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**THE CONSTRUCTION OF A CORPORATE
DICTIONARY FOR THE NEEDS OF THE DYNAMIC
BUSINESS PROCESS MANAGEMENT**

**KONSTRUKCJA SŁOWNIKÓW KORPORACYJNYCH
NA POTRZEBY DYNAMICZNEGO ZARZĄDZANIA
PROCESAMI BIZNESOWYMI**

DOI: 10.15611/ie.2018.4.11

JEL Classification: L200, M100

Summary: The article discusses the issue of corporate dictionaries that can be used for the dynamic management of business processes. The article indicates that dictionaries can be used for a full description of business process models. In these full descriptions, various types of ontologies are included relating to various aspects of organization management. These include ontologies describing the types of operations available, actors and their competences, documentation and their content, including the division into information fields and, in the case of unstructured documents, also tags and key words, resource classifications and performance indicators (PPI - Process Performance Indicators). By binding these types of ontologies, one can create a tool that will support ongoing business process management at various levels: individual operations, process instances, and even types and versions of processes. These dictionaries can communicate various IT tools such as ERP / BI class systems, as well as IT tools available on the Internet and supporting business partners of a given organization.

Keywords: corporate dictionary, ontologies, dynamic process management. life cycle of processes, a full description of process models.

Streszczenie: Artykuł porusza problematykę słowników korporacyjnych, które mogą być wykorzystywane do dynamicznego zarządzania procesami biznesowymi. W tekście wskazano, że słowniki mogą być stosowane do pełnego opisu modeli procesów biznesowych. We wspomnianych pełnych opisach zawarte są różne typy ontologii odnoszące się do różnych aspektów zarządzania organizacją. Zaliczyć do nich można ontologie opisujące rodzaje dostępnych operacji, aktorów i ich kompetencji, dokumentacji i ich treści z uwzględnieniem podziału na pola informacyjne, a w przypadku nieustrukturalizowanych dokumentów również tagów i słów kluczowych, klasyfikacje zasobów oraz wskaźniki efektywności (PPI – *Process Performance Indicators*). Wiążąc wspomniane rodzaje ontologii, można stworzyć narzędzie, które na bieżąco wspierać będzie zarządzanie procesami biznesowymi na różnych poziomach: pojedynczych operacji, instancji procesów, a nawet typów i wersji procesów.

Wspomniane słowniki mogą komunikować różne narzędzia IT, takie jak systemy klasy ERP/BI, a także narzędzia IT dostępne w Internecie, obsługujące partnerów gospodarczych danej organizacji.

Słowa kluczowe: słownik korporacyjny, ontologie, dynamiczne zarządzanie procesami, fazy życia procesów, pełny opis modeli procesów.

1. Introduction

The implementation of the process approach results in significant transformations within organizations. It should be assumed that the use of process maps, modeled in generally accepted standards such as BPMN, is just the beginning. Along with the increase of the process maturity of the organization [van Scheel et al. 2015], further areas of its activity will be transformed.

One of the first areas that requires transformation is the IT (Information Technology) area. Assuming that at least a few processes will be developed in the organization, and their launch will mean that multiple instances will be implemented at the same time, business process management will not be able to do without IT tools. The problem is that traditional IT systems, in particular in the case of ERP/BI (Enterprise Resources Planning/Bussiness Intelligence) systems implemented prior to the transition to a process approach, will not always fully reflect the users' needs. The problem lies mainly in the event philosophy of the operating of these systems, which is not very well suited to the management of process instances. The problem is that these systems are focused on the records of individual primary events and it is not always possible to bind them as part of these processes.

These considerations refer to the problem of transforming IT solutions from the event version to the process version. They assume that one of the important roles in adapting information systems to the process approach can be played by corporate dictionaries (for the potential rule of it see [Pencle, Mălăescu 2016]). The purpose of the article is to present the principles of designing corporate dictionaries whose task is to support the implementation and then the management of business processes. The problem of corporate dictionaries has been analyzed from the point of view of the elements that create them, and their mutual dependencies, as well as the sources of their origin. The study was prepared on the basis of the analysis of transformations made in IT tools aimed at their adjustment to the process rules of the organization.

2. Requirements for IT tools for the needs of process management

As has already been stated, the implementation of the process approach in the management of an organization is not without the impact on the IT tools that are used in it. As a result, there will be requirements to link the effects of individual

operations as part of the instances being implemented. In addition, it may turn out that the designed processes will include operations that until now were not provided for in the IT system used, i.e. no corresponding type of primary event was defined. In practice, we can distinguish several factors that influence the determination of requirements for IT tools. These include:

- organizational process maturity [Raczyńska 2017],
- supported life phases,
- process areas,
- environment.

Theoretically, it is possible to implement a process approach without transforming the IT system, but as the organization's process maturity increases, the gap between the information needs of users and the IT system capabilities will continue to grow. It is usually assumed that the starting point for using the appropriate IT tools to support the transformation of an organization towards a process approach is to make a decision on the standardization of the applied procedures in a company. This standardization can be achieved by designing process maps usually in notations based on the BPMN standard. When designing these maps, one can strive to build corporate regulations on their basis. On the basis of corporate regulations, it is possible to build incentive systems. However, this requires the use of a full description of processes consisting not only of process algorithms [Jelonek, Stępniać 2013], but also the indication of actors (contractors of individual operations), documentation (indicating documents for describing the effects of individual operations), the resources necessary to implement a given operation and performance indicators (PPI – Process Performance Indicators – [del Rio-Ortega et al. 2010]). The use of a full description of the processes indicates the increase of the organization's process maturity. However, it imposes appropriate obligations on it. First of all, the full description requires much more data, and thus the development of models is more time-consuming. Secondly, it requires coherence of the description between its various elements. Thirdly, it enables the dynamic management of processes as long as process models can be entered into an IT system that supports their ongoing implementation. In turn, the automation of the current description of implemented instances and their operations enables the ongoing improvement of processes [Szełągowski 2019].

The above possibilities are largely related to the phases of the life cycle of processes. Building process maps generally supports only the modeling phase. With the modern use of IT tools, this type of solution would be a kind of anachronism. That is why it is important to have a tool that will enable the conversion of developed process models into internal procedures of IT tools (these may include: ERP/BI class systems, other types of information systems, and web portals somehow involved in the implementation of these processes [Grolinger et al. 2014]). In the implementation phase of the processes, IT tools are mainly expected to:

- link all subsequent documents created as a result of the implementation of a specific instance,
- notify subsequent actors about the start of their operations,
- constantly record data regarding the implementation of a particular instance.

The possibility of current data recording within particular instances allows for the active management of their implementation. In addition, it also allows for the preparation of current reports on the implementation of all instances of a given type. This, in turn, enables actions to be taken to improve the existing types of processes. Such advanced solutions allow for business processes management in all phases of their life.

Analyzing the above conditions, one can indicate the basic group of requirements that will be set in the future before IT tools used in environments which implement business processes. The basic requirements include:

- the ability to design business process models in tools that allow their direct conversion to the procedures of applied IT tools (ERP / BI, CRM, corporate portals) – [Krishna et al. 2019],
- process modeling using a full description thanks to which, on the basis of documentation, the status of the implementation of a given instance can be updated, as well as the effects of actions under individual operations,
- the creation of early warning mechanisms thanks to the possibility of comparing the results of individual operations with assigned PPIs [Stępnia 2016],
- the current collective assessment of process types and versions, instances and operations.

The condition for meeting the above requirements is the need to ensure semantic consistency between the elements of the business model description and the current record of the effects of implemented operations within the framework of the instances being performed. Corporate dictionaries should provide this coherence [Bobkowska 2015].

3. The idea of corporate dictionaries

Corporate dictionaries shape the scope of terms that are used and recorded in IT tools. It can be assumed that the nucleus of dictionaries shapes ontologies. As part of ontology Weber distinguishes such elements as: concepts, objects, relations, attributes and axioms [Weber 2009]. In general, dictionaries should cover all terms defining quantitative data and tags describing documents containing qualitative data. Their use should de facto start in the „0” phase of business process planning. At least the conclusions of studies on potential new types of processes should be described in accordance with the dictionaries used. The use of dictionaries should, in principle, last until the last phase of the life cycle of processes, i.e. the phase of ending processes (for phases shown see [Mielcarek 2018]).

The task of corporate dictionaries is to organize the concepts used in the environment of the modeled processes. Their existence should facilitate communication between all entities involved in the implementation or control of the processes performed.

The growing importance of the role of corporate dictionaries is due to several factors. These include:

- the necessity to organize the concepts used in documentation and corporate regulations,
- the transmission of selected tasks in the scope of process control of IT tools,
- creating corporate regulations that are understandable for all real and potential actors,
- facilitating the conversion of process models into IT systems procedures.

The basic design assumptions were developed on the basis of observations of IT tools supporting process management and discussions conducted at scientific conferences on process management and supporting IT tools which are currently available on the market. During the conference, discussions were held with both theoreticians and practitioners involved in the implementation of IT tools supporting process management.

Corporate regulations cover many areas of an organization's activity. They can refer to both functional and procedural areas. The mentioned division depends, to a large extent, on the process maturity of the organization. Within the dictionaries there may be various types of ontologies. They may include:

- the name of the operation (divided into an argumentative and functional part),
- the layout, naming and symbolism within the organizational structure and data on cooperating entities,
- instruction on the circulation of documentation, possibly a list of documents used in the organization, including a list of information fields,
- the classification of fixed assets, materials, finished products, goods, description of lines and sockets,
- layouts of the company's chart of accounts together with the positions of the calculation,
- a list of economic indicators used in the enterprise, both functional – regarding the enterprise as a whole, i.e. KPI (Key Performance Indicators) and processors, PPI (Process Performance Indicators).

As it appears from the above list, corporate dictionaries can be strongly developed and can consist of many different elements [Voskuil 2015]. In spite of their diversity, particular types of ontologies can enter into various relationships. This is already evident during the construction of process models where the nomenclature used to describe them can be complicated. As already mentioned, the process models consist of several elements that should be connected with each other, as well as with other information resources collected in a given environment.

4. Resources shaping dictionaries

Considering the scope of the elements shaping the resources of corporate dictionaries, it can be assumed that their shaping takes place in various ways. Although some dictionaries' resources are built during process modeling, some of them are in fact derived from external sources such as IT systems or Internet portals. Some of them may come from legal provisions which the organization must comply with.

From the point of view of the need to support the dynamic management of business processes, it seems that this is more important when elements of a dictionary are created. In this case it refers to assigning to a specific phase of life of the processes rather than identifying specific entities as sources.

In the zero phase, or the planning phase, the starting point is the search for inspiration or new business opportunities. Along with the identification of new potential opportunities, new ontologies describing the mentioned ideas appear. They should be registered regardless of whether or not any measures have been taken in the area. After all, it may happen that something which has been rejected some time ago, in the future will become the subject of interest again. In this case, the source will be the subject or material (information resource) that caused interest in the topic. If the subject has undergone any analysis, then there should be some trace in the form of material with an indication of why the topic was discussed, what was done and what effect it had. The material itself can be a text, a multimedia material, but in that case it should be stored in accordance with archival materials (e.g. title, inventory number, tags or keywords). For the organization's board, or the Center of Excellence Business Process Management, this is a material that they can always refer to.

It seems that the most important aspect in the construction of corporate dictionaries is the first phase associated with building the process models. Due to the fact that IT tools can be assigned to competencies, in the recognition of situations that trigger instances of processes and assess whether an instance or its individual operations have been successful, it is important to define unambiguous criteria by which it can be estimated.

New ontologies are created in the design phase of models or the existing ones are used. Part of the ontology can be modified, for example, by adding new functions or attributes. The scope of their application will then also increase.

The starting point for designing process models is defining the success determinants of a given type of process. In other words it is about defining a state that should occur after the correct execution of a given instance within a given type of process.

Usually this is a reference to a document that should be included in the documentation workflow instruction or be defined in IT tools (usually in an ERP/BI class system). An appeal may refer to a document as a whole or to specific information fields. In the latter case, it is usually not enough to fill in specific information fields,

but it is also necessary to verify the values of the indicated information fields. Sometimes, instant success is verified by fulfilling a combination of conditions related to logical formulas.

Similarly, the effects of individual operations obtained in the implementation of specific instances are verified. In this case, the reference is also made to a specific document and the appropriate information field.

Recognizing the situation that triggers the process consists in defining all potential situations causing the implementation of a particular instance. Sometimes this can mean the occurrence of one of the possible situations or a combination of them. In practice, this means entering the right signal into the right IT tool. It may be a document sent by post (classical or electronic), otherwise it may be a date resulting from the appropriate schedule.

In practice, it can be assumed that calling a process instance or assessing the effects of particular operations or an instance as a whole, results from the reference to the list of admissible documents and their information fields, treated in this case as ontology attributes. It should be remembered that individual information fields can refer to other types of ontologies, e.g. ontologies regarding material resources, intangible assets, as well as people, organizational units or other organizations.

Assuming that a full description of the process model means that it will consist of five elements. The first element is the process algorithm. In other words, it is a process map. The semantic layer of the model contains the names of the operations to be performed during the process. The description of the operation can be a coherent whole or divided into two parts: functional and argument. A coherent description is used when the IT designer has developed a finite set of acceptable operations. Modeling the process in fact involves selecting subsequent operations that will be arranged in an algorithm. By building a process algorithm, the designer can only select operations that are in the dictionary. Otherwise, first, it is necessary to develop the appropriate procedure for the IT system, name it and then add it to the dictionary. Only then can it be used when designing processes. In the case of the division of operations into functional and argument parts, a different approach is usually used. This results from the object-oriented approach to creating information systems. At the beginning, a set of permissible activities is built. For defined activities, procedures that can be parameterized are being developed, then the functions in the corporate dictionary can be assigned. In this case, ontologies act as object classes in the object-oriented approach which consists in assigning selected functions to selected ontologies. These functions may be inherited if the ontology has a hierarchical arrangement with respect to subordinate concepts.

Both in the case of coherent and complex operations, IT companies dealing with software development have a large contribution to building a corporate dictionary. In the first case, a dictionary element will be a set of allowable operations. This is important because the other elements of the process model are based on this set. In the second case, a dictionary element becomes a set of permissible functions that

are assigned to arguments. However, the arguments are the ontologies that describe the organization's resources. Manufacturers of information systems constructing databases define concept systems that will create corporate dictionaries.

The second element of the description are the actors or implementers of process algorithms. Actors can be defined in several ways. The first method is based on the organizational structure of the organization. In this case, the ontologies are organizational units. The second method is based on competences. Competences can be assigned to organizational units or employees on one hand, and operations as part of process algorithms on the other one. Thanks to this, an actor can only be an entity with appropriate competences. The third way is based on employees. This method is usually used in organizations that are at a relatively low level of maturity, where the assignment of roles to actors is done manually by indicating the person acting as the process integrator. In multiorganization environments, an actor may be the types of organizations that cooperate with a given entity.

The third element of the description is documentation. Documentation is largely defined by the IT company providing the software. This applies especially to documentation defined by state regulations or being standard documentation in the relations between organizations. Additional documentation can be added through a special order for an IT company or through software parameterization. An additional element describing the documentation are information fields. They can be treated as attributes of particular types of documents, however, sometimes they refer to other types of ontologies, such as organizational units, resources and others. Then they become a kind of link between different types of ontologies. The dependencies relate mainly to standard documentation. In the case of non-standard or unstructured documentation, it is stored in document databases. These can be electronic text, graphic, audio or multimedia documents. In this case, tags or keywords are used to describe the documentation. At least some of them may adopt ontology functions.

The fourth element is resources. The basic classification of resources is usually provided by the software supplier in accordance with the structure of the directories and tables in the database. The resource classification proposed by the software provider is the starting point for describing resources. It is imposed on documents that regulate resource management (e.g. technology cards). Such documents are usually generated by CoE BPM (see [Dyer et al. 2013]) or another unit responsible for the design and management of processes.

The fifth element is PPI, defined so that the effectiveness of the processes can be examined. They are based on ontologies defining resources, performance indicators, and they themselves determine the limits of effectiveness. Typically, these limits are the attributes of individual indicators. PPI is usually defined by CoE BPM or another unit responsible for process design and management.

The second phase of the processes' lives is the implementation of their models. The basic problem of this phase is the method of converting developed models into IT tool procedures. As of today, the ideal solution seems to be full automation of

this phase. However, modern tools usually do not provide such opportunities. The problem lies both in the assignment of individual operations to the appropriate IT tool procedures and their subsequent parameterization. From the point of view of corporate dictionaries, the basic issue is to perform the parameterization, and its results should be placed in the IT tools and assigned to the relevant ontologies that they will concern.

An additional element related to the parameterization is the need to define PPI not only at the level of operations and instances, but also at the level of process types and their versions. Thanks to that, it will be possible to assess in the future not only the implementation of individual instances, but also individual types of processes and their versions.

The third phase is related to the implementation of processes. In this case, data on the effects of the implementation of individual instances and their operations are collected. In this case, new ontologies are not built, but, on the basis of the results of the implementation of individual instances, the values of attributes connected to selected ontologies are collected.

The fourth phase is the evaluation and improvement of process models. At the stage of evaluation, aggregate parameters are created. At the same time, ontologies can be created on the same principle as in the first phase. After all, improving process models basically involves creating new versions of models.

There is also a phase of extinguishing the types of processes. Regardless of how the extinction takes place, there should be some indication in the organization's documentation as well as in the corporate dictionary that the type of process was once implemented in the given organization.

5. The construction of corporate dictionaries

Referring to the previous point, it can be seen that corporate dictionaries can contain very diverse and related elements. It can be assumed that within the dictionary one can distinguish different groups of ontologies, each of them having its own specific connections, attributes or functions. The dictionaries themselves are created in several stages, by various entities, and additionally they are subject to constant modification. To sum up the previous considerations, the following construction assumptions of the mentioned dictionaries can be made:

- the basic element of dictionaries are ontologies, within which concepts, objects, relations, attributes and axioms can be distinguished,
- these ontologies can be compared to object classes,
- ontologies can be represented graphically in the form of abstract maps, and the highlighted classes of objects will constitute single thematic layers on the map [Somers, Casal 2017] and [Stepniak 2015],
- ontologies can come from various sources,

- different types of ontologies can be linked with each other through relationships, attributes or axioms,
- dictionaries can be used for both static (design-related models) and dynamic process management (ongoing control and control of current implementation of process instances),
- a significant part of the formalization of corporate dictionaries results from the use of IT tools,
- corporate dictionaries can change by adding new types of ontologies, creating or changing types of links between ontologies or their concepts.

The presented construction layout of corporate dictionaries results from the analysis of the directions of development of IT tools, the aim of which is to support the implementation of the process approach to management. The implementation of a corporate dictionary should facilitate communication between employees, organizational units and even cooperating entities. Models of processes in the discussed approach in the semantic layer may facilitate the construction and understanding of corporate regulations, as well as facilitate the communication itself among the interested entities. In addition, the creation of a formalized dictionary with the possibility of defining the appropriate attributes and axioms should increase the role of IT tools in current control of the realized instances of processes.

For ordinary actors, the operation of dictionaries is in fact hardly visible. It is important only when the need to build some procedure manually appears. Accounting of most processes (unless there are any specific effects) can be automatic which should motivate the organization's staff.

6. Conclusions

The issue of corporate dictionaries has gained significance along with the growing popularity of the process approach and the continuous increase in the importance of IT tools in the operation of modern organizations. Corporate dictionaries are designed to organize the conceptual layer of the organization. Thanks to them, one can communicate different aspects of the process implementation such as: the purpose and the core of the operation, the actor and its competences, implementation requirements, required resources, and during the implementation of individual instances to monitor their progress.

This article addresses the issue of the construction of corporate dictionaries used for dynamic business process management. The main focus is on the content and sources of concepts that are found in dictionaries. Particular attention was paid to the fact that for dynamic process management it is not enough to create a dictionary, but first of all, the concepts existing in it should be linked. These links should facilitate the management of processes at various levels of process organization maturity and regardless of the phase of life of a given type of process.

These dictionary solutions are mainly used in ERP/BI class systems. However, they can also be used on web portals, especially those where database technologies are used. By unifying dictionaries in various tools, it is possible to create a platform for their communication, and thus to support dynamic process management in multiorganization environments.

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