The Use of Reference Models in Business Process Renovation

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Abstract

Enterprise resource planning (ERP) systems are often used by companies to automate and enhance their business processes. The capabilities of ERP systems can be described by best-practice reference models. The purpose of the article is to demonstrate the business process renovation approach with the use of reference models. Although the use of reference models brings many positive effects for business, they are still rarely used in Slovenian small and medium-sized companies. The reasons for this may be found in the reference models themselves as well as in project implementation methodologies. In the article a reference model based on Microsoft Dynamics NAV is suggested. The reference model is designed using upgraded BPMN notation with additional business objects, which help to describe the models in more detail.

Keywords: ERP solution, reference model, business process renovation, Microsoft Dynamics NAV, BPMN

JEL Classification: M, M1, M15

1. Introduction

Companies and other organizations are using enterprise resource planning (ERP) systems more and more extensively. ERP systems support most of the key functions of an enterprise such as logistics, sales, and financial management. These systems are generic and the functionality they provide can serve a large variety of enterprises. The implementation of an ERP system involves a process of customizing the generic package and aligning it with the specific needs of the enterprise (Soffer, Golany & Dori, 2003).

It is very important to select an appropriate ERP system. The decision concerning the purchase of individual modules or their development can only be made on the basis of good knowledge of business needs, which have to be compared with the capabilities of an ERP system (Kovačič & Bosilj Vukšić, 2005).

ERP system capabilities are best described by reference models. Reference models are generic conceptual models that formalize recommended practices for a certain domain (Rosemann & van der Aalst, 2007). It represents one or more pre-engineered and integrated organizational views. The type of reference model could be a business process reference model, or a description of data flows (Enterprise Integration Inc., 2007).
The use of reference models has many positive effects for business (Kirchmer, 2009; Fettke & Loos, 2007). Despite that, they are still rarely used in Slovenian small and medium-sized companies. The reasons for this can be found in the reference models as well as in implementation methodologies. For some ERP systems reference models have not been developed yet. Developing models from scratch can be very time- and cost-consuming. Therefore, it is reasonable to reuse existing reference models as a starting point to develop specific conceptual models (Becker, Beverungen & Knackstedt, 2010).

The aim of this article is to present the business process renovation approach with the use of reference models. Our research goals are to:

- review the reference models research area;
- suggest Microsoft Dynamics NAV reference models;
- upgrade BPMN (Business Process Modeling Notation) with additional information objects that enable the design of reference models on a more detailed level; and
- present the use of reference models.

The structure of the paper is as follows: the first section introduces the business renovation concept and identifies the role of ERP systems. Section two generally describes reference models. Section three suggests the Dynamics NAV purchase reference model based on BPMN. The last section shows how to use reference models in business process renovation. First, an existing (as-is) business process is presented and then, with the use of a reference model, a to-be process is suggested.

2. Business Renovation and ERP systems

The rapid and constant changes that are very common in today's business environments affect not only business

itself, but also its supporting business information systems (IS). As a result, IS require constant change, renovation and adaptation to meet actual business needs.
Business renovation is presented as the highest level of a strategy for managing change that usually cannot be handled by continuous improvement and reengineering methods or organizational restructuring (Kovacic, 2001). Process renovation is a reengineering strategy that critically examines current business policies, practices and procedures, rethinks them and then redesigns critical products, processes and services (Prasad, 1999).

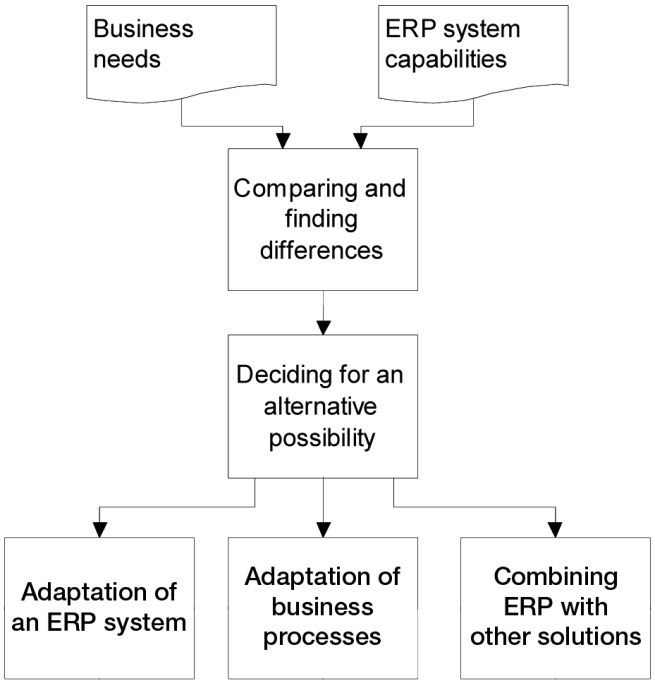
The implementation of large IS is impossible without first altering business processes, while renovation is essential in order to extract the maximum benefit from IS products. In the past, companies first decided how they wanted to do business and then selected the software package that supported their business processes. They made many modifications to ensure a tight fit. This changed with the introduction of ERP systems that often required business processes to be modified to fit the IS (Davenport, 1998).

An ERP system is a business management system that comprises integrated sets of comprehensive software that can be used, when successfully implemented, to manage and integrate all business processes and functions within an organization. They usually include a set of mature business applications and tools for financial and cost accounting, sales and distribution, management of materials, human resources, production planning and computer integrated manufacturing, supply chain, and customer information (Kovačič & Bosilj Vukšić, 2005).
Nowadays many organizations support their processes by purchasing ERP systems. The rate of unsuccessful projects is significantly high. The main reason for this is the underestimation of the complexity of such a project that requires several organizational changes and the involvement of employees. The massive organizational changes involved in ERP implementation result from the shift in business design from a fragmented, functional-based organizational structure to a process-based one (Davenport, 1998).

It is very important to select an appropriate ERP system. The selection process should be based on a comparison of business needs and the capabilities of an ERP system (Kovačič & Bosilj Vukšić, 2005). Business needs are best described by organization's strategy and desired business processes. Processes inside an organization have to be compared with the ERP system's capabilities (Figure 1).

Based on the comparison a company can choose between three alternatives. The first is to adapt an ERP system to their business processes. Most ERP systems allow a certain degree of customizations and parameterization. This alternative can cause high additional costs

Figure 1: The alternatives for selecting and implementing an ERP system



Source: A. Kovačič & M. Indihar Štemberger, The Role of Business Process Modeling in ERP Implementation Projects, 2008

along with problems in further maintenance and upgrade projects.

The second alternative is the adaption of business processes to an ERP system. Typically, the delivery of best practice applies more usefully to large organizations and especially where there is a required standard, or where the process is a commodity like accounting processes. This is because the procedure of capturing and reporting standardized or commodity content can be readily codified within the ERP software, and then replicated across multiple businesses with the same business requirements.

The disadvantage of this alternative is that an organization might lose the advantage of a unique and perhaps a better business practice. Best-practice processes are comparable to everyone else in the industry sector and therefore erode competitive advantage. The third alternative is to combine the acquired ERP system, integrated best-of-breed systems and engineered adapted or built applications. This is the best possible alternative for the majority of cases (Štemberger & Kovacic, 2008).

The comparison therefore requires clear business needs on one side and recognized capabilities of ERP system on the other side. ERP system capabilities can be presented by ERP consultants, user manuals, training materials etc. The best way to formalize the capabilities of

an ERP system is by process reference models. They can be used to describe the features of different ERP packages. Based on such a description, it is possible to compare and select an appropriate ERP package for an enterprise.

3. Business Process Reference Models

Process design is a key phase in the renovation of a business process. The resulting blueprint is the basis for implementation and execution, as well as monitoring and controlling processes. Ensuring such modeling quality can be very time-consuming. The use of process templates significantly increases the efficiency and effectiveness of the process design phase. The process templates are generally called business process reference models (Kirchmer, 2009).

A reference model encompasses one or more pre-engineered and integrated organizational views. For example, one type of reference model might be a business process reference model, or a depiction of data flows (Enterprise Integration Inc., 2007). It is an abstraction to facilitate understanding of the relationships among various objects, and for the development of consistent standards or specifications supporting an integrated environment. A reference model is based on a small number of unifying concepts and may be used as a basis for education and explaining standards to non-specialists (AGIMO, 2007).

In the literature we can find several other definitions of reference models. Rosemann (2003) defines reference models as generic conceptual models that formalize recommended practices for a certain domain. Fettke and Loos (2003) contended that a reference model represents a class of domains.

Reference models have the following characteristics (Fettke & Loos, 2007; Fettke & Loos, 2003; Kirchmer, 1999; Scheer, 1998):

- a representation of best practices (providing best practices for conducting business);
- universal applicability (representing a class of domains, not a particular enterprise); and
- reusability (they can be understood as blueprints for developing information systems, they can be structured for easy adaptability to company-specific situations).

Reference models play an increasingly important role in activities such as business engineering (Scheer, 2000), information systems development (Winter, 1994) customizing of ERP systems (Rosemann & van der Aalst, 2007) and training and research (Thomas, 2006). In order to be able to use reference models, they must be adapted to the requirements of a specific enterprise. Reference models are also called universal models, generic models or model patterns.

Reference models represent the content of various domains. The most important types are the following (Kirchmer, 2009; Fettke & Loos, 2003):

- industry reference models (representing the best practices of a specific industry sector);
- software reference models (these could be traditional applications such as ERP systems, or a reference model representing the sub-process supported by service-oriented architecture (SOA);
- procedural reference models (e.g., a project management reference model); and
- company reference models (representing best practices within a company or a company group).

Process reference models (*Table* 1) integrate the well-known concepts of business process reengineering, benchmarking, and process measurement into a cross-functional framework (eKnowtion, 2009).

Certain types of software are designed and developed once, and then replicated many times (e.g. Microsoft Office). Certain software vendors (e.g. SAP, Oracle etc.) have applied this same concept at the enterprise level.

Table 1: The process reference model concept

Business Process Reengineering	Benchmarking	Best Practices Analysis	Process Reference Model
Capture the "as-is" state of a process and derive the desired "to-be" future state.	⇒	⇒	Capture the "as-is" state of a process and derive the desired "to-be" future state.
	Quantify the operational performance of similar companies and establish internal targets based on "best-in-class" results.	⇒ ⇒	Quantify the operational performance of similar companies and establish internal targets based on "best-in-class" results.
		Characterize the management practices and software solutions that result in "best-in-class" performance. ⇒	Characterize the management practices and software solutions that result in "best-in-class" performance.

Source: eKnowtion, Achieving Operations Excellence with SCOR, 2009

They have designed and developed modular standard software solutions that enable business applications to be deployed across the enterprise. The idea is to implement the software with minimum modifications in order to avoid the associated costs and risks (Enterprise Integration Inc., 2007).

The use of reference modeling has different economic effects on the modeling process (Hilt, 2007; Fettke & Loos, 2007; Kirchmer, 2009):

- a decrease in costs (reference models can be reused so the development costs of the reference model can be saved);
- a decrease in modeling time (the knowledge contained in the reference model reduces learning and development time, allowing the identification of and a direct focus on critical processes);
- an increase in model quality (reference models are proven solutions and provide better model quality and an awareness of own deficiencies); and
- a decrease in modeling risk (the risk of failures during reference model usage can be reduced because reference models are already validated).

Possible disadvantage of using reference models is that an organization might lose some advantage of its unique and perhaps better business practices. The best practice represented by reference models is more or less widely used in the industry sector and therefore cannot represent a source of competitive advantage.

4. Purchase reference model design

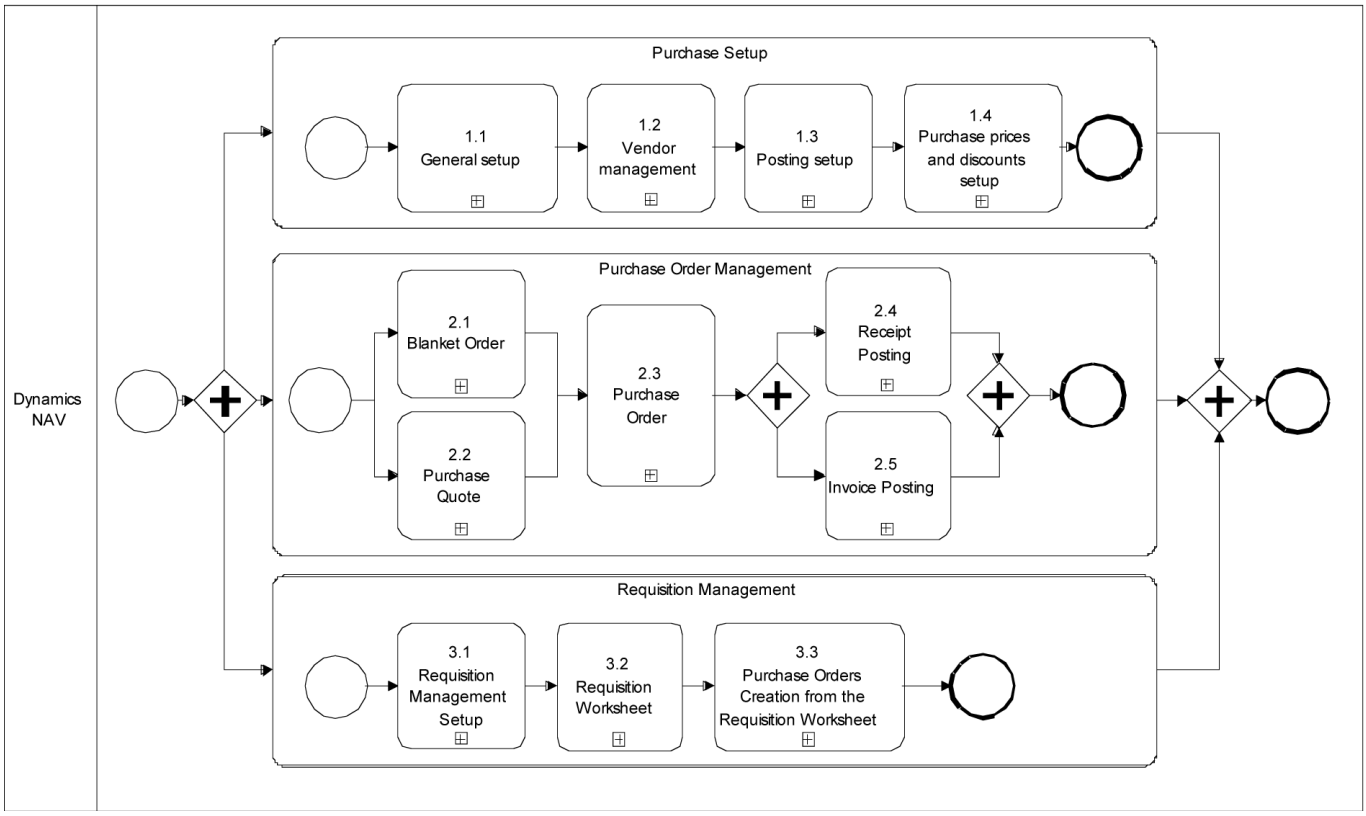
ERP-specific reference process models describe the main ERP processes on different levels. Depending on the underlying methodology these models include details of the control flow, organizational units, input and output data and business objects. Further, it is usually possible to refer to the relevant part of the online documentation and, at the lowest level, even to the corresponding ERP transaction (Rosemann, 2000).

The reference model of the ERP solution Microsoft Dynamics NAV (Dynamics NAV) has not yet been published. In this section I will therefore suggest a purchase reference model on two levels. The first level will present a general overview of purchase processes. The second, more detailed level explains purchase posting transactions. The design of the general reference model is based on ERP system educational materials on the purchase area (Microsoft Corporation, 2008), while the design of the purchase posting reference model is based on development and consulting experiences in ERP solution implementation projects.

4.1. Purchase reference model

The reference model (*Figure* 2) represents some ERP system Dynamics NAV purchase processes. It can be used by managers and business consultants to gain a general overview of certain ERP system capabilities.

Figure 2: Purchase reference model (business view)



Practical usage of the reference model is expected at lower levels of detail.

The structure of the reference model discussed in the following sections is as follows: purchase setup, purchase order management and requisition management.
Purchase setup (1.1) processes elaborate on setup options that define the functionality of the purchase module. Based on established practices, companies must specify how they want the program to support them in managing different aspects of their purchase transactions. These are the general setup options applied to all purchase transactions regardless of which item and vendor are involved. Managing vendor (1.2) information is an important part of managing the total purchases and finances of a company. Basic information (such as name, address and so on) and details (such as credit limit, invoicing, discount and payment terms, currencies, and a list of regularly supplied items) are recorded for each vendor on a vendor card.

Posting setup (1.3) defines the connection between a vendor and the accounts in the general ledger. This is done by assigning a vendor to a posting group for balance sheet and income statement accounts. Companies have the possibility to specify cost and discount information (1.4) for each item on the item card, and are given a functionality that facilitates the task of purchase price management. The program automatically retrieves information about the last direct cost stored on an item card to copy it to the purchase order line for the item in question.

The first step in a workflow involves making a blanket order (2.1) or purchase quote (2.2). A blanket purchase order represents a framework for an agreement between the company and a vendor. Blanket orders are used when the company has committed to buying large quantities of an item that are to be received in several smaller shipments over a certain period of time. A quote can be described as a draft order in which purchasing agents can register the vendor's offer specifying the price, terms of sale, description of items etc. A blanket order and quote can be converted into a purchase order (2.3), which is a cornerstone of purchase management functionality in Microsoft Dynamics NAV. Receipts and invoices are posted from the purchase order.
The requisition management functionality (3.1, 3.2, and 3.3) helps automate the procurement process and enables the purchasing agent to perform basic purchasing activities more efficiently. The requisition worksheet calculates a current and detailed purchase order proposal plan, creates actual purchase orders from order proposal lines, manually handles created purchase order proposal lines, controls the flow of relevant information between the departments concerned, and provides a practical overview of the individual processes involved.

4.2. Purchase posting reference model

This section introduces a more technical view of ERP system dynamics NAV. The purchase posting transaction is presented with corresponding business objects which enable particular activity. In order to design such a reference model, we have upgraded the BPMN with additional ERP system objects (*Table* 2).

Table 2: ERP solution Dynamics NAV business objects

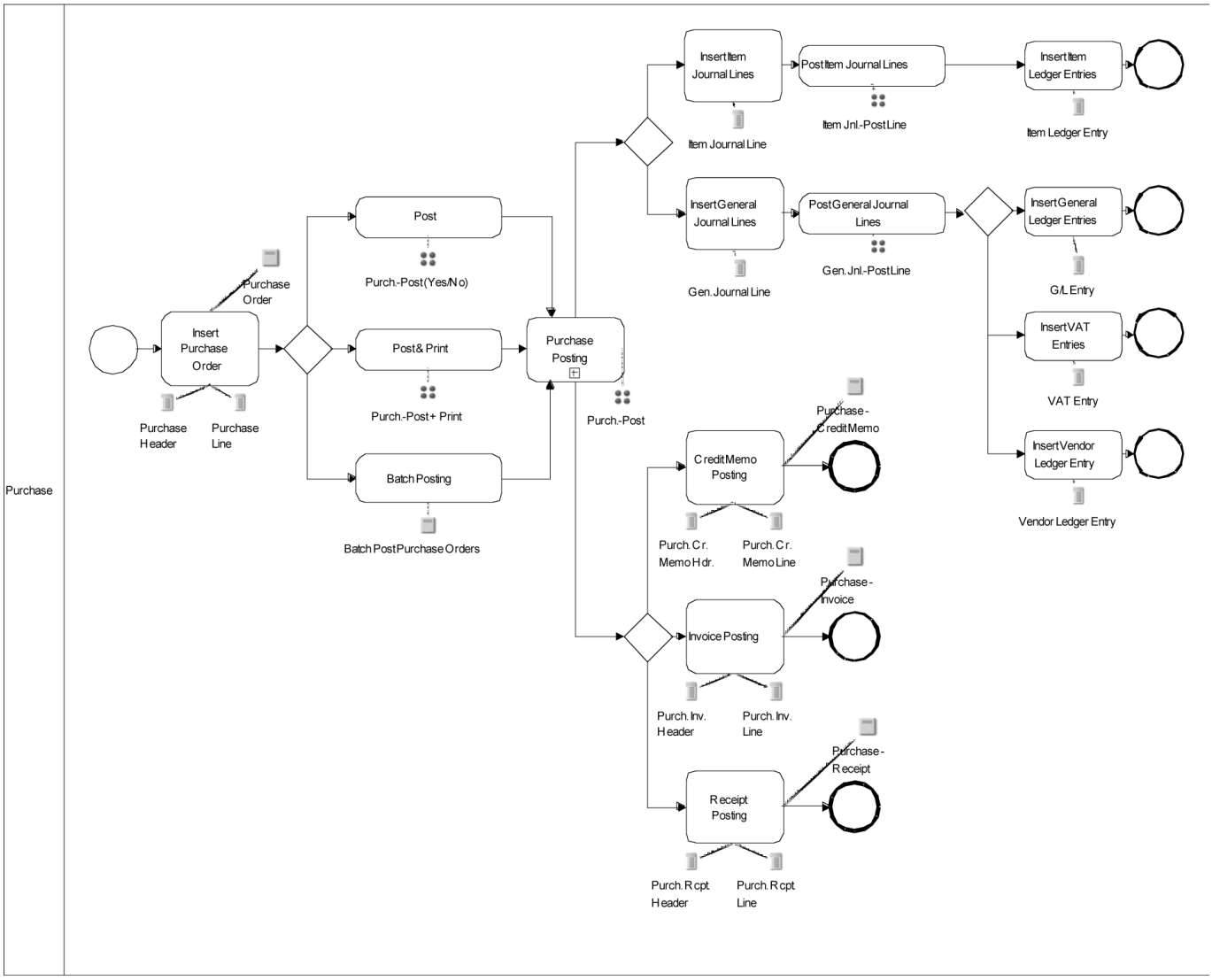
	Table: Used to describe how data is stored in the database and how it is retrieved
	Form: Used to display data to the user in a familiar and useful way
	Report: Enables users to summarize and print detailed information using the filters and sorting that they choose
	Dataport: Able to export or import table data
	XML port: Related to a dataport; used to import and export data
	Codeunit: Contains program functions

The business object adds additional information to the model. This could be very useful information for ERP system analysts and developers especially in the design and development phases of ERP system implementation. The reference model therefore can represent the basis for technical documentation (Figure 3).

5. Use of the purchase reference model in process renovation

This section shows how to use reference models in a business process renovation. First an existing requisition business process (*Figure* 4) in a trading and manufac-

Figure 3: Purchase posting reference model (technical view)



turing company is presented. The main activities of the selected company are the wholesale of textile goods, products and household services. The sales are focused on the Slovenian market.

With the use of the purchase reference model presented in the previous section, the existing requisition process is renovated and a new to-be process (*Figure* 5) is suggested. The to-be process is supported by ERP system Dynamics NAV.

5.1. Purchase requisitions process modeling

The purchase requisitions process (*Figure* 4) explains events that can trigger the requisition of a specific product or service. These events can be:

- external, e.g. a paper list from a warehouse or a confirmation or invoice from a supplier;
- a released sales order in the case of a direct delivery where received goods are delivered directly to the customer;
- a confirmed requisition; or
- a requisition plan which has information regarding the optimal inventory level, requisition time periods etc.

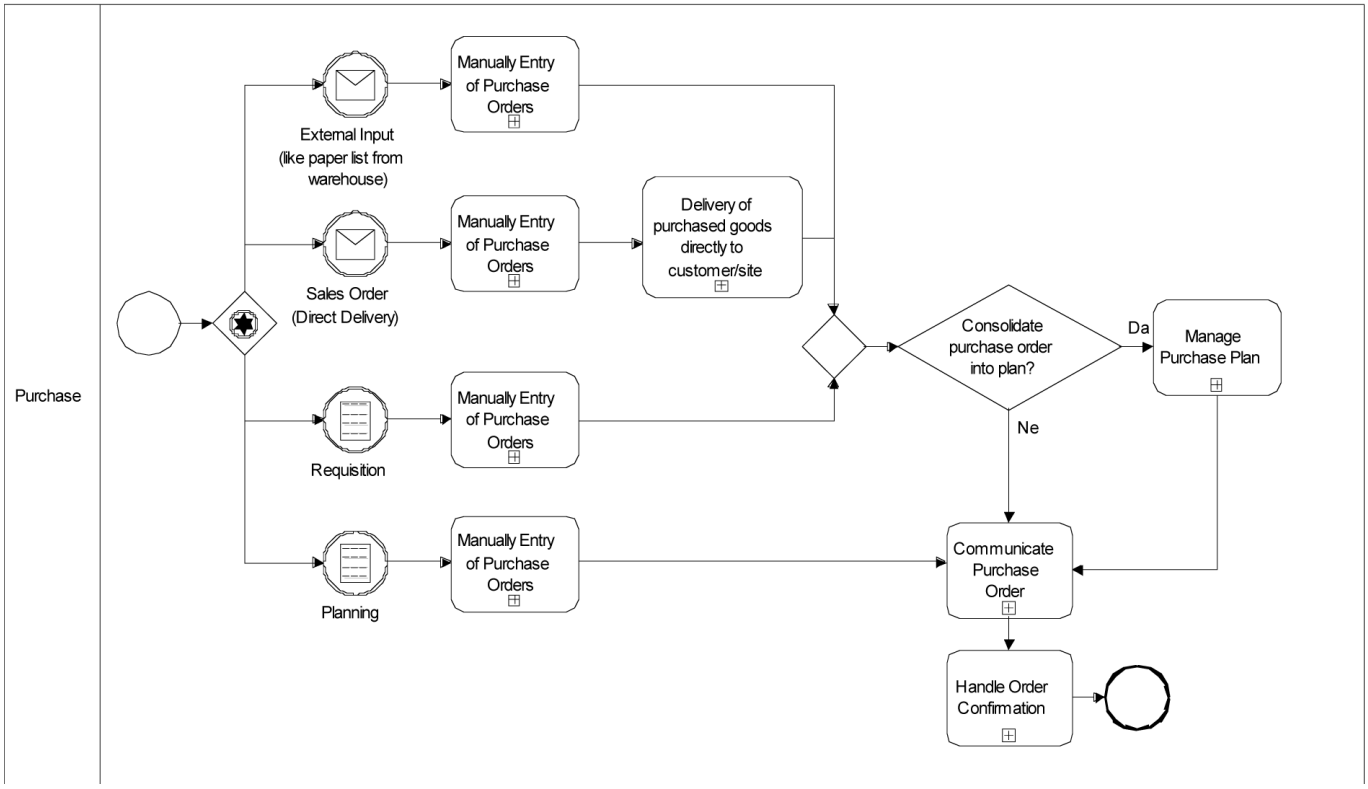
Regardless of the source, currently in all cases the purchase order is manually entered into the system by purchasing clerks. The owner of the requisition plan is purchasing manager. The plan is supported by Microsoft Excel.

The presented process involves a lot of manual work, especially with the entering of purchase orders and updating of the purchase plan.

5.2. Purchase requisitions process renovation

Process renovation is achieved based on a comparison between the purchase reference model of an ERP system Dynamics NAV, presented in section 4.1 and the purchase requisitions process (Figure 4). The activities of

Figure 4: Purchase requisitions process (as-is)



the new to-be process (Figure 5) have a corresponding number of reference model sub-processes. This represents a link and explains which component of an ERP system supports the specific activity of the company's process. The result of the comparison shows the degree of fit and how many modifications would be needed on the ERP system side.

A reduction of manual work and many other advantages are achieved with the next process improvements:

- sales order lines, in the case of direct delivery, are now directly transferred to purchase orders (the purchasing clerk does not have to manually enter them again);
- the confirmed requisition is already entered in the system as a purchase quote (a blanket order is converted into a purchase order automatically); and
- a requisition plan based on predefined parameters suggests the necessary requisitions and also automatically creates purchase orders.

6. Conclusion

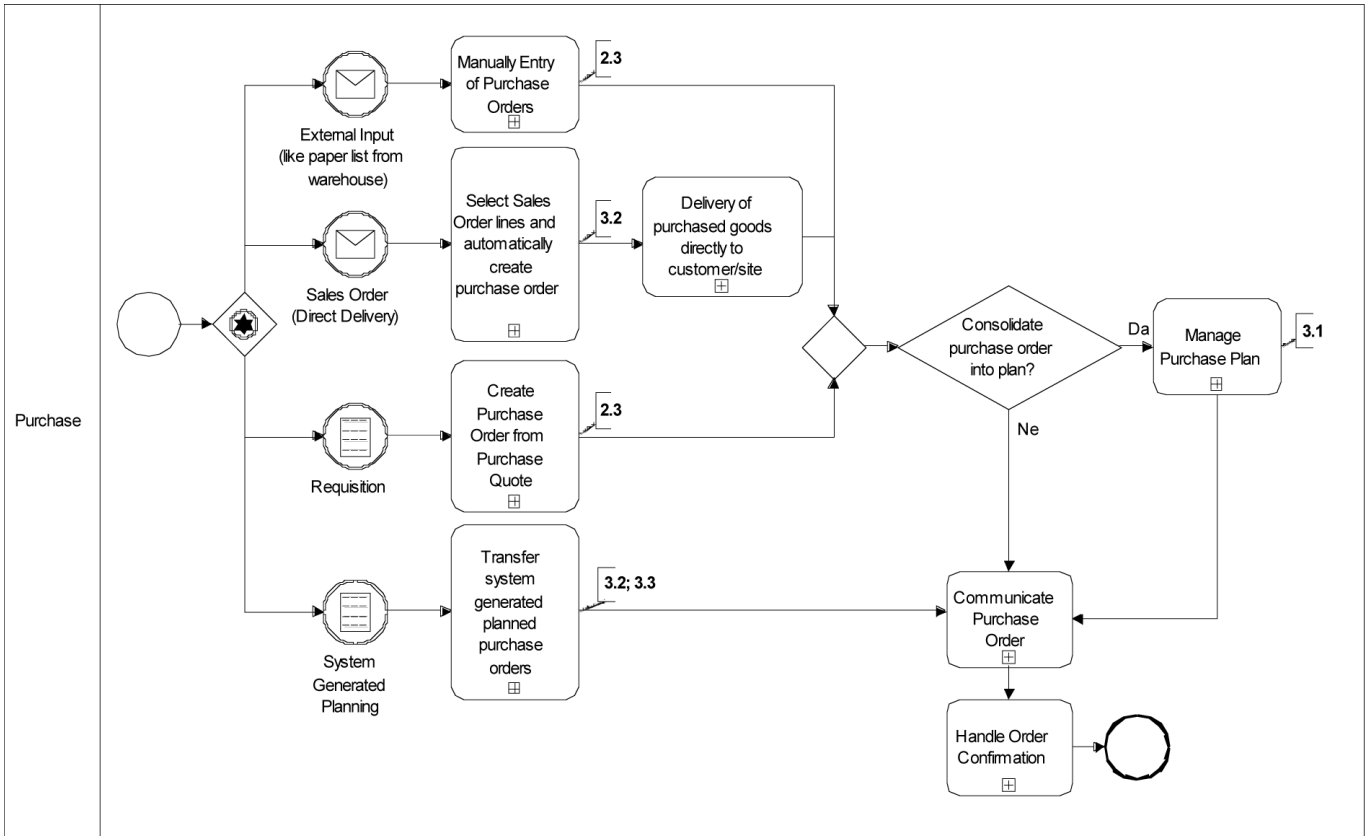
The redesign of business processes and implementation of an IS can represent the best way to face the challenges of today's changing business environment. Information systems require constant change, renovation and adaptation to meet actual business needs.

Conceptual models play an increasingly important role in all phases of the information systems life cycle. For instance, they are used for business engineering, information systems development and the customizing of ERP systems. The design of such models is often cost- and time-consuming. The concept of reference modeling has been introduced to overcome these failures and improve the development of enterprise-specific models. Reference models are generic conceptual models which formalize recommended practices for a special domain. They deliver best practice information that can be used many times.

In the paper we presented alternative possibilities for the selection and implementation of an ERP system. In second section we introduced the reference model concept. In the third section we suggested the Dynamics NAV purchase reference model based on BPMN. We also upgraded the BPMN with additional ERP system objects, which bring additional information to the model.

In the last section we presented how to use reference models in business process renovation. First, an existing requisition business process in a trading and manufacturing company was presented. Based on the comparison between the suggested reference model and the as-is process we designed the to-be process and explained the modifications. We presented many positive effects that reference models have on business. In the future we should devote more attention to this area, especially in practice.

Figure 5: Purchase requisitions process (to-be)



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