

## Ontologies in Business Process Automation

Business process automation (BPA) is playing an ever increasing role, since it helps organizations improve the efficiency of process execution and to cut costs. Clearly, organizations are striving to increase the ratio of human-assisted processes over human-assisting processes.

Human-assisted processes are at the core of business process automation. The system has a complete picture of the process with all its process steps. Only when the business process engine (BPE), which is part of a Business Process Management System (BPMS), is confronted with a situation where it cannot infer what exactly is involved in the execution of a process step will it require human assistance.

In contrast, with a human-assisting system, human users drive the business process. The BPE has no complete picture of the business process. Human users know in what sequence process steps need to be performed and which application is to be used to perform a process step. In particular, ad hoc workflow and collaborative workflow fall into this category.

There is no black-and-white proposition, though. Both process types can be found in every organization. However, business managers strive to increase the portion of human-assisted business processes for many good reasons. To help BPA move forward, the system, represented by the BPE and applications (a.k.a. activity implementations), must be able to rely on a comprehensive information base. Along this line, semantically rich business process definitions are of paramount importance.

So, what is the use case for ontologies in Business Process Automation (BPA)? By definition, an ontology is about sharing common understanding of the structure of information among people or software agents. Since BPA relies heavily on software agents, which need to “make sense” of information in the process execution context, an ontology is the perfect foundation for BPA.

Imagine, for a moment, a relational database schema. It defines entity types and relations among them. A software engineer, who knows the data modeling rules (e.g. Entity/Relationship modeling), can make a lot of sense of a data model. A user or an application would populate the database with data. For example, one would use a data modeling editor to define the data model, and a different editor to populate the database.

As an analogy, an ontology is the equivalent of a database schema. It defines concepts (i.e. classes) and relationships among them. A knowledge base is the equivalent of a populated database. Of course, correlating an ontology to a relational database schema, and a knowledge base to a populated database, is not adequate. An ontology can represent a much richer information model than a relational database schema, and also a richer information model compared to a UML class model.

A Business Process Ontology should provide support for the entire business process lifecycle. Then it will provide outstanding value to business management and IT alike. The ontology would represent explicit formal specifications of the terms in the entire business process management domain and relationships among them. As such, an ontology would define structure, not behavior. The business process engine, administration and monitoring tools, and user applications would implement behavior. At any rate, a Business Process Ontology (BPO) ontologies will provide outstanding value for business process automation, which will live up to its full potential.

### Process Definition

In priority terms, organizations often place emphasis on tactical rather than strategic aspects. Pressing integration needs call for quick remedy. Due to financial constraints, a rewrite of an application system from scratch is ruled out in most cases. Most organizations spend the major part of their IT budgets on solving integration issues and maintenance of existing applications. Although business and IT decision makers are aware that patching holes is not the right approach, time constraints and other pressing needs all too often cause them to decide otherwise.

Introducing a BPO is definitely an undertaking of strategic scope. It requires an organization to define business processes from the ground up, starting with reusable entity types, such as activity types, business object types, business document types, roles, and so on. Business process definitions would then be created based on the foundation made up of semantically rich definitions. The rewards are manifold, however.

Describing entities in a semantically rich manner is completely in line with the *modus operandi* in a business engineering project. It is just a small step from describing business processes in template-based text documents to describing business processes based on an ontology. Undoubtedly, the ontology-based approach is superior, since consistency and integrity rules can be defined, which govern the population of the knowledge base.

In the first instance, populating the knowledge base is a labor intensive task. It requires one or more business analysts to identify business activity types, business object types, business documents types, roles, etc. and enter respective definitions into the knowledge base. This task may take months or even years. Critical influential factors are the number of concepts to define and the quality of existing definitions. In many organizations, for example, several variants of a business object type exist in parallel and some effort is required to reconcile sometimes conflicting variants.

Alternatively, existing definitions of business object types and business document types can be adopted from an existing ontology and accommodated to meet an organization's requirements. This is often the more effective approach and saves time and effort. In addition, adopting existing definitions is adequate in many cases, since business object and business document types generally prove highly stable over time. For example, the business party concept can be defined in a highly generic fashion, so that it fits the needs of almost every organization. Likewise, business document types, such as invoice, can also be defined to meet the requirements of multiple organizations, at least at the level of an industry segment. However, business activities are less generic and typify an organization's competitiveness, as do business processes.

The table below identifies entity types that are important in business process modeling and characterizes them.

Entity Type	Scope of Definition	Frequency of Change	Impact on Competitiveness
Business process	Organization (Private processes) Collaborating organizations (Public processes)	Very high (Private processes) Low (Public processes)	Very high (Private processes) Very high (Public processes)
Business activity	Organization	High	Very high
Role	Organization	Low	None
Business object type	Varies from industry-neutral (e.g. "Party" concept) to organization-specific	Low	None
Business document type	Varies from industry-specific (e.g. "Invoice") to organization-specific	Low	None
Resource type	Organization	Low	None

As a consequence, an organization will be well advised to reuse existing definitions where competitiveness is not affected. There are only two entity types where an organization can set apart itself from the competition: Business processes and business activities. Of course, other entity types, such as business object types, have some bearing on the effectiveness of information processing within an organization, but they do not directly affect competitiveness.

An ontology and a knowledge base can be the source for the generation of diverse design and software artifacts (see the Jenz & Partner White Paper: "Simplifying the Software Development Value Chain").

However, one question remains: Why would one consider an ontology-centric approach when there are so many business process modeling tools? The answer lies in the extensibility and adaptability of the BPO. Commercial off-the-shelf process modeling tools generally rely on a vendor-defined information model that is not adaptable to meet specific needs of an organization. Secondly, an ontology provides a homogeneous definition platform for multiple entity types, not just business process models. However, provided that an import script exists, it is possible to import a knowledge base into a process modeling tool and use specific tool functionality, if that is considered to be beneficial.

### Process Execution and Monitoring

Once a business process definition has been deployed in a BPE, the BPE can instantiate and execute it multiple times. With every execution, the BPE collects data, such as statistics about the performance of business activity execution, errors raised during process execution, and so on.

It is, of course, possible to develop an ontology that provides for the capture of process execution information at run-time. In the course of business process execution, the business process engine would populate the knowledge base. Today, most business process engines

use a relational database to store process performance data, audit trails, etc. None provides an application interface that allows for storing such data in a knowledge base.

Undoubtedly, it would be very helpful if process definition and execution information could be related with each other in real time, so that business analysts could run reports to detect bottlenecks. Using the BPMS administration functions to relate process definitions with execution statistics is the normal approach. To make available process execution statistics in the knowledge base, the only practical solution would require the import of execution statistics into the knowledge base. Import would require a custom-developed application, which would run on a regular basis. Obviously, this is far from an ideal approach, but a pragmatic one.

### **Conclusion**

In an idealistic scenario, a standardized ontology would exist, which forms the storage backend of a business process engine. All kinds of information created during the business process lifecycle (e.g. executable process definitions, monitoring data, etc.) would be stored in the knowledge base. Is there any chance for such scenario to come true? Probably not, since what is to the advantage of user organizations is often disadvantageous for software vendors. They were deprived of opportunities to set themselves apart from their competition. As a consequence, there is no interest from the software vendors' side to pursue the idealistic scenario. If there were influential open source projects committed to the idea of total BPE interoperability, the idealistic scenario would probably not be completely out of sight, though.

Taking a risk-oriented view, the biggest risk is definitely in business process design. Although current BPMS do not provide any support for ontologies in a meaningful way, there is still sufficient reason to make intelligent use of ontologies today: a homogeneous base of business process definitions and increased vendor-independence.