Chapter 6
Reference Models to Empower MPE

Process design is a key phase of management of process excellence (MPE). The resulting blueprint is the basis for the implementation and the execution, as well as the monitoring and controlling of processes. The use of flexible execution environments, such as SOA, particularly requires business process models in high-quality syntactical and semantic formats. Ensuring such modeling quality can be very time consuming. The use of appropriate process-modeling tools and process templates that are adapted to company-specific requirements can help tremendously. The use of process templates increases the efficiency and effectiveness of that process design phase significantly. The process templates are generally called "business process reference models."

Reference models facilitate the achievement of high-quality design while keeping the necessary resources at an acceptable level. Therefore, the use of reference models is an important element of MPE. They are key enablers of the process design phase.

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 BPM initiatives. Accenture has built a major BPM Reference Model repository with over 20,000 models describing 71 industries. This enables a continuously increased value for Accenture's clients as those clients strive to achieve high performance. Process reference models truly increase efficiency and lead to higher-quality results.

This chapter will define reference models 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 MPE, 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

Fig. 6.1 Focus on process design of MPE

the market. Just as enterprises today purchase application software, in the future they may procure content in form of reference models.

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

Let us assume that you would like to design your procurement process, using the process factory in the MPE design phase. This process is not of particular importance and you do not expect to achieve any competitive advantage through its design. Therefore, it is sufficient to follow industry best practice. But how do you know what that industry best practice is? How can you complete necessary process models quickly and cost efficiently? This is where reference models can help.

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

- Representation of best practices: RMs provide best practices for doing business.
- Universal applicability: RMs deliver business content well beyond an individual issue. Hence, they will not only be used for one enterprise, but a whole set of enterprises.
- Reusability: RMs are conceptual frameworks that can be easily reused in many information system projects. They are structured for easy adaptability to company-specific situations.

This means that RMs deliver best-practice information that can be used many times (e.g., in multiple organizations or for different projects). Their format allows easy application to specific situations. Therefore, they are, in general, available in digital form, e.g., files of process modeling software systems. 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 MPE, we will apply "business process RMs." The RMs consist of "conceptual models" that are relevant for business processes, primarily even process models (complemented by models for other views on processes-like functions, data, or organization). In this chapter, we use RM as synonym for business process RMs.

In the procurement business process example explained earlier, one could use an industry best-practice RMs that includes a suggestion for the procurement. This enables the use of industry knowledge in an efficient and effective way, reduces the design time, and assures the desired design quality.

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

- Industry RM: They represent best practices of a specific industry sector (e.g., a banking RM or a consumer packaged goods RM).
- Software RM: They describe best practice processes on the basis of a specific application software system. These could be traditional applications, such as ERP systems, or RM representing the subprocess supported by a service of an SOA.
- Procedural RM: They show best practices of specific procedures that are not part of the daily operational business of an organization (e.g., a project management RM or an RM to build business process governance).
- Company RM: These models represent a best practice within a company or a company group (e.g., a sales process that is rolled out to all sales subsidiaries of the organization).

In many cases, RMs represent a combination of two or more model types. For example, 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
- Basis for benchmarking

Since "premanufactured" models can be used, the development cost for company-specific process models is reduced. This also reduces development time. It is much faster to discuss how to modify a process model to adapt it to a company-specific situation than to develop it from scratch. The anticipated high-quality modeling
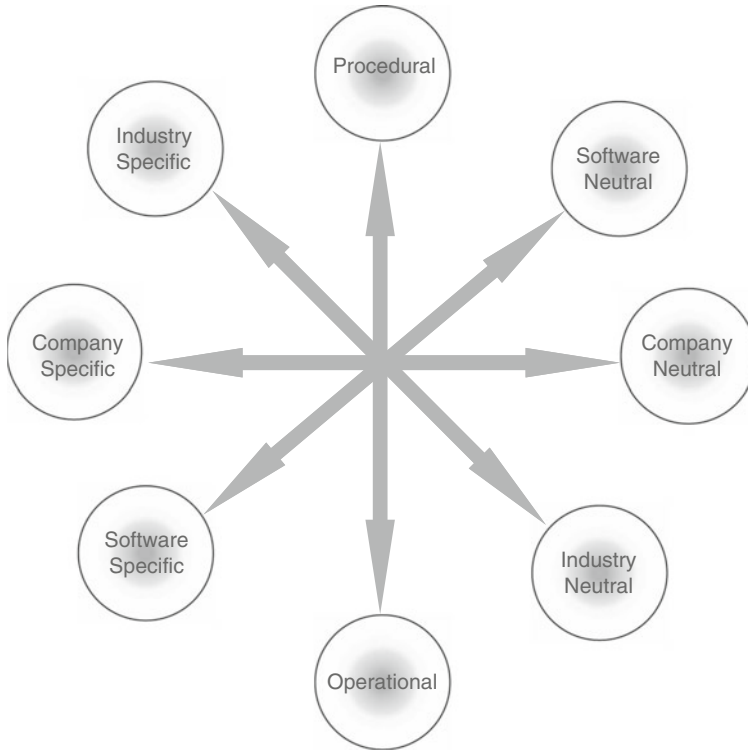
Fig. 6.2 Types of business process reference models

of RM leverages this quality standard for enterprise-specific process-modeling activities. This is true for syntactical as well as for semantic aspects. The content of RM is already validated; hence, its application leads to risk reduction. A knowledge domain described by RM becomes transparent through the clear and easy-to-read structure of RM. RM defines also the terms used in the model, hence they can be the basis for a common language, e.g., in inter-enterprise projects with team members of different companies. If several enterprises use the same RM as a basis to structure their business processes, this facilitates the benchmarking of those processes later.

Summarizing those effects, RMs lead to efficient process design, effective execution, and therefore, the increased agility of an organization. This is visualized in Fig. 6.3.

This is exactly the effect required by MPE RM enable smart decisions and fast execution. They effectively link strategy to execution in an organization, being focused on the key phase of MPE – process design.

So, where can one find such RMs? Are there specialized vendors like can be found for packaged software?
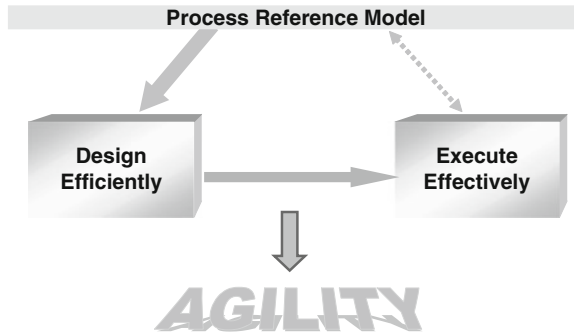
Fig. 6.3   Agility through business process reference models

6.2   How to Obtain RMs?

RMs are basically products that you use to build business processes, just as you use other products such as software or hardware. In a broad sense, all of those products can be procured through the IT 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 ERP systems. Suddenly, the main attention shifted to software products, especially to standard application software. Hardware became more or less a commodity. Because the business content of some of those standard software systems was already documented in form of RM [6], the market for business content in form of RM started to develop. I expect that this market will increase significantly in the next few years. Because SOA offers organizations increased flexibility, the necessary business content, to manage and use this flexibility efficiently, has to be procured separately. Otherwise, the development of major process-oriented software systems may become too cost and time intensive. This development is shown in Fig. 6.4.

Many of the RMs available today are not sold as standalone products. They are either provided together with other products (e.g., software systems or consulting offerings) or as part of a membership service (e.g., of a non-for-profit organization). However, I expect that the "productization" of RM will progress rapidly. Consulting and software companies could have major business units delivering RM-based products. Accenture has already gone this direction and is in the mean time surely leading this field. Some companies may even decide to just focus on the development and sale of RM. They will become pure RM vendors.

Today, the main procurement sources for RMs are:

- Software companies
- Consulting companies
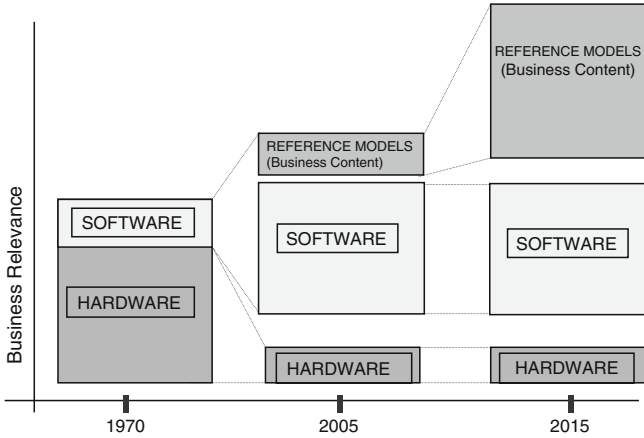- Industry organizations
- Academic organizations

Fig. 6.4 Development of the IT market

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 form of event-driven process chains (EPC) [5, 6]. Others, such as PeopleSoft (which has since been acquired by Oracle) followed. The software vendors, especially SAP, have been key drivers in the development of RM.

Consulting companies were also forced to structure their knowledge in the form of RM to increase their own productivity: They can use RMs to train consultants and make engagements more efficient and effective. RM provided by consulting companies can be especially interesting if the companies do not only include best practices but also next practices or suggestions for process innovations. Accenture's reference models, e.g., include not only process descriptions for 71 industries but also 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 significantly. Using those models organizations can benefit from a vast industry-specific and cross-industry experience in a systematic efficient way. Especially, the use of RM from other industries to support emerging trends and "next practices" in the own industry has become a major trend and use case for RM. The models can typically be procured indirectly through consulting engagements. PMOLink is one company that already sells RM as products. They offer a RM for project management, based on the industry standard "PMBOK" [7]. To support usability, the RM is delivered in a database of the process-modeling system ARIS Platform [8]. The structure of the project management model is shown in Fig. 6.5. The size of this RM product is described in Fig. 6.6.

Industry organizations also deliver knowledge in the form of RM. For example, the Supply Chain Council offers the Supply Chain Operations Reference Model (SCOR) [9, 10]. SCOR is in its eighth version and has been continuously developed
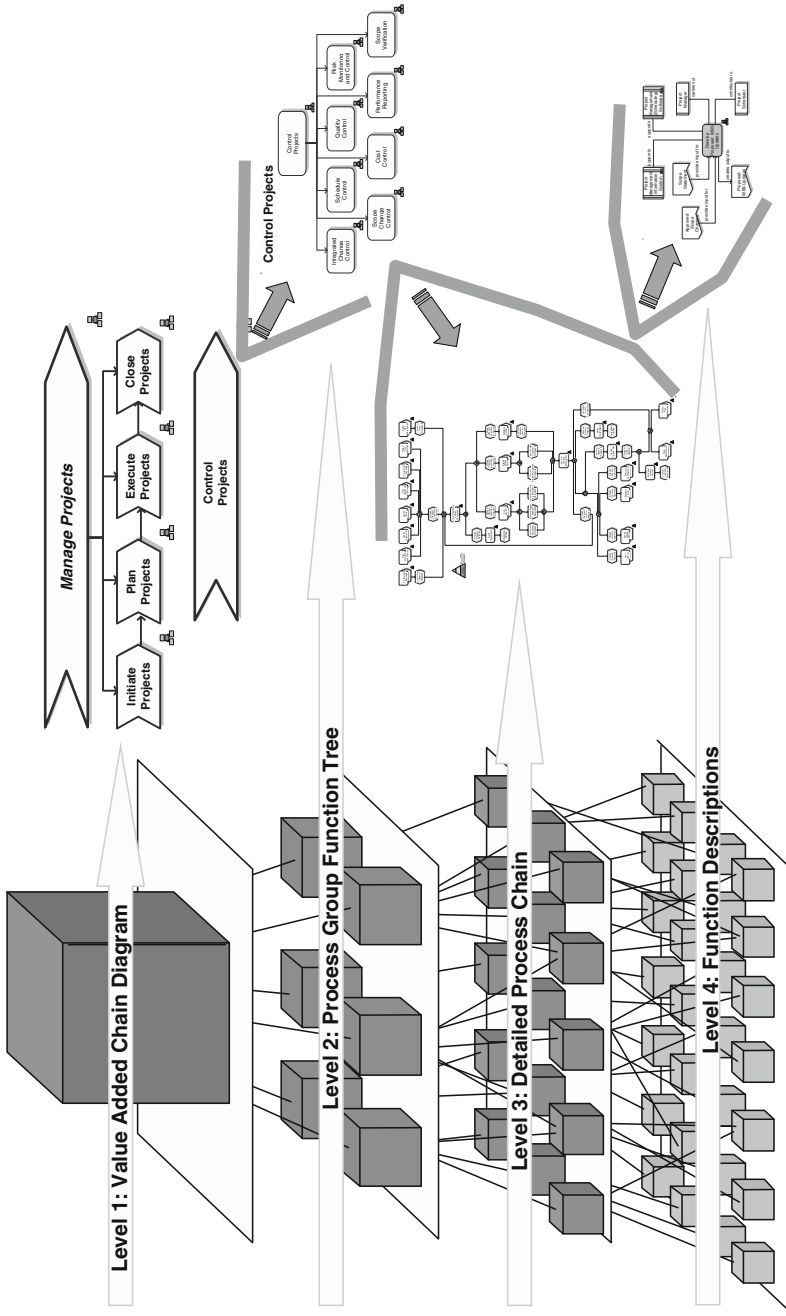
■ **345 Detailed Process Models**

▲ **295 Derived from the PMBOK**

▲ **50 Extended Processes**

■ **1263 Objects**

▲ **1075 Derived from the PMBOK**

▲ **188 Extended Functions**

▲ **16,625 Attributes**

■ **33 Embedded "Quick Start" Files**

▲ **Templates**

▲ **Checklists**

▲ **Spreadsheets**

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

Fig. 6.6 Size of PMOLink's project management reference model

for more than 10 years. It is used all over the world and has received great recognition. It is a great 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:

- 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

Companies implement their supply chain solution on level 4 (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 Value Chain Group is another industry organization that delivers an RM, the Value Reference Model (VRM). VRM focuses on the complete value chain with the top processes of plan, execute, and govern [11]. Also, the American Productivity and Quality Center (APQC) provides high-level reference models in form of industry-neutral and industry-specific frameworks [12]. 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.
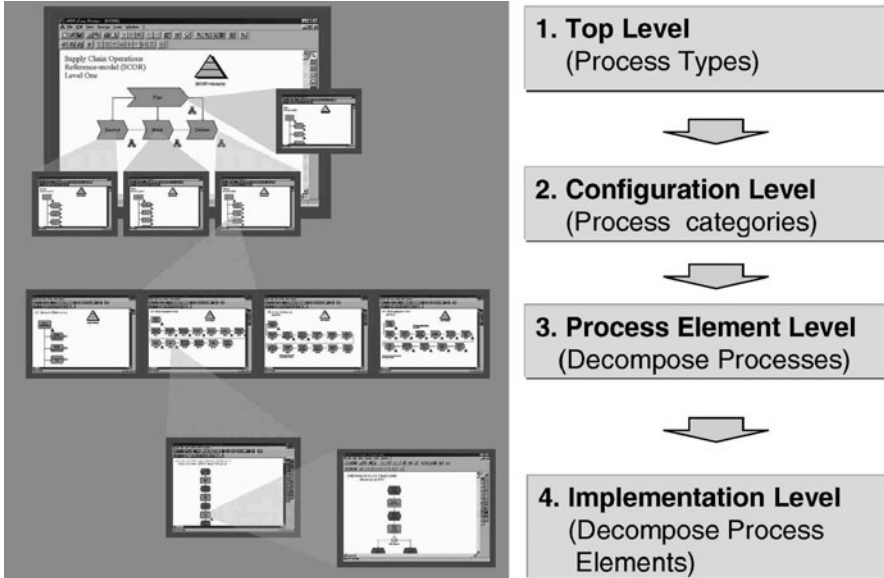
Fig. 6.7 Structure of SCOR

Academic organizations also deliver RM. 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, 13] 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 core support processes are defined above the "Y."

Becker's RM for retail enterprises [14, 15] is another example of an 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.

As the market for RM 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 [16]:

- Syntactic criteria

  - Size
  - Correctness and consistency
  - Modularity
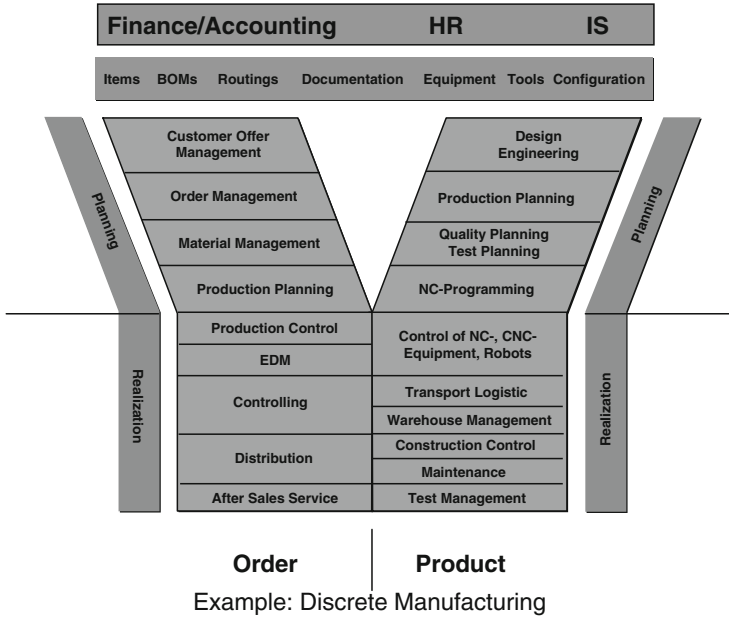 - Structure (hierarchy)
  - Complexity

| Finance/Accounting | HR | IS |

| Items | BOMs | Routings | Documentation | Equipment | Tools | Configuration |

Planning

Customer Offer Management	Design Engineering
Order Management	Production Planning
Material Management	Quality Planning Test Planning
Production Planning	NC-Programming

Realization

Production Control	Control of NC-, CNC- Equipment, Robots
EDM	
Controlling	Transport Logistic
	Warehouse Management
Distribution	Construction Control
	Maintenance
After Sales Service	Test Management

Order | **Product**

Example: Discrete Manufacturing

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

  – 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

We have seen that RMs are already available on the market. We will now discuss how to apply an RM in a specific company situation to achieve the described benefits.

6.3 How Do You Apply RMs?

The basic procedure to apply RM to support business process design is fairly straightforward. Eliminate parts of the RM that are not relevant for your specific organization and adjust the process logic wherever necessary. If the RM is missing certain elements (e.g., a subprocess needed in your company), those elements are added to the model. The result is an enterprise-specific process model, as it has to be delivered in the process design of MPE through the process factory. This approach is visualized in Fig. 6.9.

The use of RM in the process design makes achieving process excellence easier. The above-described benefit leads in process initiatives to the following effects that are of great importance to enable an efficient and effective process design as required by MPE:

- Best and next practices are applied systematically
- A common terminology is used more or less automatically
- The design initiative remains business focused (also can be used to prepare for the implementation of IT, such as an ERP system)
- The scoping of a project is very effective (e.g., a process improvement initiative)
- The benchmarking with other organizations using similar basic structure is easier

Best and known "next" practices are not just used based on word of mouth, but on solid documentation. The RM defines the terminology to be used. This is especially important for work on inter-enterprise processes [10], in which members of multiple organizations are involved (e.g., a SCM improvement initiative), as discussed
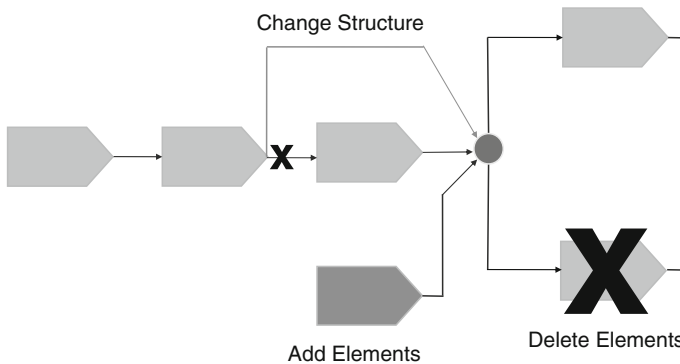

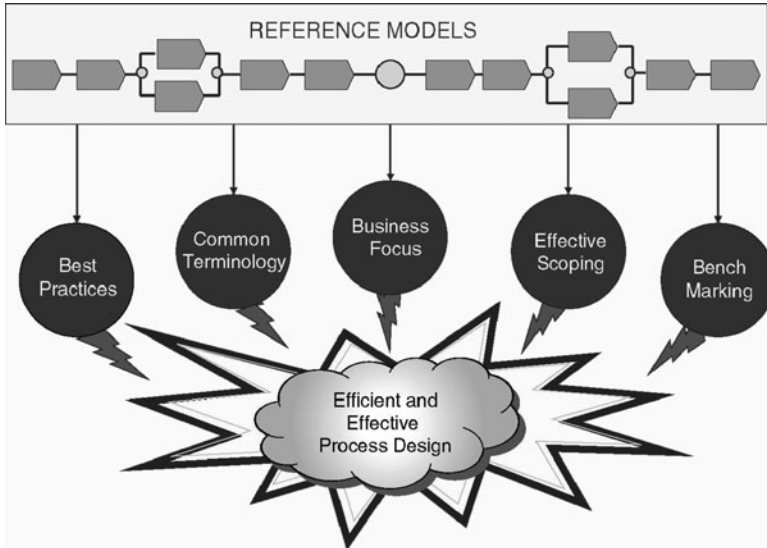**Fig. 6.9** Applying business process reference models

Fig. 6.10 Effects of the use of reference models

above. In such an environment, the RM ensures that everyone speaks the same language and uses terminology in the same manner. Software implementations, such as ERP projects, can be used to drive process improvements. However, project teams often lose focus on real business process topics. The use of RMs avoids that pitfall. An RM also supports the appropriate scoping of an initiative because it describes the relevant domain in a transparent way. Once several companies have organized their processes, based on the same RM, it becomes easier to benchmark the performance (e.g., the performance of supply chain processes can be compared using the structures delivered by Supply Chain Operations Reference Model (SCOR)). These effects of the use of RM are shown in Fig. 6.10.

RMs can be used for many company-specific initiatives and projects, including the following important applications [17, 18]:

- Business process design for a specific organization
- Validation of enterprise-specific models
- Development of standard software applications (could also be a company standard)
- Selecting software packages (e.g., ERP or services to be used in an SOA)
- Education and training

A challenge in applying RM is that the models generally do not include any information about what can be modified and how the modifications can look like, so that they really make sense. Is a specific subprocess of an 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 RM 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
- 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.

The application of RM is another core element of MPE. The process warehouse of the process factory contains all of an enterprise's relevant RM to be used in the company-specific design. This may also include industry models from various industries to exchange best practices across industry boundaries. For example, a biotechnology company may use the product configuration process developed for the machinery industry to organize the final configuration of their bio-substances to deliver the final products. RM enables the efficient and effective use of domain know-how around business process excellence.

6.4   The Bottom Line

- RMs are generic conceptual models, which formalize recommended practices for a special domain. This means RMs deliver best practice information that can be used many times (e.g., in multiple organizations). Their format enables easy application in specific situations (Sect. 6.1).
- RMs represent content of various domains, which can be used to distinguish various types of RM (Sect. 6.1).
- RMs provide key business benefits for process design, such as cost, time, and risk reduction or the improvement of the modeling quality (Sect. 6.1).
- The market for RM should increase significantly in the next few years, especially due to new, flexible SOA-based application software (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 RM include the SAP RMs, the PMOLink project management model, the SCOR model, the VRM model, the Y-Model, and the retail-H model (Sect. 6.2).
- Criteria for the evaluation and selection of RM can be defined (Sect. 6.2).
- The basic procedure to apply RM to support business process design is fairly straightforward (Sect. 6.3).
- The use of RM in efficient and effective process design is required by MPE to enable high performance for the organization as a whole (Sect. 6.3).

- Configurable RMs facilitate the use and transformation of the RM into company-specific process models (Sect. 6.3).

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