Chapter 6
Reference Models: Accelerators and More

Quality and speed of the process design have a significant impact on the management of the business process life cycle through the value-driven BPM-Discipline. The information models produced in the process design lay the basis for the implementation, execution, and controlling of processes. The use of flexible next-generation process execution environments requires an input business process models in high-quality syntactical and semantic formats. Ensuring such modeling is of quality can be very time-consuming. The use of appropriate process-modeling tools and even more importantly leveraging process templates that are adapted to company-specific requirements can help tremendously. The use of appropriate business process templates increases the efficiency and effectiveness of the process design phase. A client I have worked with stated that the use of such predefined templates as a starting point of the process design had reduced the design time by over 50%—while maintaining or even increasing the design quality. The process templates are generally called "business process reference models." Reference models facilitate the achievement of high-quality design while keeping best efficiency.

While working in Japan for IDS Scheer, I started an initiative to develop a reference model for the pharmaceutical industry on the basis of specific documentation and reporting requirements, a model that would also reflect the related capabilities of SAP's enterprise resource planning (ERP) system. We were able to sell the product to clients and could use it ourselves successfully in consulting engagements, which proved that such "content products" were becoming increasingly important in supporting process management initiatives. Accenture, a leading consulting firm I had been working with heading their BPM practice, has built a major reference model repository describing common practices in dozens of industry segments using thousands of process and other information models. This continuously increases the value it offers to their clients. At BPM-D, the company I cofounded, we have developed a patent-pending reference model for the BPM-Discipline itself. This helps to develop a fast and effective company-specific management discipline for people- and technology-based strategy execution.

© Springer International Publishing AG 2017

M. Kirchmer, *High Performance Through Business Process Management*,
DOI 10.1007/978-3-319-51259-4_6

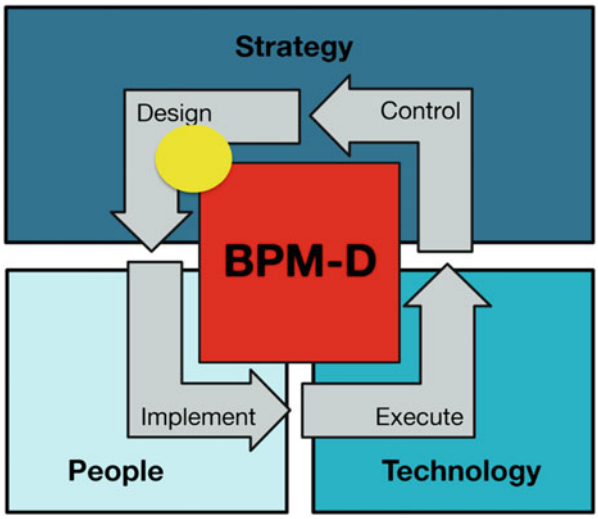

Fig. 6.1 Focus on process design of value-driven BPM

Process reference models truly increase speed and reduce risk of transformation and improvement initiatives.

This chapter will define reference models in general and focus specifically on business process reference models. It discusses how to procure reference models and learn how to use them in practice. The focus of this chapter, the process design of value-driven BPM, is shown in Fig. 6.1.

Process reference models show how process knowledge can be formalized and structured as a step toward "knowledge transfer" into a "product" that can be sold on the market. Just as enterprises today purchase application software, in the future they may procure best and common process practices in the form of reference models.

6.1 What Are Reference Models and Why Should You Use Them?

Let us look at an example. We assume you need to improve your procurement process for office material because it currently performs significantly under industry average: it is too expensive and too slow. This process is not of particular importance, and you do not expect to achieve any competitive advantage through its design. It is a real commodity process. Therefore, it is sufficient to bring it to industry average performance, using common industry practices. But how do you know what those industry common practices are? How can you complete appropriate process models driving the improvement quickly and cost efficiently? This is where reference models help.

Reference models (RMs) are generic conceptual information models that formalize recommended practices for a special domain [1–3]. Therefore, they have the following characteristics [1–5]:

- Representation of common or even best practices: RMs provide the necessary knowledge for conducting business activities in a specific domain at a common or best performance level.
- Universal applicability: RMs deliver business content that can be used well beyond an individual company-specific situation. Hence, they will not only be used in one organization, but a whole set of organizations.
- Reusability and adaptability: RMs are conceptual frameworks that can be easily reused in many related projects. They are structured for easy adaptability to company-specific situations.

This means that RMs deliver common or best practice information that can be used many times, for example, in multiple organizations or for different projects. Their format allows easy adaptability to specific situations in different companies. Therefore, they are, in general, available in digital form, in most cases as files of process-modeling and repository tools. Although the currently available RMs often do not completely fulfill all of those characteristics [4], they at least come close to those requirements.

In the context of value-driven BPM, we will focus on "business process reference models." The RMs consist of "conceptual models" that are relevant for business processes, primarily even process models. Those can be complemented by models for other views on processes, like functions, data, organizational structure, or deliverables. In this chapter, we use RM as a synonym for business process reference models.

In the procurement example explained earlier, one could use an industry common-practice RM that includes a suggestion for the procurement of office material. This enables the simple and efficient use of industry-specific knowledge as required in this situation.

RMs represent content of various domains. According to those domains, one can distinguish different types of RMs. The most important are the following:

- Industry RM: They represent common or best practices of a specific industry sector, like a banking RM, a telecommunication reference model, a pharmaceutical, or a machinery industry reference model.
- Software RM: They describe common-practice processes on the basis of a specific application software system. These could be traditional applications, such as ERP systems or RMs representing the subprocess supported by a service of a service-oriented architecture (SOA).
- Procedural RM: They show best practices of nonindustry-specific domains or of domains that are not part of the daily operational business of an organization, for example, a project management RM, a RM for the BPM-Discipline, or functional RMs, e.g., for human resources or finance.

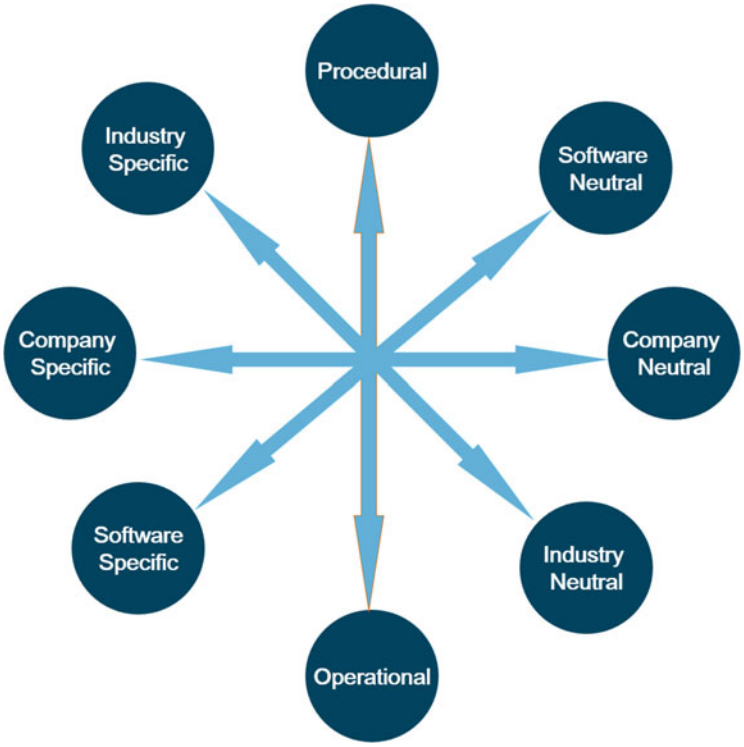

Fig. 6.2 Types of reference models

- Company RM: These models represent common practices within a larger organization or a company group, for example, a common practice for organizing maintenance processes or call center operations—in the specific product, market, and company context. These RMs do not fully meet the criteria of "universal applicability." But in large organizations, those models can be of high importance, for example, for standardization initiatives.

In many cases, RMs represent a combination of two or more model types. For example, the RM could be an ERP-based reference model (e.g., for SAP software) for the consumer packaged goods industry, including special aspects, like a "direct store delivery" process. The different types of RMs are visualized in Fig. 6.2.

The use of RMs provides business benefits in the process design, such as:

- Cost reduction
- Time reduction
- Quality improvement
- Risk reduction
- Transparency
- Common language

- Preparation for benchmarking
- Innovation through transfer of practices between domains

It is much easier to modify an existing process model in order to adapt it to a company-specific context than to develop the entire model from scratch. This is especially true for commodity processes where the goal is to modify as little as possible of the reference model. The result is a significant reduction of design time and with that related cost. Experience has shown that the design time for commodity processes can be reduced by up to 70%. And remember, 80%+ of a company's processes are commodity processes. Design workshops for those processes are mostly about identifying how to adjust the existing organization to the common practice described through the RM.

The anticipated high-quality modeling of RMs can be transferred and used in enterprise-specific process-modeling activities. This is true for syntactical as well as for semantic aspects. The content of RMs is already validated; hence, its application leads to risk reduction. The structure of a RM includes the thinking of various experts and experience from different organizations. The syntax and formal structure can be used as a solid starting point and "best practice" for company-specific process-modeling initiatives. This is especially helpful in defining the different levels of detail an enterprise modeling approach should cover: the levels can be defined in relation to the levels used in the RM [6]. A knowledge domain described by RMs becomes transparent through the clear and easy-to-read structure of the RM. Hence, it is easier to scope projects based on such reference models. A RM defines the terms used in the model, for example, functions or data objects. Hence those definitions can be the basis for a common language for all people involved in related process management. If several enterprises use the same RM as a basis to structure their business processes, this facilitates the benchmarking of those processes later since it is easier to compare "apples with apples" due to the use of the same or similar terms and structure of the processes. RMs can also be used to transfer practices form one industry to another, enabling process innovation. For example, a biotechnology company may use the configuration process of a machinery company by applying a machinery industry reference model.

Summarizing those effects, RMs lead to fast and effective process design and increase with that the agility of an organization. This is visualized in Fig. 6.3.

RMs enable smart decisions and fast execution. They effectively help to link strategy to execution in an organization.

So, where can one find such RMs? Are there specialized vendors?

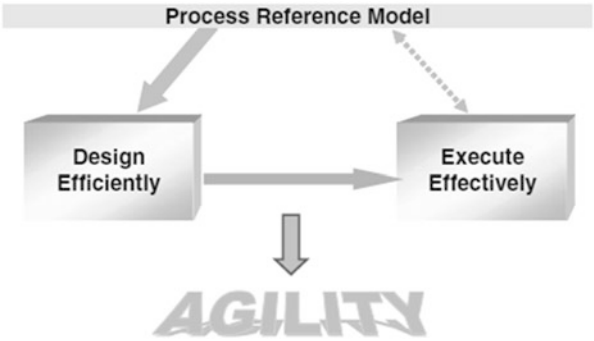

Fig. 6.3 Agility through business process reference models

6.2 How to Obtain Reference Models and How to Evaluate Them?

RMs are basically "products" that you use to build business process models, just as you use other products such as software or hardware. In a broad sense, all of those products can be procured through the information technology market.

Let us review briefly the development of this market of information systems and technology. In the 1970s, the dominating products were hardware—computers. Once the hardware was selected, the software was developed or procured accordingly. This changed in the 1990s with the appearance of software packages, such as ERP systems. Suddenly, the main attention shifted to software products, especially to standard application software packages. Hardware became more or less a commodity. Because the business content of some of those standard software systems was already documented in form of RMs [7], the market for business content in the form of RMs started to develop. I expect that this market will continue to increase in the next few years. Since next-generation software architectures offer organizations increased flexibility, the necessary business content, to manage this flexibility efficiently, has to be procured separately. RMs help to develop the process models necessary to "configure" the next-generation application software. Otherwise, the configuration of major process-oriented software systems may become too cost and time intensive.

Many of the RMs available today are not sold as stand-alone products. They are either provided together with other products, such as software applications or consulting offerings, or they are sold as part of a membership service, for example, of an industry organization. However, I expect that the "productization" of RMs will progress rapidly. Consulting and software companies could have business units delivering RM-based products. Some companies may even decide to only focus on the development and sale of RMs. They may become pure RM vendors.

Today, the main procurement sources for RMs are:

- Software companies
- Consulting companies

- Industry organizations
- Academic organizations

Vendors of ERP systems were forced to make the business content of complex holistic software applications more transparent. For example, SAP documented the business processes enabled by their R/3 software in the form of event-driven process chains (EPCs) [5, 7]. Others, such as PeopleSoft (which has since been acquired by Oracle) followed. Software vendors, especially SAP, have been key drivers in the development of RMs.

Consulting companies were also forced to structure their knowledge in the form of RMs to increase their own productivity: they can use RMs to train consultants and make engagements more efficient and effective. RMs provided by consulting companies can be especially interesting if the companies do not only include common practices but also best and "next" practices or suggestions for process innovations. RMs can include value-related components like capability assessment models, KPI frameworks, or value trees. These components enable an outcome-oriented use of the process reference models increasing the value of those models even more. Using those models, organizations can benefit from a vast business experience in a systematic efficient way. Specifically, utilizing RMs from other industries to support emerging trends and "next practices" in a company's own industry has become a major trend of RMs. However, I also have to mention that most consulting companies combine the use of their RMs with consulting services to make sure those assets are used in the appropriate way.

Models are typically procured indirectly through consulting engagements. PMOLink is one company that already sells RMs as products. They offer a RM for project management, based on the industry standard "PMBOK" [8]. To support usability, the RM is delivered in a database of the process-modeling system ARIS Platform [9]. The structure of the project management model is shown in Fig. 6.4. The size of this RM product is described in Fig. 6.5.

BPM-D, a consulting company focused on establishing and applying a BPM-Discipline that provides value through fast and effective strategy execution, offers a reference model for the underlying process of process management [10]. The reference model consists of over 150 components, many of them linked to job aids and tools providing additional detailed information. It includes process, data, organizational, and value models. The reference model is used to increase speed and reduce risk of establishing a company-specific process management discipline for strategy execution. The RM is visualized in Fig. 6.6.

Industry organizations also deliver knowledge in the form of RMs. For example, the APICS Supply Chain Council offers the supply chain operations reference (SCOR) model [11, 12]. SCOR has been continuously developed for more than 15 years. It is used all over the world and has received great recognition. It is an excellent example for a successful RM. Let us have a closer look at it.

SCOR is a business process reference model that contains all supply chain activities, from supplier's supplier to a customer's customer, including:

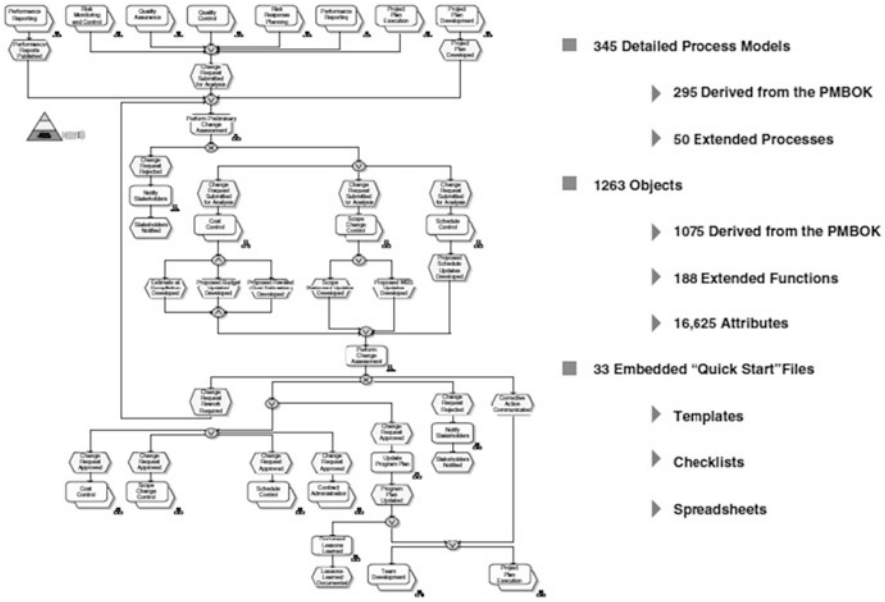

Fig. 6.4 Structure of PMOLink's project management reference model of PMOLink

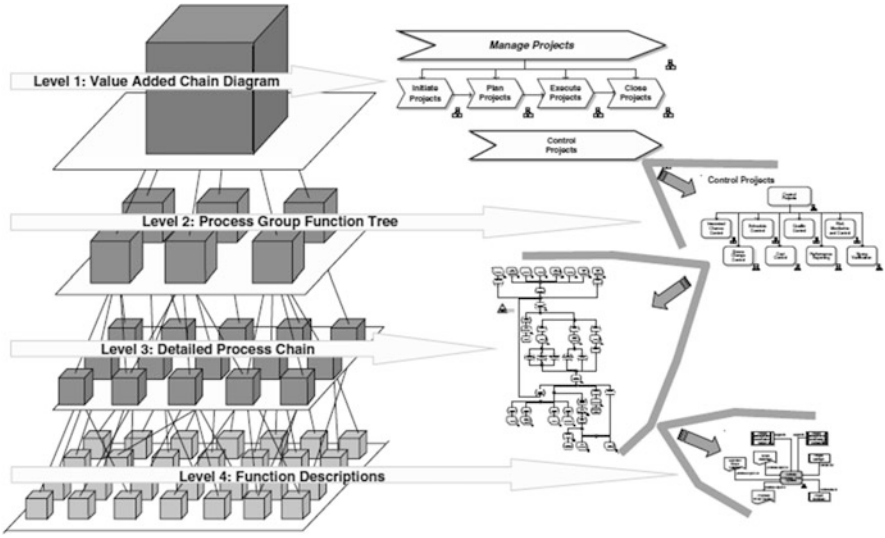

Fig. 6.5 Size of PMOLink's project management reference model

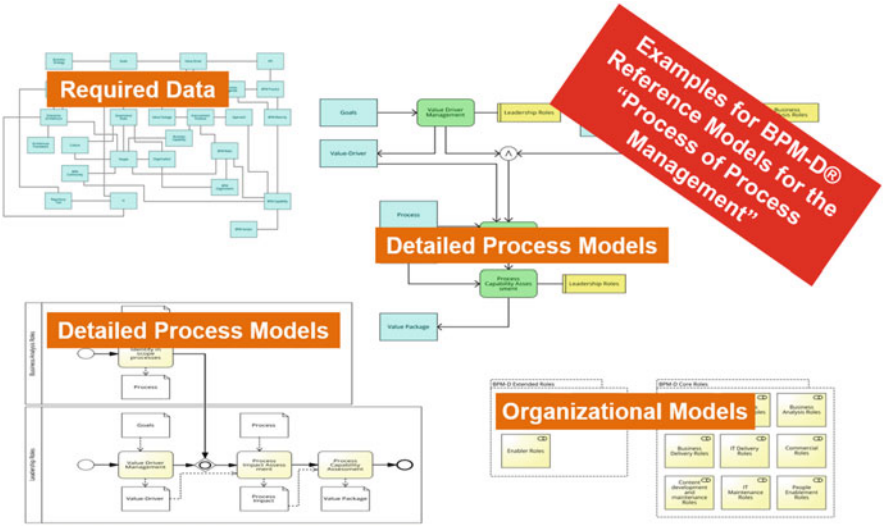

Fig. 6.6 BPM-D® reference model for the BPM-Discipline

- All customer interactions, from order entry through paid invoice
- All product (physical goods, services, etc.) transactions, including equipment, supplies, spare parts, bulk product, software, etc.
- All market interaction, from the understanding of the aggregate demand to the fulfillment of each order

SCOR contains three levels of process detail. The top level (process types) defines the scope and content. It consists of the five top-level processes:

- Plan
- Source
- Make
- Deliver
- Return

The second level of SCOR, the configuration level (process categories), contains more than 30 process categories, such as "make to stock," "make to order," "engineer to order," or "production execution." These process categories can be used to "configure" a company's supply chain. Companies implement their operations strategy through the configuration they choose for their supply chain.

The third SCOR level, the process element level (decomposed processes), is used to fine-tune the operations of a company. It consists of the following:

- Process element definitions
- Process element information inputs and outputs
- Process performance metrics
- Best practices
- System capabilities necessary to support best practices
- Systems/tools to be used

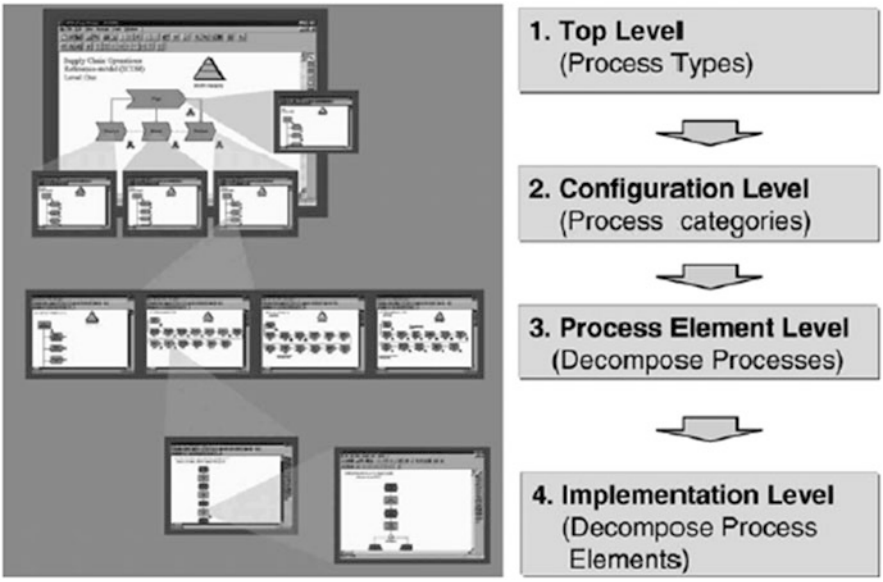

Fig. 6.7 Structure of SCOR

Companies implement their supply chain solution on level four (or even more detailed levels). Level four, or the implementation level (decomposed subprocess), defines practices to achieve competitive advantage and to adapt to changing business conditions. This level is company specific and not in the scope of SCOR. The structure of SCOR is shown in Fig. 6.7.

The American Productivity and Quality Center (APQC) provides high-level reference models in the form of industry-neutral and industry-specific frameworks [13]. These models are, e.g., used to structure processes for benchmarking purposes. RMs are great tools for industry organizations to organize the knowledge of their members and make it available in a useful format.

Academic organizations also deliver reference models. Research in this area is popular in Europe, especially in Germany [4], but it is also evolving in other parts of the world. An example is Scheer's "Y-model," a reference model for industrial enterprises [1, 14] that has been adapted to multiple industry sectors. The top level of the Y-model for discrete manufacturing companies is shown in Fig. 6.8. The left side of the "Y" displays all order-related processes, and the right side shows all product-focused processes. Horizontally, the "Y" structures the processes in execution and planning processes. The support processes are defined above the "Y."

Becker's reference model for retail enterprises [15, 16] is another example of a RM originating in academia. The RM, "retail-H," outlines various aspects of trade information systems, including contracting, order management, goods receipt, invoice auditing, accounts payable, warehousing, marketing, selling, goods issue, billing, and accounts receivable.

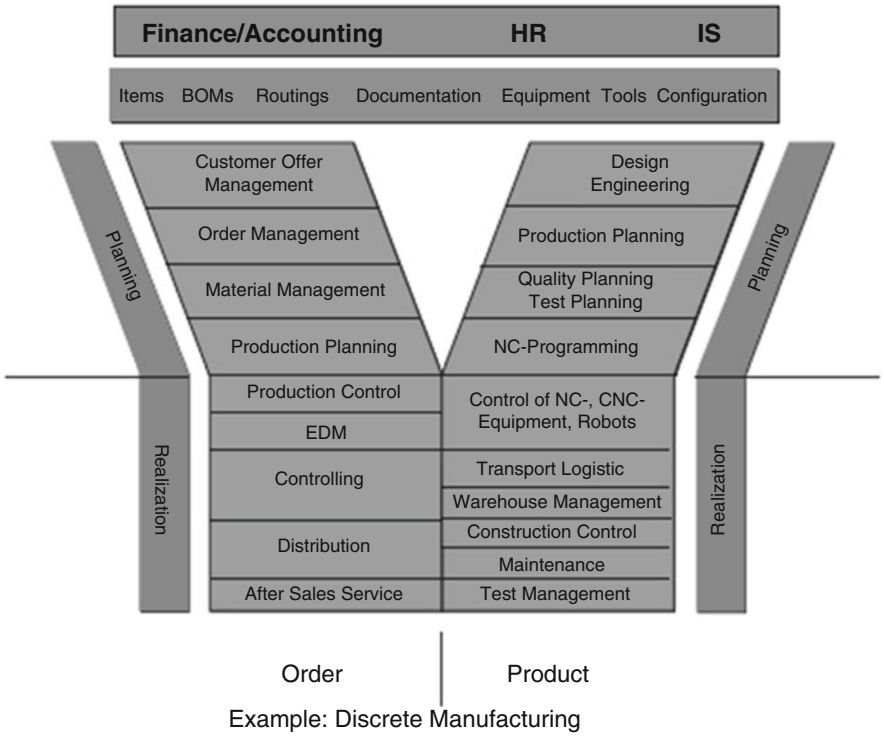

Fig. 6.8 "Y-model": reference model for industrial enterprises (after A.-W. Scheer)

As the market for RMs evolves, available models must be evaluated and compared. Just as one selects software, one also has to choose the appropriate RM. The following criteria can be used to support this RM selection process [17]:

- Syntactic criteria
  - Size
  - Correctness and consistency
  - Modularity
  - Structure (hierarchy)
  - Complexity
  - Architecture
- Semantic criteria
  - General applicability
  - Coverage of domain
  - Completeness
  - Efficiency of use
  - Expressiveness
  - Similarity with other models, possible overlaps

  - Comprehensibility
  - Documentation
- Pragmatic criteria
  - Popularity
  - Flexibility of use
  - Maturity
  - Relevance
  - Availability
  - Cost
  - Tool support

Now we know how to find and select reference models. Let us now discuss how to apply those models operationally in a specific company situation to achieve the described benefits.

6.3 How Do You Apply Reference Models?

The basic procedure to apply a RM to support business process design is fairly straightforward. Eliminate parts of the RM that are not relevant for your specific business context and adjust the process logic wherever necessary. If the RM is missing certain elements, for example, a subprocess needed in your company, those elements are added to the model. The result is an enterprise-specific process model, reflecting the design necessary to achieve company-specific goals. This approach is visualized in Fig. 6.9.

Applying reference models in the context of specific business initiatives delivers value based on the specific benefits of RMs discussed before:

- Systematic integration of common and innovative business practices
- Simplification of content discussions through the use of the terminology of the reference model
- Business-driven implementation of application software systems
- Fast and effective scoping of process-related initiatives
- Easier identification of the maturity level of business processes

Reference models deliver available common practices that can be combined systematically with process innovations that fit into the context of a specific organization. They simplify the design of commodity processes and ensure sufficient resources for high-impact processes. The result is a best practice for a company. The RM defines the terminology to be used; hence, it facilitates and simplifies content discussions [18]. This is especially important for initiatives focused on inter-enterprise processes [12], in which members of multiple organizations are involved. Software implementations, such as ERP projects, can be powerful tools to drive process improvements. However, project teams often lose focus on real

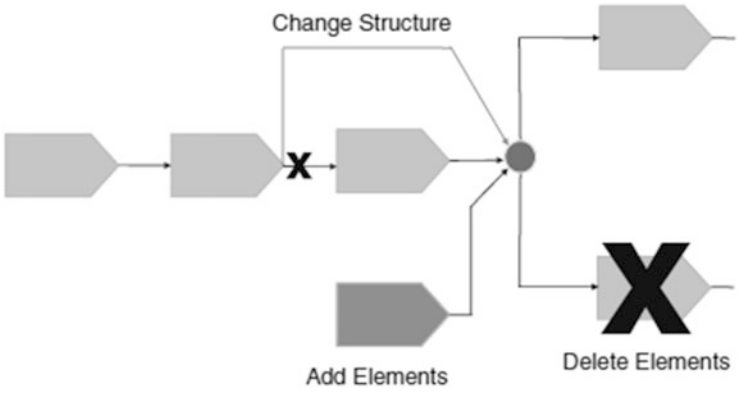

Fig. 6.9 Applying business process reference models

business process topics. The use of RMs avoids that pitfall. The software reference model focuses discussions on the business impacts of the software. It speeds up the process design significantly, especially for the 80%+ commodity processes of an organization. I have worked with clients that stated that the use of RMs in an ERP rollout reduced the design time by over 50% compared to earlier conventional rollouts. A RM also supports the appropriate scoping of an initiative because it describes a business domain in a transparent way. Once several companies have organized their processes, based on the same RM, it becomes easier to benchmark the performance. The performance of supply chain processes, for example, can be compared using the structures delivered by the supply chain operations reference (SCOR) model. As a result, it gets easier to identify the maturity level or processes. This again is key to set up the right improvement and transformation initiatives. These effects of the use of RMs are shown in Fig. 6.10.

Reference models are also in most case not static. New version reflecting new practices are released. This provides the opportunity of further improvements for the areas the RMs are used in. Hence, RMs can become a powerful tool to support a targeted continuous improvement.

A challenge in applying RM is that the models generally do not include any information about what can be modified and how the modifications should look like, so that they really make sense. Is a specific subprocess of a RM optional or do I really need it? Does it make sense to change the sequence of certain functions? These are examples of questions that can be answered by RMs designed as configurable models [19]. These configurable RMs deliver the following advantages [19]:

- Support decisions for the transformation of the model.
- Configuration of all relevant aspects, including data or functions.
- Configuration decisions are classified into mandatory and optional categories.
- Configuration decisions are classified into global (central) and local decision categories.

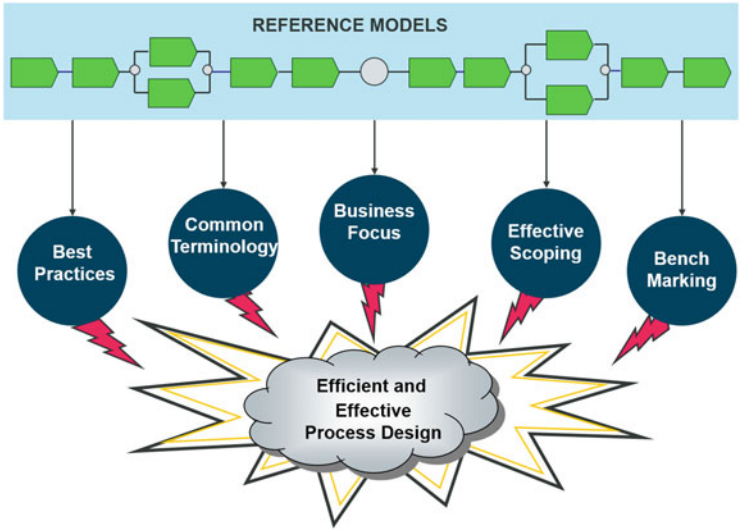

Fig. 6.10 Effects of the use of reference models

- Configuration decisions can be interrelated.
- Relations of decisions must be transparent.
- Guidelines for the use of the models.
- Configurable models are very comprehensive.

Although such configurable models are still not the norm, I am convinced that future RM products will increasingly reflect those requirements to expand the use of the models. This is especially important if those reference models are combined with next-generation process automation systems. The combination of a configurable reference model and the execution engine basically represent a new type of application.

The application of RMs is another accelerator systematically leveraged in value-driven BPM. The process warehouse of the process factory contains all of an enterprise's relevant RMs so that they can be used as components of the process "manufacturing." RMs enable the efficient and effective use of domain know-how around business processes, especially common standards for commodity processes.

6.4 The Bottom Line

- RMs are generic conceptual models, which formalize recommended practices for a special domain. This means RMs deliver common or even best practice information that can be used many times, in multiple organizations. Their format enables easy application in specific situations (Sect. 6.1).

- RMs represent content of various groups of domains, which can be used to distinguish various types of RMs, such as industry or software reference models (Sect. 6.1).
- RMs provide key business benefits for process design, such as cost, time, and risk reduction or the improvement of modeling quality (Sect. 6.1).
- The market for RMs should increase significantly in the next few years, especially due to flexible next-generation software architectures leading to our digital world (Sect. 6.2).
- Today, the main procurement sources for RMs are software companies, consulting firms, industry organizations, and academic organizations (Sect. 6.2).
- Examples of available RMs include the SAP reference models, the BPM-D Framework Reference Model for the Process of Process Management, the PMOLink project management model, the SCOR model, the Y-model, and the retail-H model (Sect. 6.2).
- Criteria for the evaluation and selection of RMs are available (Sect. 6.2).
- The basic procedure to apply RMs to support business process design is fairly straightforward (Sect. 6.3).
- Configurable RMs facilitate the use and transformation of the RM into company-specific process models (Sect. 6.3).
- Reference models are an important accelerator of value-driven business process management.

References

1. Scheer, A.W.: Business Process Engineering—Reference Models of Industrial Enterprises, 2nd edn. Springer, Berlin (1994)
2. Fettke, P., Loos, P.: Classification of reference models: A methodology and its application. Inf. Syst. E-Business Manag. **1**(1), 35–53 (2007)
3. Jost, W.: EDV-gestuetzte CIM Rahmenplanung. Gabler, Wiesbaden (1993)
4. Fettke, P., Loos, P.: Perspectives on reference modeling. In: Fettke, P., Loos, P. (eds.) Reference Modeling for Business Systems Analysis, pp. 1–20. Hershey, London (2007)
5. Kirchmer, M.: Business Process Oriented Implementation of Standard Software—How to Achieve Competitive Advantage Efficiently and Effectively, 2nd edn. Springer, Berlin (1999)
6. Scheruhn, H.-J., von Rosing, M., Fallon, R.L.: Information modelling and process modelling. In: von Rosing, M., Scheer, A.-W., von Scheel, H. (eds.) The Complete Business Process Handbook—Body of Knowledge from Process Modelling to BPM, vol. 1. Morgan Kaufmann, Amsterdam (2015)
7. Curran, T., Keller, G.: SAP R/3 Business Blueprint: Business Engineering mit den R/3-Referenzprozessen. Addison-Wesley, Bonn (1999)
8. PMOLink (ed.): Project Management Processes—Based on the PMBOK Guide. PMOLink, New Orleans (2004)
9. IDS Scheer AG (ed.): ARIS Platform. Product Brochure. IDS Scheer, Saarbruecken (2007)
10. Kirchmer, M.: The process of process management—mastering the new normal in a digital world. In: Business Modeling and Software Development (BMSD) Proceedings, July 2015
11. See: http://www.apics.org/sites/apics-supply-chain-council/frameworks/scor

12. Kirchmer, M., Brown, G., Heinzel, H.: Using SCOR and other reference models for E-Business process networks. In: Scheer, A.W., Abolhassan, F., Jost, W., Kirchmer, M. (eds.) Business Process Excellence—ARIS in Practice, pp. 45–64. Springer, Berlin (2002)
13. American Productivity and Quality Center (APQC): Business Process Frameworks. http://www.apqc.org/process-classification-framework (2011)
14. Scheer, A.W., Jost, W., Guengoez, O.: A reference model for industrial enterprises. In: Fettke, P., Loos, P. (eds.) Reference Modeling for Business Systems Analysis, pp. 167–181. Hershey, London (1997)
15. Becker, J., Schuette, R.: Handelsinformationssysteme, 2nd edn. Redline Wirtschaft, Frankfurt (2004)
16. Becker, J., Schuette, R.: A reference model for retail enterprises. In: Fettke, P., Loos, P. (eds.) Reference Modeling for Business Systems Analysis, pp. 182–205. Hershey, London (2007)
17. van Belle, J.: Evaluation of selected enterprise reference models. In: Fettke, P., Loos, P. (eds.) Reference Modeling for Business Systems Analysis, pp. 266–286. Hershey, London (2007)
18. Kirchmer, M., Scheer, A.W.: Change management—key for business process excellence. In: Scheer, A.W., Abolhassan, R., Jost, W., Kirchmer, M. (eds.) Business Process Change Management—ARIS in Practice, pp. 1–14. Springer, Berlin (2003)
19. Recker, J., Rosemann, M., van der Aalst, W., Jansen-Vullers, M., Drelling, A.: Configurable reference modeling languages. In: Fettke, P., Loos, P. (eds.) Reference Modeling for Business Systems Analysis, pp. 22–46. Hershey, London (2007)