and standard letter to participant/sponsor	Approval/rejection retirement letter	Artifact	No
Generate retirement calculation statement	Calculation statement	Artifact	No
Check retirement calculation statement	Calculation statement	Artifact	No
Forward retirement calculation statement and acceptance/ rejection letter to participant	Calculation statement	Artifact	No
Forward retirement calculation statement and acceptance/ rejection letter to participant	Approval/rejection retirement letter	Artifact	No
Sign retirement approval/ rejection	Approval/rejection retirement letter	Artifact	Yes
Sign retirement approval/ rejection and acceptance/ rejection letter	Retirement process	Artifact	Yes

Table VIII.
Contextual elements – Analyst 1

"Participant registry" and "DC/VC plans regulation." However, all five immediate/ internal contextual elements identified were considered in the analysis of these results, forward by the impressions gathered during the following interviews.

4.4 Interview findings

In order to support the findings about applying the method, we conducted four interviews with managers and professionals who carry out activities related to the process. First we interviewed two process managers, one of which was recently re-assigned to a new position yet maintains close affiliation with the process. Both managers, current and past, occupy executive positions and were interviewed. The third professional interviewed occupies a management position, and the last one is a senior technician.

The respondents were allowed to consult and check the business process model and related documents during our interviews. Our objective was to elicit situations where the goal of the process has not been reached, both because of the known situations, but

Essential activity	Attributes related to the activity	Attribute class	If the value of the attribute varies, the goal of the process will be affected?
Request application for retirement benefit	Request DC/VC benefit	External data	No
Check eligibility for retirement	CPF/RG	External data	No
Check eligibility for retirement	Retirement application form	External data	No
Check eligibility for retirement	Letter of award INSS	External data	No
Check eligibility for retirement	Contractual cessation of employment	External data	No
Check eligibility for retirement	Bank statement	External data	No
Check eligibility for retirement	Participant registry	Artifact	Yes
Check eligibility for retirement	DC/VC plans regulation	Artifact	Yes
Generate retirement calculation statement	Calculation statement	Artifact	No
Update participant information in the GNP/ACB	Retirement application form	External data	No
Update participant information in the GNP/ACB	Participant registry	Artifact	No
Forward acceptance/rejection letter and standard letter to participant/sponsor	Sponsor standard letter	Artifact	No

Table IX. Contextual elements – Analyst 2

not explicitly addressed in the process, and also by unexpected situations that might have occurred. The analysis of situations identified by managers in comparison with the results obtained by applying the method would allow further conclusions about the outcome of this research.

All the four respondents were found to have a good understanding about the process. When asked about the existence of situations in which the process had not reached its goal, they cited five instances:

(1) Participants were taxed for a benefit of two types of plans. This situation is not addressed by the process; though some cases have been occurring since 2005, because of the portability of plans.

(2) A participant has more than one plan, is a single payer, the taxing system is progressive, but taxation is done separately for each plan instead of on the total of the incomes. The case is yet being studied for possible legal risks and injury to the participant.

(3) A participant, when still active, despite having updated the name of his/her dependents, did not designate any dependent for annuity purposes, and then he died. This situation is not addressed by the process for any of the benefits, neither if it is an annuity for a retirement, or for death after a retirement. In these cases, the use of the benefit may only be granted through legal court.

(4) Due to the fact that FPC system is not parameterized for the various plans, the waiting time for the participant, regarding his/her request retirement, could be very long, and the process is likely to fail due to interpretation of sometimes complex combinations of parameters.

(5) A tax was applied after the granting of a benefit to a participant. The review process for granting retirement still does not address such cases. The solution should be a review of the retirement concession after the inclusion of revenue, and it could be considered as a new event for the process.

Afterwards, the respondents were asked about the relationship between the contextual elements identified by the analysts through the method with the situations they reported. We discuss their impressions in the following section, in which we also reflect about relevant learnings from the method application.

4.5 Reflections on the application of ORGANON

One of our starting assumptions for the development of ORGANON was that the process goal is well-known and explicit for the organization. However, in this case, the goal was informally elicited, despite being known by the people who manage and run the process. It is possible that this is a common situation in companies, which in turn means that additional effort is required to identify and formalize process goal in order to be able to apply the ORGANON method.

The process studied was modeled at a macro level, making the analysis of the model difficult during the application of the method. Thus, we noticed that it is maybe necessary to consider the degree of detail of the process model before starting the application of the method. For example, a new attribute that impacts the process goal in a given situation reported was identified during the interview. However, this attribute was not described in the process model, so the analysts were not able to observe it in spite of the knowledge they have about the business. Besides, the analysis of the model may also need to take into account all processes that have interface with it. A big view might help the understanding of the process.

All contextual elements identified as relevant by the method were evaluated against the five situations identified by respondents. However, there was no consensus on all relationships with each situation. We inferred that this is due to the possible different interpretations on the regulations. There are dozens of rules for the DC/VC plans with significant differences among them, which are not explicitly modeled (neither within the diagram, nor through a specific language for this purpose). The regulation plan is a written document in the form of instructions. The criteria and treatment for various situations and cases are cited in a certain order without necessarily explaining their relationship. Hence, the regulation is subject to interpretations that may vary from one person to another. Furthermore, there a few cases that are not even predicted yet. This is typically what people use to say: "it depends on the context." Some situations like that were mentioned in the interviews, and also some of them were identified by the method application.

Three respondents mentioned the situation "Participants taxed for a benefit of two types of plans." Two of them converged about the relevance of the contextual element "Participant registry" for the activity "Check eligibility for retirement." In this same situation, the contextual element "DC/VC plans regulation" in the activity "Check eligibility for retirement" obtained an opposite result. Two respondents stated that the issue of the tax type is exclusively handled by the law; thus, the internal regulation must fit it. Based on this arguments, we concluded that, the method could not identify an attribute "Legislation" because it was not part of the process model; however, the business rules embed in the "DC/VC plans regulation" must reflect the law, so, it is possible that some of the respondents have interpreted that the situation "Participants

taxed for a benefit of two types of plans" were related to contextual element "DC/VC plans regulation" and other mentioned legislation, which can also be considered a contextual element. This is a typical example of ambiguity, since the content that should be monitored as context is basically the same, i.e., the content of the laws.

Three respondents expressed their disagreement regarding the relationship of the contextual element "Sponsor letter" with the situation "Participants taxed for a benefit of two types of plans." They claimed that this letter, which is produced in the "Control input and output of benefits" process is only sent to the sponsor in case of rejection of the retirement request. The fourth respondent stated he ignores this attribute. We can interpret that there is a deficiency in that process, or a there was a mistake in the interpretation of the analyst during the application of the method, thus it is reasonable to disregard this contextual element as relevant.

Two respondents have expressed their disagreement with the relationship of the contextual element "Approval/rejection retirement letter" and the contextual element "Retirement process," both with the situation "Participants taxed for a benefit of two types of plans." Both respondents said this contextual element does not have information about tax policy. These attributes are identified in the model as the input to the activity "Sign retirement approval/rejection letter," but it is not clear where they are produced. Moreover, there is not enough information in the process model about the content of the letter. For these reasons, we understand there was subjective inference on the identification of this contextual element as relevant, and we decided to disregard it.

Two respondents mentioned the situation "No designation of dependents for annuity purposes." There was positive convergence among them about the relevance of the contextual element "DC/VC plans regulation" to the activity "Check eligibility for retirement process." Likewise, there was convergence in the negative manifestation regarding the relevance of the contextual elements "Approval/rejection retirement letter" and "Retirement process," both of them in the activity "Sign retirement approval/rejection letter." With respect to the contextual element "Participant registry" and the activity "Check eligibility for retirement process," they demonstrate the opposite. With respect to the contextual element "Sponsor letter" and the activity "Forward acceptance/rejection letter and Sponsor letter," there was only one negative manifestation. We observed the correlation of respondents regarding the relevance of the contextual element "DC/VC plans regulation" and the activity "Check eligibility for retirement process," identified by the method.

For the situation "Applying taxes after the granting of a benefit to a participant," although it was not associated with any activity, there were contrary manifestations for the following contextual elements: "Participant registry," "DC/VC plans regulation," "Approval/rejection retirement letter" and "Retirement process." This shows that there was no relevant contextual element associated to this situation.

One interviewee mentioned that the situation "More than a plan for the same participant, with single payer, taxed separately" is inclined to be addressed in the "Close payroll benefit" process, and therefore saw no contextual elements associated with this issue. However, he said "If we had thought about taxes in modeling phase, we would have dealt with this problem. They are predictable, but they were not planned in at the right time." Since the issue of taxes had already been identified as the information contained in the legislation, the researcher confirmed his understanding to consider the legislation as a contextual element (attribute) relevant to the process.

In summary, we identified the following key reflections about the application of ORGANON in the case study:

- the contextual element "Participant registry" and "DC/VC plans regulation" both related to the activity "Check eligibility for retirement process" were correctly identified by the method as relevant to the process and, if they suffer variations, they may impact the goal of the process in two of the five situations mentioned by the interviewees;
- the attribute "Law" is a strong candidate to be considered a contextual element, however its relationship with the "DC/VC plans regulation" should be established; and
- "Sponsor letter," "Approval/rejection retirement letter" and "Retirement process" are likely to be disregarded.

Our main conclusion is thus that there is evidence that it is possible to identify immediate/internal contextual elements in a given business process with ORGANON, and that it is possible to verify the impact of their variation on the process goal. Table X summarizes the insights gained from the method application.

5. Related work

Context awareness in business process management is now considered one of the leading principles for good practice (Vom Brocke *et al.*, 2014).

Addressing context in business process management involves the identification of relevant information to be considered for analysis and adaptation in response to emerging demands. Recker *et al.* (2009) advocate that current process modeling techniques only capture the intrinsic part of process flexibility, but lack contextualization. As stated by the authors, the conceptualization of the system and environment in which a process is embedded would be a base for the specification of truly context-aware processes. Such extensions, in turn, would lead to the context-aware analysis, design, and implementation of systems typically used to enact business processes, such as ERP systems (Srivardhana and Pawlowski, 2007; Nandhakumar *et al.*, 2005), as well as a better

Observation	Relevant element of ORGANON	Key finding
Level of modeling detail	Step 1, activity 1	ORGANON requires a high-level model of business processes with relevant attributes well captured within the model
Process goal	ORGANON premise	ORGANON rather requires a well-known and explicit process goal; the way it is expressed could affect the method
Interfaces with the process	Not predicted as an input in the method	A view of the whole process architecture might help the understanding of the process under analysis
The impact analysis activity of the method could lead to subjectivity	Step 2, activity 2	All contextual elements identified as relevant by the method were evaluated against the five situations identified by respondents, but there was no consensus among them
Attributes described informally could lead to misunderstandings	Step 2, activities 1 and 2	The formats for attributes' description should be defined

Table X. Summary of the observations about the application of the method

understanding of the role of context in requirements engineering (Urquhart, 2001) and process change projects (Kallio *et al.*, 1999).

According to Saidani and Nurcan (2007), there are no approaches to support adequately the problem of variability of contextual requirements for business process. They claim that context should be part of business process modeling. Thus, a context-aware business process would be able to adapt running instances in accordance to changes in context. Role-oriented business processes modeling, created by Saidani and Nurcan (2006) has been extended to enable the provision of context information to help decide between options for assigning roles to functions. As an illustration, the authors cite the "competence" as an element of context that impacts on the assignment of an actor to a task, and they exemplify the case where "experience" and "urgency" together can influence in hiring a professional by indicating the best choice at a certain moment. This proposal requires as a first step the elicitation of the context information, in order to capture, aggregate and structure context; however, it does not provide a systematic way to accomplish this task. According to Cipriani *et al.* (2011), a central task in the development of context-aware applications is the modeling and management of complex context information. The modeling task involves two steps: create the context model schema, which specifies entities relevant for the application; and provide the context model data, which represent the concrete instances of specified entities. To reduce the burden of obtaining and maintaining such context models, they propose NexusEditor, which provides a graphical user interface to design schemas for spatial and technical context models, interactively create queries, send them to a server and visualize the results. This work does not discuss which entities should be modeled, or in other words, how to elicit context elements that might compose the model.

Rosemann *et al.* (2008) present an approach for process modeling, in which context can be conceptualized, classified and integrated. The proposal includes the Onion framework (see Section 2), a metamodel for classifying context, and a basic procedure of how to apply the framework in five steps: identify the goal of the process; decompose the process into a set of information relevant to the goal and determine the relevance of context, and identify contextual elements; categorize contextual elements according to the model Onion. Still, detailed information on execution or application of the method is not provided in the paper, in particular about the key step of identifying contextual elements.

Ploesser *et al.* (2009) proposed a conceptual framework to facilitate the identification of context changes and their impact on business processes. Based on an analysis of secondary data from case studies on process adaptation, the authors explain the framework, and categorize four generic archetypes of context awareness based on organizational awareness and preparedness, ranging from "elements of surprise" to "oscillation." Their aim was to provide an understanding of the different types of context change and the types of required adaptation to make relevant processes flexible. The work provides a set of questions to raise insights with respect to contextual variables: what is relevant context? Where do changes in context impact processes? How do changes in context impact on processes? When do changes in context occur and when do they impact the process? Although the work presents a framework to assist in the identification and classification of context change, the authors do not address how to identify exactly what relevant context is, the first question of the framework, opening space to explore this aspect of the research.

Heravizadeh and Edmond (2008) propose to integrate context in workflows, offering support for the manipulation of the current context of a process in real time. In general, knowledge-intensive tasks depend on the knowledge gained from contextual information, besides the tacit knowledge of staff involved and the explicit knowledge

in documents. The context-aware workflow system provides adequate knowledge at the right time for the user who will be working in a specific knowledge-intensive task. One important point is the emphasis given on context that represents the dependency between tasks. A task may depend on other(s) task(s) because its problem depends on a context attribute of a previous task and/or rely on a problem linked to a previous task. To identify the relevant context, the authors suggest six actions: establish any issues that may arise in each task; for each issue, identify context attributes that can help to decide if the issue deserves attention; define important properties for each context attribute; establish conditions under which a context attribute can be considered as being in a critical level; express rules on the possible values of attributes and context; and, present ways to solve the issues. In this procedure, the selection of context attributes is a problem to be solved by the modeler. The authors only define the selection criteria, without indicating a method of identifying the attributes.

Finally, Ramos *et al.* (2011) propose a method to identify and prioritize external context variables that influence the implementation of specific process activities based on concepts of competitive intelligence and data mining techniques. The BPECREL method aims to support the analyst and the decision maker in choosing which variables of the external environment should be monitored. The method consists of two phases: an adaptation of Herring (1999) Key Intelligence Topic (KIT) and a knowledge discovery procedure. Phase 1 results in a list of candidate variables from the external environment identified through interviews with the process managers. Then, in Phase 2, the historical data from these variables are collected; this data are used to enrich the process instances log, where mining techniques (feature selection and decision tree) are applied to learn their relevance to the process goal. In spite of this work be the closest to our method, it focussed just on the external context of a given process.

Table XI summarizes our comparison of ORGANON to the literature.

Approach	Source	Key contributions
Process change drivers and traces	Kallio *et al.* (1999)	Demonstrated significance of external context as a driver to change business processes
RBPM (role-oriented business processes modeling	Saidani and Nurcan (2007)	Provision of context information in a process to help deciding the assignment of roles
Onion model	Rosemann *et al.* (2008)	Classification of types of context potentially related to business processes Procedural model for context-aware process adaptation
Context change archetypes	Ploesser *et al.* (2009)	Classification of organizational responses to different types of contextual disruptions Classification of published cases into framework
Context-aware workflows	Heravizadeh and Edmond (2008)	Identification of dependencies among tasks in a process based on their contextual attributes
NexusEditor	Cipriani *et al.* (2011)	Tool to support the creation of context models
BPCREL	Ramos *et al.* (2011)	Discovering of external context variables that influence the implementation of specific process activities
ORGANON	This paper	Step-by-step method to support the identification of immediate/internal contextual elements based on the process model

Table XI. Review of approaches associated with context-aware process management

Given this body of knowledge, our proposed method intends to enable the identification of elements of internal and immediate context relevant to a business process, which impact on the goal of this process. This allows us to extend the available approaches through a method that explicitly addresses the question "which contextual elements matters to a business process?"

6. Conclusions

This paper presents the ORGANON method and discusses its application to a retirement granting process in a case study. We applied the method and discussed its application and results through interviews with managers and technicians that perform the process. The results showed five elements, which were presented to respondents in order to assess whether they have any relationship with the situations they identified as impacting the process goal. We identified some evidence that it was possible to identify the contextual elements of a given business process through ORGANON.

Our key contribution is that ORGANON can allow extending current business process modeling techniques of in order to identify contextual factors that impact on business processes. Furthermore, as byproducts of the method, the concept of essential activity (Sharp and McDermott, 2010) and ontological building blocks (Dietz and Hoogervorst, 2008) are emphasized. Thus, from the method, it is possible to identify the essential activities of a process already modeled, and consequently to be the starting point to promote a discussion about how to improve it. Another spin-off generated by the method is the definition of variation for certain attributes of a process activity. Finally, the method starts a discussion on the relationship between process goal and its contextual elements, which plays a fundamental link to study proposals for flexible business processes.

Regarding limitations of the proposed method, during the case study, we identified some drawbacks. Business processes modeled in macro level, with no detailed information, may hinder the understanding of models in method application. Respondents are only subject to list situations they remembered during the time of the interview, so it might not have been a complete assessment.

The lack of an explicit formalization of the business process goal can be a common situation in companies, resulting in additional work when applying the method. Besides, not adopting a formal approach to represent goal and link them to the process, like presented by Soffer and Wand (2005) and Soffer and Wand (2007) makes the assessment of the implications of an attribute variation subjective. Even though in our proposal we have defined the concept of variation, it would be more precise if incorporated in a formal model.

Regarding limitations of our evaluation, our empirical work was limited to one instantiation in one case organization. We took care to select a moderately complex process that can be expected to exist in similar vein in many organizations. Still, our evaluation is preliminary in nature and conclusions drawn must be regarded as tentative. Further work could mitigate this limitation, for instance, by performing longitudinal studies (pre- and post-implementation of ORGANON) to measure the impact on process performance, or examine efficacy of the method in more controlled experimental settings under varying conditions such as process complexity (high/low), expertise of analyst (high/low) or contextual information available (poor/rich).

In our future work, we will apply and evaluate the method ORGANON to other scenarios, in order to confirm and further validate our findings, as well as to refine some activities of the method that may yet be too complex, under- or over-engineered.

As one specific area for improvement, we deem it necessary to reduce or mitigate subjective bias in the application some parts of the method, for example, by including new settings for varying process attributes and through formalization and automation of the method. We also see a future perspective to research in the conceptualizing of the attributes variability and process adaptation. Finally, it is possible to incorporate the method into a business process modeling technique by applying and extending existing modeling language for context information, such as in Analyti *et al.* (2007).

One point that should also be considered in future work is how to address the contextual element issues in knowledge-intensive processes (KIP). Even though they cannot be captured by structured process models, such as the ones we deal with here, KIP are still considered to be processes because individual tasks need to be coordinated, performed by process participants using organizational resources. However, the coordination patterns, even the tasks themselves often evolve, as the work progresses. In this context, the concept of context also becomes highly dynamic and evolving and furthermore many other variables should be considered.

An important challenge faced by context-aware business process is to decide which context variables are relevant enough to be considered in the adaptation of the process. This paper advances the notion of internal context by suggesting that the process model by itself is able to provide sources to elicit the relevant contextual elements. This will further support the development of strategies to allow adaptation based on situations that combine the elements identified.

Note

1. http://unicomsi.com/products/system-architect/

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