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Fundamentals of Business Process Management

Springer

Acronyms

6 M	Machine, Method, Material, Man, Measurement, Milieu
4 P	Policies, Procedures, People, Plant/Equipment
7PMG	Seven Process Modeling Guidelines
ABC	Activity-Based Costing
APQC	American Productivity and Quality Center
ATAMO	And Then, A Miracle Occurs
B2B	Business-to-Business
BAM	Business Activity Monitoring
BOM	Bill-of-Material
BPA	Business Process Analysis
BPEL	Web Service Business Process Execution Language
BPM	Business Process Management
BPMN	Business Process Model & Notation
BPMS	Business Process Management System
BPR	Business Process Reengineering
BTO	Build-to-Order
BVA	Business Value-Adding
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CIO	Chief Information Officer
CMMI	Capability Maturity Model Integrated
COO	Chief Operations Officer
CPO	Chief Process Officer
CRM	Customer Relationship Management
CPN	Colored Petri Net
CT	Cycle Time
DBMS	Database Management System
DCOR	Design Chain Operations Reference (product design)
DES	Discrete-Event Simulation
DMR	Department of Main Roads
DMS	Document Management System

DUR	Drug Utilization Review
EPA	Environment Protection Agency
EPC	Event-driven Process Chain
ERP	Enterprise Resource Planning
eTOM	Enhanced Telecom Operations Map
FIFO	First-In-First-Out
HR	Human Resources
IDEF3	Integrated Definition for Process Description Capture Method
ISP	Internet Service Provider
IT	Information Technology
ITIL	Information Technology Infrastructure Library
KM	Knowledge Management
KPI	Key Performance Indicator
NRW	Department of Natural Resources and Water
NVA	Non-Value-Adding
OASIS	Organization for the Advancement of Structured Information Standards
OMG	Object Management Group
OS	Operating System
PCF	Process Classification Framework
PD	Product Development
PDCA	Plan-Do-Check-Act
PO	Purchase Order
POS	Point-of-Sale
PPM	Process Performance Measurement
RBAC	Role-based Access Control
RFID	Radio-Frequency Identification
RFQ	Request for Quote
ROI	Return-On-Investment
SCAMPI	Standard CMMI Appraisal Method for Process Improvement
SCOR	Supply Chain Operations Reference Model
Smart eDA	Smart Electronic Development Assessment System
SOA	Service-Oriented Architecture
STP	Straight-Through-Processing
TCT	Theoretical Cycle Time
TOC	Theory of Constraints
TQM	Total Quality Management
UIMS	User Interface Management System
UEL	Universal Expression Language
UML	Unified Modeling Language
UML AD	UML Activity Diagram
VA	Value-Adding
VCH	Value Creation Hierarchy
VCS	Value Creation System
VRM	Value Reference Model

WIP	Work-In-Progress
WfMC	Workflow Management Coalition
WfMS	Workflow Management System
WS-BPEL	Web Service Business Process Execution Language
WSDL	Web Service Definition Language
XES	Extensible Event Stream
XML	Extensible Markup Language
XSD	XML Schema Definition
YAWL	Yet Another Workflow Language

Chapter 1
Introduction to Business Process Management

Ab ovo usque ad mala.
Horace (65 BCE–8 BCE)

Business Process Management (BPM) is the art and science of overseeing how work is performed in an organization to ensure consistent outcomes and to take advantage of improvement opportunities. In this context, the term "improvement" may take different meanings depending on the objectives of the organization. Typical examples of improvement objectives include reducing costs, reducing execution times and reducing error rates. Improvement initiatives may be one-off, but also display a more continuous nature. Importantly, BPM is not about improving the way individual activities are performed. Rather, it is about managing entire chains of events, activities and decisions that ultimately add value to the organization and its customers. These "chains of events, activities and decisions" are called *processes*.

In this chapter, we introduce a few essential concepts behind BPM. We will start with a description of typical processes that are found in contemporary organizations. Next, we discuss the basic ingredients of a business process and we provide a definition for the concept as well as of BPM. In order to place BPM in a broader perspective, we then provide a historical overview of the BPM discipline. Finally, we discuss how a BPM initiative in an organization typically unfolds. This discussion leads us to the definition of a BPM lifecycle around which the book is structured.

1.1 Processes Everywhere

Every organization—be it a governmental body, a non-profit organization, or an enterprise—has to manage a number of processes. Typical examples of processes that can be found in most organizations include:

- *Order-to-cash*: This is a type of process performed by a vendor, which starts when a customer submits an order to purchase a product or a service and ends when the product or service in question has been delivered to the customer and the customer has made the corresponding payment. An order-to-cash process encompasses activities related to purchase order verification, shipment (in the case of physical products), delivery, invoicing, payment receipt and acknowledgment.

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- *Quote-to-order*: This type of process typically precedes an order-to-cash process. It starts from the point when a supplier receives a "Request for Quote" (RFQ) from a customer and ends when the customer in question places a purchase order based on the received quote. The order-to-cash process takes the relay from that point on. The combination of a quote-to-order and the corresponding order-to-cash process is called a *quote-to-cash* process.
- *Procure-to-pay*: This type of process starts when someone in an organization determines that a given product or service needs to be purchased. It ends when the product or service has been delivered and paid for. A procure-to-pay process includes activities such as obtaining quotes, approving the purchase, selecting a supplier, issuing a purchase order, receiving the goods (or consuming the service), checking and paying the invoice. A procure-to-pay process can be seen as the dual of quote-to-cash process in the context of business-to-business interactions. For every procure-to-pay process there is a corresponding quote-to-cash process on the supplier's side.
- *Issue-to-resolution*. This type of process starts when a customer raises a problem or issue, such as a complaint related to a defect in a product or an issue encountered when consuming a service. The process continues until the customer, the supplier, or preferably both of them, agree that the issue has been resolved. A variant of this process can be found in insurance companies that have to deal with "insurance claims". This variant is often called *claim-to-resolution*.
- *Application-to-approval*. This type of process starts when someone applies for a benefit or privilege and ends when the benefit or privilege in question is either granted or denied. This type of process is common in government agencies, for example when a citizen applies for a building permit or when a businessman applies for a permit to open a business (e.g. a restaurant). Another process that falls into this category is the admissions process in a university, which starts when a student applies for admission into a degree. Yet another example is the process for approval of vacation or special leave requests in a company.

As the above examples illustrate, business processes are what companies do whenever they deliver a service or a product to customers. The way processes are designed and performed affects both the "quality of service" that customers perceive and the efficiency with which services are delivered. An organization can outperform another organization offering similar kinds of service if it has better processes and executes them better. This is true not only of customer-facing processes, but also of internal processes such as the procure-to-pay process, which is performed for the purpose of fulfilling an internal need.

As we go along this book, we will use a concrete example of a procure-to-pay process for renting construction equipment, as described below.

Example 1.1 Procure-to-pay process at BuildIT.

BuildIT is a construction company specialized in public works (roads, bridges, pipelines, tunnels, railroads, etc.). Within BuildIT, it often happens that engineers working at a construction site (called *site engineers*) need a piece of equipment, such as a truck, an excavator, a bulldozer, a water pump, etc. BuildIT owns very little equipment and instead it rents most of its equipment from specialized suppliers.

The existing business process for renting equipment goes as follows. When site engineers need to rent a piece of equipment, they fill in a form called "Equipment Rental Request" and send this request by e-mail to one of the clerks at the company's depot. The clerk at the depot receives the request and, after consulting the catalogs of the equipment suppliers, selects the most cost-effective equipment that complies with the request. Next, the clerk checks the availability of the selected equipment with the supplier via phone or e-mail. Sometimes the selected option is not available and the clerk has to select an alternative piece of equipment and check its availability with the corresponding supplier.

Once the clerk has found a suitable piece of equipment available for rental, the clerk adds the details of the selected equipment to the rental request. Every rental request has to be approved by a works engineer, who also works at the depot. In some cases, the works engineer rejects the equipment rental request. Some rejections lead to the cancellation of the request (no equipment is rented at all). Other rejections are resolved by replacing the selected equipment with another equipment—such as a cheaper piece of equipment or a more appropriate piece of equipment for the job. In the latter case, the clerk needs to perform another availability enquiry.

When a works engineer approves a rental request, the clerk sends a confirmation to the supplier. This confirmation includes a Purchase Order (PO) for renting the equipment. The PO is produced by BuildIT's financial information system using information entered by the clerk. The clerk also records the engagement of the equipment in a spreadsheet that is maintained for the purpose of tracking all equipment rentals.

In the meantime, the site engineer may decide that the equipment is no longer needed. In this case, the engineer asks the clerk to cancel the request for renting the equipment.

In due time, the supplier delivers the rented equipment to the construction site. The site engineer then inspects the equipment. If everything is in order, the engineer accepts the engagement and the equipment is put into use. In some cases, the equipment is sent back because it does not comply with the requirements of the site engineer. In this case, the site engineer has to start the rental process all over again.

When the rental period expires, the supplier comes to pick up the equipment. Sometimes, the site engineer asks for an extension of the rental period by contacting the supplier via e-mail or phone 1–2 days before pick-up. The supplier may accept or reject this request.

A few days after the equipment is picked up, the equipment's supplier sends an invoice to the clerk by e-mail. At this point, the clerk asks the site engineer to confirm that the equipment was indeed rented for the period indicated in the invoice. The clerk also checks if the rental prices indicated in the invoice are in accordance with those in the PO. After these checks, the clerk forwards the invoice to the financial department and the finance department eventually pays the invoice.

1.2 Ingredients of a Business Process

The above example shows that a business process encompasses a number of *events* and *activities*. Events correspond to things that happen atomically, meaning that they have no duration. The arrival of an equipment at a construction site is an event. This event may trigger the execution of series of activities. For example, when a piece of equipment arrives, the site engineer inspects it. This inspection is an activity, in the sense that it takes time.

When an activity is rather simple and can be seen as one single unit of work, we call it a *task*. For example, if the inspection that the site engineer performs is quite simple—e.g. just checking that the equipment received corresponds to what was ordered—we can say that the equipment inspection is a task. If on the other hand the equipment inspection requires many steps—such as checking that the equipment fulfills the specification included in the purchase order, checking that the equipment is in working order, and checking the equipment comes with all the required accessories and safety devices—we will call it an activity.

In addition to events and activities, a typical process involves *decision points*, that is, points in time when a decision is made that affects the way the process is executed. For example, as a result of the inspection, the site engineer may decide that the equipment should be returned or that the equipment should be accepted. This decision affects what happens later in the process.

A process also involves a number of actors (human actors, organizations, or software systems acting on behalf of human actors or organizations), physical objects (equipment, materials, products, paper documents) and immaterial objects (electronic documents and electronic records). For example, the equipment rental process involves three types of human actor (clerk, site engineer and works engineer) and two types of organizational actor (BuildIT and the equipment suppliers). The process also involves physical objects (the rented equipment), electronic documents (equipment rental requests, POs, invoices) and electronic records (equipment engagement records maintained in a spreadsheet).

Finally, the execution of a process leads to one or several *outcomes*. For example, the equipment rental process leads to an equipment being used by BuildIT, as well as a payment being made to the equipment's supplier. Ideally, an outcome should deliver value to the actors involved in the process, which in this example are BuildIT and the supplier. In some cases, this value is not achieved or is only partially achieved. For example, when an equipment is returned, no value is gained, neither by BuildIT nor by the supplier. This corresponds to a *negative outcome*, as opposed to a *positive outcome* that delivers value to the actors involved.

Among the actors involved in a process, the one who consumes the output of the process plays a special role, namely the role of the *customer*. For example, in the above process, the customer is the site engineer, since it is the site engineer who puts the rented equipment to use. It is also the site engineer who will most likely be dissatisfied if the outcome of the process is unsatisfactory (negative outcome) or if the execution of the process is delayed. In this example, the customer is internal to BuildIT, meaning that the customer is an employee of the organization. In other processes, such as an order-to-cash process, the customer is external to the organization. Sometimes, there are multiple customers in a process. For example, in a process for selling a house, there is a buyer, a seller, a real estate agent, one or multiple mortgage providers, and at least one notary. The outcome of the process is a sales transaction. This outcome provides value both to the buyer who gets the house and to the seller who monetizes the house. Therefore, both the buyer and the seller can be seen as customers in this process, while the remaining actors provide various services.

Exercise 1.1 Consider the following process for the admission of graduate students at a university.

In order to apply for admission, students first fill in an online form. Online applications are recorded in an information system to which all staff members involved in the admissions process have access to. After a student has submitted the online form, a PDF document is generated and the student is requested to download it, sign it, and send it by post together with the required documents, which include:

- Certified copies of previous degree and academic transcripts.
- Results of English language test.
- Curriculum vitae.

When these documents are received by the admissions office, an officer checks the completeness of the documents. If any document is missing, an e-mail is sent to the student. The student has to send the missing documents by post. Assuming the application is complete, the admissions office sends the certified copies of the degrees to an academic recognition agency, which checks the degrees and gives an assessment of their validity and equivalence in terms of local education standards. This agency requires that all documents be sent to it by post, and all documents must be certified copies of the originals. The agency sends back its assessment to the university by post as well. Assuming the degree verification is successful, the English language test results are then checked online by an officer at the admissions office. If the validity of the English language test results cannot be verified, the application is rejected (such notifications of rejection are sent by e-mail).
Once all documents of a given student have been validated, the admission office forwards these documents by internal mail to the corresponding academic committee responsible for deciding whether to offer admission or not. The committee makes its decision based on the academic transcripts and the CV. The committee meets once every 2 to 3 weeks and examines all applications that are ready for academic assessment at the time of the meeting. At the end of the committee meeting, the chair of the committee notifies the admissions office of the selection outcomes. This notification includes a list of admitted and rejected candidates. A few days later, the admission office notifies the outcome to each candidate via e-mail. Additionally, successful candidates are sent a confirmation letter by post.

With respect to the above process, consider the following questions:

1. Who are the actors in this process?
2. Which actors can be considered to be the customer (or customers) in this process?
3. What value does the process deliver to its customer(s)?
4. What are the possible outcomes of this process?

In light of the above, we define a business process as *a collection of inter-related events, activities and decision points that involve a number of actors and objects, and that collectively lead to an outcome that is of value to at least one customer*. Figure 1.1 depicts the ingredients of this definition and their relations.

Armed with this definition of a business process, we define BPM as *a body of methods, techniques and tools to discover, analyze, redesign, execute and monitor business processes*. This definition reflects the fact that business processes are the focal point of BPM, and also the fact that BPM involves different phases and activities in the lifecycle of business processes, as we will discuss later in this chapter.

Other disciplines besides BPM deal with business processes in different ways as explained in the box "Related Disciplines". One of the features commonly associated to BPM is its emphasis on the use of process models throughout the lifecycle of business processes. Accordingly, process models are present in one way or an-

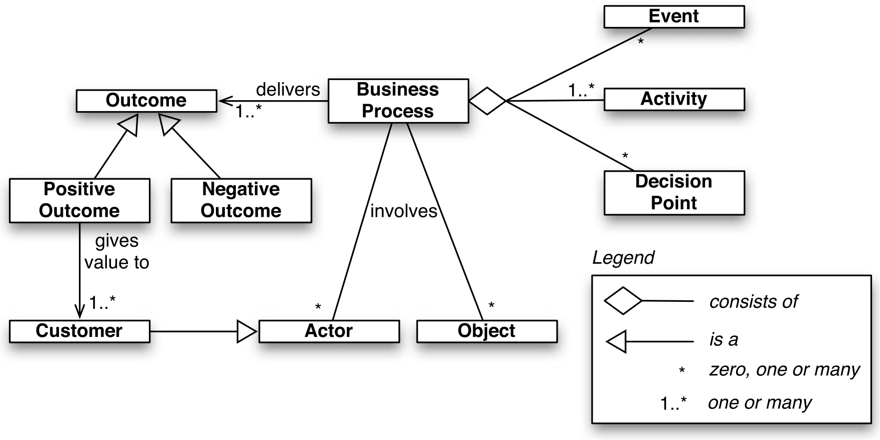

Fig. 1.1 Ingredients of a business process

other in virtually all chapters of this book and two chapters are dedicated to process modeling.

In any case, while it is useful to know that multiple disciplines share the aim of improving business processes, we should remain pragmatic and not pitch one discipline against the other as if they were competitors. Instead, we should embrace any technique that helps us to improve business processes, whether or not this technique is perceived as being part of the BPM discipline (in the strict sense) and regardless of whether or not the technique in question uses process models.

RELATED DISCIPLINES

BPM is by no means the only discipline that is concerned with improving the operational performance of organizations. Below, we briefly introduce some related disciplines and identify key relations and differences between these disciplines and BPM.

Total Quality Management (TQM) is an approach that both historically preceded and inspired BPM. The focus of TQM is on continuously improving and sustaining the quality of products, and by extension also of services. In this way, it is similar to BPM in its emphasis on the necessity of *ongoing* improvement efforts. But where TQM puts the emphasis on the products and services themselves, the view behind BPM is that the quality of products and services can best be achieved by focusing on the improvement of the processes that create these products and services. It should be admitted that this view is somewhat controversial, as contemporary TQM adepts would rather see BPM as one of the various practices that are commonly found within a TQM program. Not so much a theoretical distinction but an empirical one is that applications of TQM are primarily found in manufacturing domains—where the products are tangible—while BPM is more oriented to service organizations.

Operations Management is a field concerned with managing the *physical* and *technical* functions of a firm or organization, particularly those relating to production and manufacturing. Probability theory, queuing theory, decision analysis, mathematical modeling, and simulation are all important techniques for optimizing the efficiency of operations from this perspective. As will be discussed in Chap. 7, such techniques are also useful in the context of BPM initiatives. What is rather different between operations management and BPM is that operations management is generally concerned with controlling an existing process without necessarily changing it, while BPM is often concerned with making changes to an existing process in order to improve it.

Lean is a management discipline that originates from the manufacturing industry, in particular the engineering philosophy of Toyota. One of the main principles of Lean is the *elimination of waste*, i.e. activities that do not add value to the customer as we will discuss in Chap. 6. The customer orientation of Lean is similar to that of BPM and many of the principles behind Lean have been absorbed by BPM. In that sense, BPM can be seen as a more encompassing discipline than Lean. Another difference is that BPM puts more emphasis on the use of information technology as a tool to improve business processes and to make them more consistent and repeatable.

Six Sigma is another set of practices that originate from manufacturing, in particular from engineering and production practices at Motorola. The main characteristic of Six Sigma is its focus on the minimization of defects (errors). Six Sigma places a strong emphasis on measuring the output of processes or activities, especially in terms of quality. Six Sigma encourages managers to systematically compare the effects of improvement initiatives on the outputs. In practice, Six Sigma is not necessarily applied alone, but in conjunction with other approaches. In particular, a popular approach is to blend the philosophy of Lean with the techniques of Six Sigma, leading to an approach known as *Lean Six Sigma*. Nowadays, many of the techniques of Six Sigma are commonly applied in BPM as well. In Chap. 6, we will introduce a few business process analysis techniques that are shared by Six Sigma and BPM.

In summary, we can say that BPM inherits from the continuous improvement philosophy of TQM, embraces the principles and techniques of operations management, Lean and Six Sigma, and combines them with the capabilities offered by modern information technology, in order to optimally align business processes with the performance objectives of an organization.

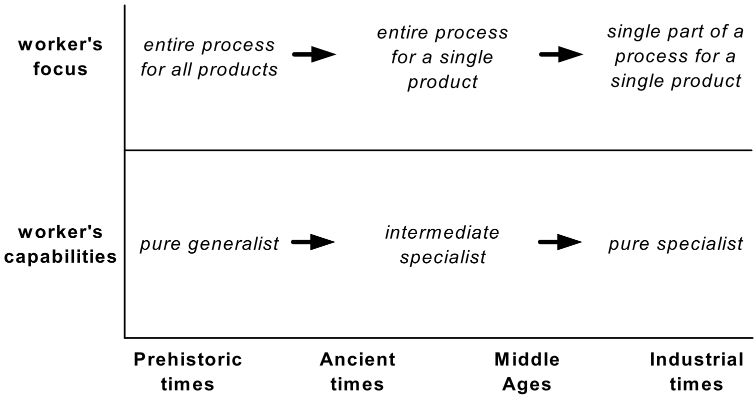

Fig. 1.2 How the process moved out of focus through the ages

1.3 Origins and History of BPM

To better understand why organizations engage in BPM and what benefits it brings to them, it is worth looking at the reasons why BPM has emerged and evolved over time. Below we look into the drivers of the BPM discipline from a historical perspective. We start with the emergence of functional organizations, continue with the introduction of process thinking, towards the innovations and failures of business process re-engineering. This discussion provides the basis for the definition of the BPM lifecycle afterwards.

1.3.1 The Functional Organization

The key idea of BPM is to focus on processes when organizing and managing work in an organization. This idea may seem intuitive and straightforward at first glance. Indeed, if one is concerned with the quality of a particular product or service and the speed of its delivery to a customer, why not consider the very steps that are necessary to produce it? Even though intuitive, it took several evolutionary steps before this idea became integral part of the work structures of organizations. Figure 1.2 provides an overview of some historical developments relevant to BPM.

In prehistoric times, humans mostly supported themselves or the small groups they lived in by producing their own food, tools, and other items. In such early societies, the consumers and producers of a given good were often the same persons. In industrial terms, people carried out their own production processes. As a result, they had knowledge of how to produce many different things. In other words, they were generalists.

In ancient times, in parallel with the rise of cities and city states, this work structure based on generalists started to evolve towards what can be characterized as an *intermediate level of specialism*. People started to specialize in the art of delivering one specific type of goods, such as pottery, or providing one particular type of services, such as lodging for travelers. This widespread development towards a higher level of specialism of the workforce culminated in the guilds of the craftsmen during the Middle Ages. These guilds were essentially groups of merchants and artisans concerned with the same economic activity, such as barbers, shoemakers, masons, surgeons, and sculptors. Workers in this time would have a good understanding of an entire process that they were involved in, but not so much about the processes that produced the goods or services they obtained from others.

This higher degree of specialization of the medieval worker shifted further towards a form of pure specialization during the Second Industrial Revolution, between the second half of the 19th century and the First World War. A name that is inseparably linked to it is that of Frederick W. Taylor (1856–1915), who proposed a set of principles known as *scientific management*. A key element in Taylor's approach was an extreme form of labor division. By meticulously studying labor activities, such as the individual steps that were required to handle pig iron in steel mills, Taylor developed very specific work instructions for laborers. Laborers would only be involved with carrying out one of the many steps in the production process. Not only in industry, but also in administrative settings, such as government organizations, the concept of division of labor became the most dominant form of organizing work. The upshot of this development was that workers became pure specialists who would be concerned with only a single part of one business process.

A side-effect of the ideas of Taylor and his contemporaries was the emergence of an altogether new class of professionals, that of *managers*. After all, someone needed to oversee the productivity of groups of workers concerned with the same part of a production process. Managers were responsible for pinning down the productivity goals for individual workers and making sure that such goals were met. In contrast to the masters of the medieval guilds, who could only attain such a rank on the basis of a masterpiece produced by themselves, managers are not necessarily experts in carrying out the job they oversee. Their main interest is to optimize how a job is done with the resources under their supervision.

After the emergence of managers, organizations became structured along the principles of labor division. A next and obvious challenge arose then: How to differentiate between the responsibilities of all these managers? The solution was to create functional units in which people with a similar focus on part of the production process were grouped together. These units were overseen by managers with different responsibilities. Moreover, the units and their managers were structured hierarchically: for example, groups are under departments, departments are under business units, etc. What we see here is the root of the functional units that are familiar to us today when we think about organizations: purchasing, sales, warehousing, finance, marketing, human resource management, etc.

The *functional organization* that emerged from the mindset of the Second Industrial Revolution, dominated the corporate landscape for the greatest part of the 19th and 20th centuries. Towards the end of the 1980s, however, major American companies such as IBM, Ford, and Bell Atlantic (now Verizon) came to realize that their emphasis on functional optimization was creating inefficiencies in their operations that were affecting their competitiveness. Costly projects that introduced

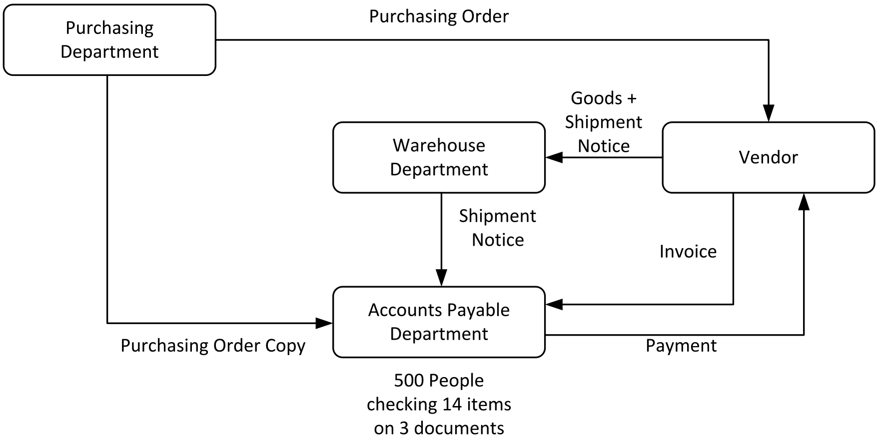

Fig. 1.3 Purchasing process at Ford at the initial stage

new IT systems or reorganized work within a functional department with the aim of improving its efficiency, were not notably helping these companies to become more competitive. It seemed as if customers remained oblivious to these efforts and continued to take their business elsewhere, for example to Japanese competitors.

1.3.2 The Birth of Process Thinking

One of the breakthrough events for the development of BPM was Ford's acquisition of a big financial stake in Mazda during the 1980s. When visiting Mazda's plants, one of the things that observant Ford executives noticed was that units within Mazda seemed considerably understaffed in comparison with comparable units within Ford, yet operated normally. A famous case study illustrating this phenomenon, first narrated by Michael Hammer [26] and subsequently analyzed by many others, deals with Ford's purchasing process. Figure 1.3 depicts the way purchasing was done within Ford at the time.

Every purchase that Ford would make needed to go through the purchasing department. On deciding that a particular quantity of products indeed had to be purchased, this department sent out an order to the vendor in question. It would also send a copy of that order to accounts payable. When the vendor followed up, the ordered goods would be delivered at Ford's receiving warehouse. Along with the goods came a shipping notice, which was passed on to accounts payable. The vendor would also send out an invoice to accounts payable directly.

Against this background, it becomes clear that the main task of accounts payable was to check the consistency between three different documents (purchase order copy, shipping notice, invoice), where each document consists of roughly 14 data items (type of product, quantity, price, etc.). Not surprisingly, various types of discrepancy were discovered every day and sorting out these discrepancies occupied

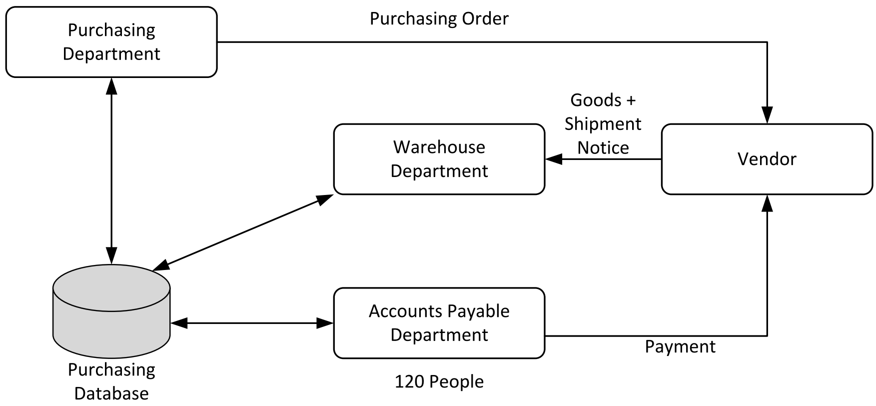

Fig. 1.4 Purchasing process at Ford after redesign

several hundred people within Ford. In contrast, at Mazda only five people worked at this department, while Mazda was not 100 times smaller than Ford in any relevant measure. Fundamentally, the problem is that Ford was detecting and resolving with problems (in this case discrepancies) one by one, while Mazda instead was avoiding the discrepancies in the first place. After a more detailed comparison with Mazda, Ford carried out several changes in its own purchasing process, leading to the redesigned process depicted in Fig. 1.4.

First of all, a central database was developed to store information on purchases. This database was used by the purchasing department to store all the information on purchase orders. This database replaced one of the original paper streams. Secondly, new computer terminals were installed at the warehouse department which gave direct access to that database. When goods arrived, the warehouse personnel could immediately check whether the delivery actually matched what was originally purchased. If this was not the case, the goods were simply not accepted: this put the onus on the vendor to ensure that what was delivered was what was requested and nothing else. In cases where a match was found between the delivered goods and the recorded purchase order, the acceptance of the goods was registered. So, the only thing left to do for accounts payable was to pay what was agreed upon in the original purchase order. Following this new set-up, Ford managed to bring down their workforce in accounts payable from roughly 500 people down to 120 people (a 76 % reduction).

Exercise 1.2 Consider the purchasing process at Ford.

1. Who are the actors in this process?
2. Which actors can be considered to be the customer (or customers) in this process?
3. What value does the process deliver to its customer(s)?
4. What are the possible outcomes of this process?

A key element in this case study is that a problematic performance issue (i.e. an excessive amount of time and resources spent on checking documents in accounts payable) is approached by considering an entire process. In this case, the accounts payable department plays an important role in the overall purchasing process, but the process also involves tasks by staff at the purchasing department, the warehouse, and by the vendor. Regardless of these barriers, changes are made across the process and these changes are multi-pronged: They include informational changes (information exchanges), technological changes (database, terminals), and structural changes (checks, policies).

This characteristic view on how to look at organizational performance was put forward in a seminal article by Tom Davenport and James Short [11]. In this article, the authors urged managers to look at entire processes when trying to improve the operations of their business, instead of looking at one particular task or business function. Various cases were discussed where indeed this particular approach proved to be successful. In the same paper, the important role of IT was emphasized as an enabler to come up with a redesign of existing business processes. Indeed, when looking at the Ford–Mazda example it would seem difficult to change the traditional procedure without the specific qualities of IT, which in general allows access to information in a way that is independent of time and place.

1.3.3 The Rise and Fall of BPR

The work by Davenport and Short, as well as that of others, triggered the emergence and widespread adoption of a management concept that was referred to as *Business Process Redesign* or *Business Process Re-engineering*, often conveniently abbreviated to *BPR*. Numerous white papers, articles, and books appeared on the topic throughout the 1990s and companies all over the world assembled BPR teams to review and redesign their processes.

The enthusiasm for BPR faded down, however, by the late 1990s. Many companies terminated their BPR projects and stopped supporting further BPR initiatives. What had happened? In a retrospective analysis, a number of factors can be distinguished:

1. Concept misuse: In some organizations, about every change program or improvement project was labeled BPR even when business processes were not the core of these projects. During the 1990s, many corporations initiated considerable reductions of their workforce (downsizing) which, since they were often packaged as process redesign projects, triggered intense resentment among operational staff and middle management against BPR. After all, it was not at all clear that operational improvement was really driving such initiatives.
2. Over-radicalism: Some early proponents of BPR, including Michael Hammer, emphasized from the very start that redesign had to be radical, in the sense that a new design for a business process had to overhaul the way the process was initially organized. A telling indication is one of Michael Hammer's early papers

on this subject which bore the subtitle: "Don't automate, Obliterate". While a radical approach may be justified in some situations, it is clear that many other situations require a much more gradual (incremental) approach.

3. Support immaturity: Even in projects that were process-centered from the start and took a more gradual approach to improving the business process in question, people ran into the problem that the necessary tools and technologies to implement such a new design were not available or sufficiently powerful. One particular issue centered around the fact that much logic on how processes had to unfold were hard-coded in the supporting IT applications of the time. Understandably, people grew frustrated when they noted that their efforts on redesigning a process were thwarted by a rigid infrastructure.

Subsequently, two key events revived some of the ideas behind BPR and laid the foundation for the emergence of BPM. First of all, empirical studies appeared showing that organizations that were process-oriented—that is, organizations that sought to improve processes as a basis for gaining efficiency and satisfying their customers—factually did better than non-process-oriented organizations. While the initial BPR guru's provided compelling case studies, such as the one on Ford–Mazda, it remained unclear to many whether these were exceptions rather than the rule. In one of the first empirical studies on this topic, Kevin McCormack [49] investigated a sample of 100 US manufacturing organizations and found that process-oriented organizations showed better overall performance, tended to have a better esprit de corps in the workplace, and suffered less from inter-functional conflicts. Follow-up studies confirmed this picture, giving renewed credibility to process thinking.

A second important development was technological in nature. Different types of IT system emerged, most notably Enterprise Resource Planning (ERP) systems and Workflow Management Systems (WfMSs). ERP systems are essentially systems that store all data related to the business operations of a company in a consistent manner, so that all stakeholders who need access to these data can gain such access. This idea of a single shared and centralized database enables the optimization of information usage and information exchanges, which is a key enabler of process improvement (cf. Chap. 8).[1] WfMSs on the other hand are systems that distribute work to various actors in a company on the basis of process models. By doing so, a WfMS make it easier to implement changes to business processes (e.g. to change the order in which steps are performed) because the changes made in the process model can be put into execution with relative ease, compared to the situation where the rules for executing the process are hard-coded inside complex software systems and buried inside tens of thousands of lines of code. Also, a WfMS very closely supports the idea of working in a process-centered manner.

[1] In reality, ERP systems are much more than a shared database. They also incorporate numerous modules to support typical functions of an organization such as accounting, inventory management, production planning, logistics, etc. However, from the perspective of process improvement, the shared database concept behind ERP systems is a major enabler.

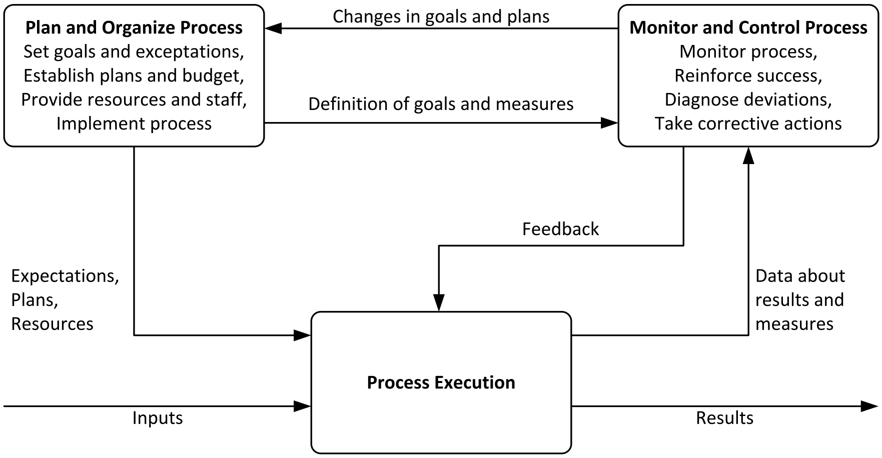

Fig. 1.5 Job functions of a manager responsible for a process (a.k.a. process owner)

Originally, WfMSs were concerned mainly with routing work between human actors. Later on, these systems were little by little extended with modules to monitor and analyze the execution of business processes. In parallel, the emergence of Web services made it easier to connect a WfMS with other systems, in particular ERP systems. As WfMSs became more sophisticated and better integrated with other enterprise systems, they became known as Business Process Management Systems (BPMSs). The functionality of BPMSs and their role in the automation of business processes will be discussed in Chap. 9.

The above historical view suggests that BPM is a revival of BPR, as indeed BPM adopts the process-centered view on organizations. Some caution is due though when BPR and BPM are being equated. The relation is much better understood on the basis of Fig. 1.5.

This figure shows that a manager that is responsible for a business process—also called the *process owner*—is concerned with planning and organizing the process on the one hand and monitoring the process on the other. The figure allows us to explain the differences in *scope* between BPR and BPM. While both approaches take the business process as a starting point, BPR is primarily concerned with planning and organizing the process. By contrast, BPM provides concepts, methods, techniques, and tools that cover all aspects of managing a process—plan, organize, monitor, control–as well as its actual execution. In other words, BPR should be seen as a subset of techniques that can be used in the context of BPM.

This discussion highlights that BPM encompasses the entire lifecycle of business processes. Accordingly, the next section provides an overview of the concepts, methods, techniques, and tools that compose the BPM discipline through the lens of the *BPM lifecycle*. This lens provides a structured view of how a given process can be managed.

1.4 The BPM Lifecycle

In general, the first question that a team embarking on a BPM initiative needs to clarify is "what business processes are we intending to improve"? Right at the outset and before the possibility of applying BPM is put on the table, there will probably already be an idea of what operational problems the team has to address and what business processes are posing those operational problems. In other words, the team will not start from scratch. For example, if the problem is that site engineers complain that their job is being hampered by difficulties in securing construction equipment when needed, and knowing that this equipment is to a large extent rented, it is clear that this problem should be addressed by looking at the equipment rental process. Still, one has to delimit this process. In particular, one has to answer questions such as: Does the process start right from the moment when rental suppliers are selected? Does it end when the rented equipment is delivered to the construction site or does it end when the equipment is returned back to the supplier, or does it continue until the fee for equipment rental has been paid to the supplier?

These questions might be easy or hard to answer depending on how much *process thinking* has taken place in the organization beforehand. If the organization has engaged in BPM initiatives before, it is likely that an inventory of business processes is available and that the scope of these processes has been defined, at least to some extent. In organizations that have not engaged in BPM before, the BPM team has to start by at least identifying the processes that are relevant to the problem on the table, delimiting the scope of these processes, and identifying relations between these processes, such as for example part-of relations (i.e. one process being part of another process). This initial phase of a BPM initiative is termed *process identification*. This phase leads to a so-called *process architecture*, which typically takes the form of a collection of processes and links between these processes representing different types of relation.

In general, the purpose of engaging in a BPM initiative is to ensure that the business processes covered by the BPM initiative lead to consistently positive outcomes and deliver maximum value to the organization in servicing its clients. Measuring the *value* delivered by a process is a crucial step in BPM. As renowned software engineer, Tom DeMarco, once famously put it: "You can't control what you can't measure". So before starting to analyze any process in detail, it is important to clearly define the *process performance measures* (also called *process performance metrics*) that will be used to determine whether a process is in "good shape" or in "bad shape".

Cost-related measures are a recurrent class of measures in the context of BPM. For example, coming back to the equipment rental process, a possible performance measure is the total cost of all equipment rented by BuildIT per time interval (e.g. per month). Another broad and recurrent class of measures are those related to time. An example is the average amount of time elapsed between the moment an equipment rental request is submitted by a site engineer and the delivery of the equipment to the construction site. This measure is generally called *cycle time*. Finally, a third class of recurrent measures are those related to quality, and specifically error rates.

Error rate is the percentage of times that an execution of the process ends up in a negative outcome. In the case of the equipment rental process, one such measure is the number of pieces of equipment returned because they are unsuitable, or due to defects in the delivered equipment. The identification of such performance measures (and associated performance objectives) is crucial in any BPM initiative. This identification is generally seen as part of the process identification phase, although in some cases it may be postponed until later phases.

Exercise 1.3 Consider the student admission process described in Exercise 1.1. Taking the perspective of the customer, identify at least two performance measures that can be attached to this process.

Once a BPM team has identified which processes they are dealing with and which performance measures should be used, the next phase for the team is to understand the business process in detail. We call this phase *process discovery*. Typically, one of the outcomes of this phase is one or several *as-is* process models. These as-is process models should reflect the understanding that people in the organization have about how work is done. Process models are meant to facilitate communication between stakeholders involved in a BPM initiative. Therefore, they have to be easy to understand. In principle, we could model a business process by means of textual descriptions, like the textual description in Example 1.1. However, such textual descriptions are cumbersome to read and easy to misinterpret because of the ambiguity inherent in free-form text. This is why it is common practice to use diagrams in order to model business processes. Diagrams allow us to more easily comprehend the process. Also, if the diagram is made using a notation that is understood by all stakeholders, there is less room for any misunderstanding. Note that these diagrams may still be complemented with textual descriptions in fact it is common to see analysts documenting a process using a combination of diagrams and text.

There are many languages for modeling business processes diagrammatically. Perhaps one of the oldest ones are *flowcharts*. In their most basic form, flowcharts consist of rectangles, representing activities, and diamonds, representing points in the process where a decision is made. More generally, we can say that regardless of the specific notation used, a diagrammatic process model typically consists of two types of node: activity nodes and control nodes. Activity nodes describe units of work that may be performed by humans or software applications, or a combination thereof. Control nodes capture the flow of execution between activities. Although not all process modeling languages support it, a third important type of element in process models are event nodes. An event node tells us that something may or must happen, within the process or in the environment of the process, that requires a reaction, like for example the arrival of a message from a customer asking to cancel their purchase order. Other types of node may appear in a process model, but we can say that activity nodes, event nodes and control nodes are the most basic ones.

Several extensions of flowcharts exist, like cross-organizational flowcharts, where the flowchart is divided into so-called *swimlanes* that denote different organizational units (e.g. different departments in a company). If you are familiar with the

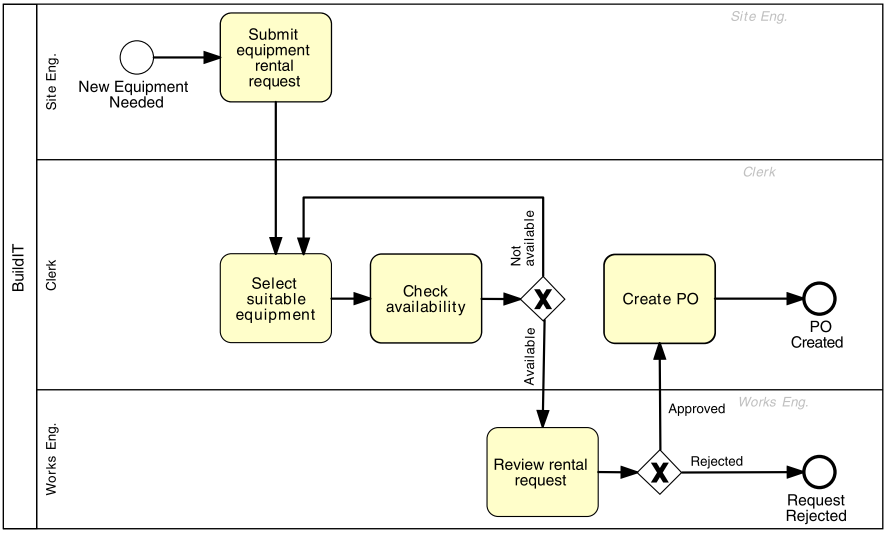

Fig. 1.6 Process model for an initial fragment of the equipment rental process

Unified Modeling Language (UML), you probably will have come across *UML Activity Diagrams*. At their core, UML Activity Diagrams are cross-organizational flowcharts. However, UML Activity Diagrams go beyond cross-organizational flowcharts by providing symbols to capture data objects, signals and parallelism among other aspects. Yet another language for process modeling are *Event-driven Process Chains* (*EPCs*). EPCs have some similarities with flowcharts but they differ from flowcharts in that they treat events as first-class citizens. Other languages used for process modeling include data-flow diagrams and *IDEF3*, just to name two.

It would be mind-boggling to try to learn all these languages at once. Fortunately, nowadays there is a widely used standard for process modeling, namely the Business Process Model and Notation (BPMN). The latest version of BPMN is BPMN 2.0. It was released as a standard by the Object Management Group (OMG) in 2011. In BPMN, activities are represented as rounded rectangles. Control nodes (called *gateways*) are represented using diamond shapes. Activities and control nodes are connected by means of arcs (called flows) that determine the order in which the process is executed. Figure 1.6 provides a model representing an initial fragment of the equipment rental process, up to the point where the works engineer accepts or rejects the equipment rental request. This process model shows two decision points. In the first one, the process takes one of two paths depending on whether the equipment is available or not. In the second, the equipment rental request is either approved or rejected. The model also shows the process participants involved in this fragment of the process, namely the site engineer, the clerk and the works engineer. Each of these participants is shown as a separate *lane* containing the activities performed by the participant in question.

The process model in Fig. 1.6 is captured at a high level of abstraction. At best, it can serve to give to an external person a summary of what happens in this process. In some cases, however, the model needs more details for it to be useful. Which additional details should be included in a process model depends on the purpose. Oftentimes, process models are intended to serve as documentation of the way an organization works. In this case, the key characteristics of process models are simplicity and understandability. Accordingly, additional text annotations might be added to the process model to clarify the meaning of certain activities or events, but beyond such annotations, not much additional detail would be added. In other cases, process models are intended to be analyzed in detail, for example in order to measure process performance. In this case, further details may be required such as how much time each task takes (on average). Finally, in a few cases, process models are intended to be deployed into a BPMS for the purpose of coordinating the execution of the process (cf. Sect. 1.3.3). In the latter case, the model needs to be extended with a significant amount of details regarding the inputs and outputs of the process and each its activities.

Having understood the as-is process in detail, the next step is to identify and analyze the issues in this process. One potential issue in BuildIT's equipment rental process is that the cycle time is too high. As a result, site engineers do not manage to get the required equipment on time. This may cause delays in various construction tasks, which may ripple down into delays in the construction projects. In order to analyze these issues, an analyst would need to collect information about the time spent in each task of the process, including both the amount of time that process participants spend actually doing work and the amount of idle time, meaning the amount of time when the equipment request is blocked, waiting for something to happen. This idle time is also called *waiting time*. Also, the analyst would need to gather information regarding the amount of rework that takes place in the process. Here, rework means that one or several tasks are repeated because something went wrong. For example, when the clerk identifies a suitable piece of equipment in a supplier's catalog, but later finds out that the piece of equipment is not available on the required dates, the clerk might need to search again for an alternative piece of equipment from another supplier. Valuable time is spent by the clerk going back and forth between consulting the catalogs and contacting the suppliers to check the availability of plants. In order to analyze this issue, the analyst would need to find out in what percentage of cases the availability check fails and thus how often the clerk needs to do some rework in order to identify alternative pieces of equipment and check for their availability. Given this information, a process analyst can employ various techniques to be discussed throughout this book, in order to trace down the cause(s) of long cycle times and to identify ways of changing the process in order to reduce the cycle time.

Another potential issue in BuildIT's equipment rental process is that sometimes the equipment delivered at the construction site is unsuitable, and the site engineer has to reject it. This is an example of a negative outcome. To analyze this issue, an analyst would need to find out how often such negative outcomes are occurring. Secondly, the analysts would need to obtain information that would allow them to understand why such negative outcomes are happening. In other words, where did things go wrong in the first place? Sometimes, this negative outcome might stem from miscommunication, for example between the site engineer and the clerk. Otherwise it might come from inaccurate data (e.g. errors in the description of the equipment) or from an error on the supplier's side. Only by identifying, classifying and ultimately understanding the main causes of such negative outcomes can an analyst find out what would be the most suitable way of addressing this issue. The identification and assessment of issues and opportunities for process improvement is hereby called the *process analysis* phase.

We observe that the two issues discussed above are tightly related to performance measures. For example, the first issue above is tied to cycle time and waiting time, both of which are typical performance measures of a process. Similarly, the second issue is tied to the "percentage of equipment rejections", which is essentially an error rate—another typical performance measure. Thus, assessing the issues of a process often goes hand-in-hand with measuring the current state of the process with respect to certain performance measures.

Exercise 1.4 Consider again the student admission process described in Exercise 1.1. Taking the perspective of the customer, think of at least two issues that this process might have.

Once issues in a process have been analyzed and possibly quantified, the next phase is to identify and analyze potential remedies for these issues. At this point, the analyst will consider multiple possible options for addressing a problem. In doing so, the analyst needs to keep in mind that a change in a process to address one issue may potentially cause other issues down the road. For example, in order to speed-up the equipment rental process, one might think of removing the approval steps involving the works engineer. If pushed to the extreme, however, this change would mean that the rented equipment might sometimes not be optimal since the works engineer viewpoint is not taken into account. The works engineer has a global view on the construction projects and may be able to propose alternative ways of addressing the equipment needs of a construction project in a more effective manner.

Changing a process is not as easy as it sounds. People are used to work in a certain way and might resist changes. Furthermore, if the change implies modifying the information system(s) underpinning the process, the change may be costly or may require changes not only in the organization that coordinates the process, but also in other organizations. For example, one way to eliminate the rework that the clerk has to do when checking for availability of equipment, would be that the suppliers provide information regarding the availability of plants. This way, the clerk would use the same interface to search for suitable equipment and to check the availability of the equipment for the required period of time. However, this change in the process would require that the suppliers change their information system, so that their system exposes up-to-date equipment availability information to BuildIT. This change is at least partially outside the control of BuildIT. Assuming that suppliers would be able to make such changes, a more radical solution that could be considered would be to provide mobile devices and Internet connection to the site engineers, so that they can consult the catalog of equipment (including availability information) anytime and anywhere. This way, the clerk would not need to be involved in the process during the equipment search phase, therefore avoiding miscommunications between the site engineer and the clerk. Whether or not this more radical change is viable would require an in-depth analysis of the cost of changing the process in this way versus the benefits that such change would provide.

Exercise 1.5 Given the issues in the admissions process identified in Exercise 1.4, what possible changes do you think could be made to this process in order to address these issues?

Equipped with an understanding of one or several issues in a process and a candidate set of potential remedies, analysts can propose a redesigned version of the process, in other words a *to-be* process which would address the issues identified in the as-is process. This to-be process is the main output of the *process redesign phase*. Here, it is important to keep in mind that analysis and redesign are intricately related. There may be multiple redesign options and each of these options needs to be analyzed, so that an informed choice can be made as to which option should be chosen.

Once redesigned, the necessary changes in the ways of working and the IT systems of the organization should be implemented so that the to-be process can eventually be put into execution. This phase is called *process implementation*. In the case of the equipment rental process, the process implementation phase would mean putting in place an information system to record and to track equipment rental requests, POs associated to approved requests and invoices associated to these POs. Deploying such an information system means not only developing the IT components of this system. It would also relate to training the process participants so that they perform their work in the spirit of the redesigned process and make the best use of the IT components of the system.

More generally, process implementation may involve two complementary facets: *organizational change management* and *process automation*. Organizational change management refers to the set of activities required to change the way of working of all participants involved in the process. These activities include:

- Explaining the changes to the process participants to the point that they understand both what changes are being introduced and why these changes are beneficial to the company.
- Putting in place a change management plan so that stakeholders know when will the changes be put into effect and what transitional arrangements will be employed to address problems during the transition to the to-be process.
- Training users to the new way of working and monitoring the changes in order to ensure a smooth transition to the to-be process.

On the other hand, process automation involves the configuration or implementation of an IT system (or the re-configuration of an existing IT system) to support the "to-be" process. This system should support process participants in the performance

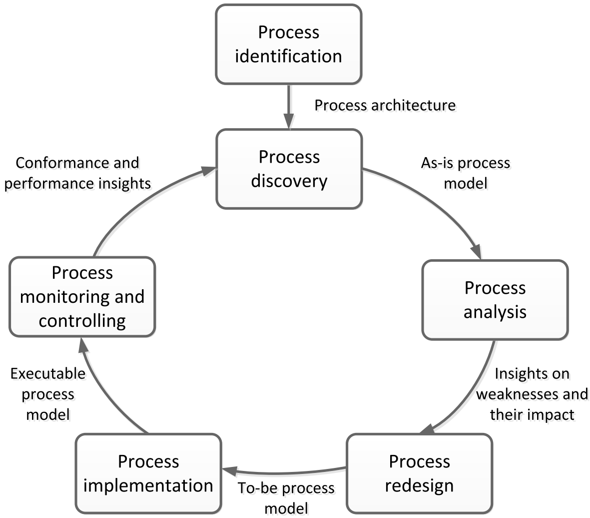

Fig. 1.7 BPM lifecycle

of the tasks of the process. This may include assigning tasks to process participants, helping process participants to prioritize their work, providing process participants with the information they need to perform a task, and performing automated cross-checks and other automated tasks where possible. There are several ways to implement such an IT system. This book focuses on one particular approach, which consists of extending the to-be process model obtained from the process redesign phase in order to make it executable by a BPMS (cf. Sect. 1.3.3).

Over time, some adjustments might be required because the implemented business process does not meet expectations. To this end, the process needs to be monitored and analysts ought to scrutinize the data collected by monitoring the process in order to identify needed adjustments to better control the execution of the process. These activities are encompassed by the *process monitoring and controlling* phase. This phase is important because addressing one or a handful of issues in a process is not the end of the story. Instead, managing a process requires a continuous effort. Lack of continuous monitoring and improvement of a process leads to degradation. As Michael Hammer once put it: "every good process eventually becomes a bad process", unless continuously adapted and improved to keep up with the ever-changing landscape of customer needs, technology and competition. This is why the phases in the BPM lifecycle should be seen as being circular: the output of monitoring and controlling feeds back into the discovery, analysis and redesign phases.

To sum up, we can view BPM as continuous cycle comprising the following phases (see Fig. 1.7):

- *Process identification.* In this phase, a business problem is posed, processes relevant to the problem being addressed are identified, delimited and related to each other. The outcome of process identification is a new or updated process architecture that provides an overall view of the processes in an organization and their relationships. In some cases, process identification is done in parallel with performance measure identification. In this book, however, we will associate performance measure identification with the process analysis phase, given that performance measures are often used for process analysis.

- *Process discovery (also called as-is process modeling).* Here, the current state of each of the relevant processes is documented, typically in the form of one or several as-is process models.[2]
- *Process analysis.* In this phase, issues associated to the as-is process are identified, documented and whenever possible quantified using performance measures. The output of this phase is a structured collection of issues. These issues are typically prioritized in terms of their impact, and sometimes also in terms of the estimated effort required to resolve them.
- *Process redesign* (also called *process improvement*). The goal of this phase is to identify changes to the process that would help to address the issues identified in the previous phase and allow the organization to meet its performance objectives. To this end, multiple change options are analyzed and compared in terms of the chosen performance measures. This entails that process redesign and process analysis go hand-in-hand: As new change options are proposed, they are analyzed using process analysis techniques. Eventually, the most promising change options are combined, leading to a redesigned process. The output of this phase is typically a to-be process model, which serves as a basis for the next phase.
- *Process implementation.* In this phase, the changes required to move from the as-is process to the to-be process are prepared and performed. Process implementation covers two aspects: organizational change management and process automation. Organizational change management refers to the set of activities required to change the way of working of all participants involved in the process. Process automation on the other hand refers to the development and deployment of IT systems (or enhanced versions of existing IT systems) that support the to-be process. In this book, our focus with respect to process implementation is on process automation, as organizational change management is an altogether separate field. More specifically, the book presents one approach to process automation wherein an executable process model is derived from the to-be process model and this executable model is deployed in a BPMS.
- *Process monitoring and controlling.* Once the redesigned process is running, relevant data are collected and analyzed to determine how well is the process performing with respect to its performance measures and performance objectives. Bottlenecks, recurrent errors or deviations with respect to the intended behavior are identified and corrective actions are undertaken. New issues may then arise, in the same or in other processes, requiring the cycle to be repeated on a continuous basis.

[2]This phase is also called *process design* in the literature. However, process discovery is arguably a more appropriate term since the process already exists, at least implicitly in the heads of the actors who perform it. The goal of this phase is generally to discover the process rather than to design it. In rare cases (e.g. new companies) no process is yet in place so the discovery and analysis phases are not required and the process has to be designed for the first time rather than redesigned.

The BPM lifecycle helps to understand the role of technology in BPM. Technology in general, and especially Information Technology (IT), is a key instrument to improve business processes. Not surprisingly, IT specialists such as system engineers often play a significant role in BPM initiatives. However, to achieve maximum efficacy, system engineers need to be aware that technology is just one instrument for managing and executing processes. System engineers need to work together with process analysts in order to understand what the main issues affecting a given process, and how to best address these issues, be it by means of automation or by other means. As a renowned technology businessman, Bill Gates, once famously put it: "The first rule in any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency". This means that learning how to design and improve processes—and not only how to build an IT system to automate a narrow part of a business process—is a fundamental skill that should be in the hands of any IT graduate. Reciprocally, business graduates need to understand how technology, and particularly IT, can be used to optimize the execution of business processes. This book aims at bridging these two viewpoints by presenting an integrated viewpoint covering the whole BPM lifecycle.

A complementary viewpoint on the BPM lifecycle is given by the box "Stakeholders in the BPM lifecycle". This box summarizes the roles in a company that are directly or indirectly involved in BPM initiatives.[3] The list of roles described in the box highlights the fact that BPM is inter-disciplinary. A typical BPM initiative involves managers at different levels in the organization, administrative and field workers (called process participants in the box), business and system analysts and IT teams. Accordingly, the book aims at giving a balanced view of techniques both from management science and IT, as they pertain to BPM.

STAKEHOLDERS IN THE BPM LIFECYCLE

There are different stakeholders involved with a business process throughout its lifecycle. Among them we can distinguish the following individuals and groups.

- *Management Team*. Depending on how the management of a company is organized, one might find the following positions. The *Chief Executive Officer* (*CEO*) is responsible for the overall business success of the company. The *Chief Operations Officer* (*COO*) is responsible for defining the way operations are set-up. In some companies, the COO is also responsible for process performance, while in other companies, there is a dedicated posi-

[3]The role of the customer is not listed in the box as this role is already discussed in previous sections.

tion of *Chief Process Officer* (*CPO*) for this purpose. The *Chief Information Officer* (*CIO*) is responsible for the efficient and effective operation of the information system infrastructure. In some organizations, process redesign projects are driven by the CIO. The *Chief Financial Officer* (*CFO*) is responsible for the overall financial performance of the company. The CFO may also be responsible for certain business processes, particularly those that have a direct impact on financial performance. Other management positions that have a stake in the lifecycle of processes include the *Human Resources* (*HR*) *director*. The HR director and their team play a key role in processes that involve significant numbers of process participants. In any case, the management team is responsible for overseeing all processes, initiating process redesign initiatives, and providing resources and strategic guidance to stakeholders involved in all phases of the business process lifecycle.

- *Process Owners*. A process owner is responsible for the efficient and effective operation of a given process. As discussed in the context of Fig. 1.5, a process owner is responsible on the one hand for planning and organizing, and on the other hand for monitoring and controlling the process. In their planning and organizing role, the process owner is responsible for defining performance measures and objectives as well as initiating and leading improvement projects related to their process. They are also responsible for securing resources so that the process runs smoothly on a daily basis. In their monitoring and controlling role, process owners are responsible for ensuring that the performance objectives of the process are met and taking corrective actions in case they are not met. Process owners also provide guidance to process participants on how to resolve exceptions and errors that occur during the execution of the process. Thus, the process owner is involved in process modeling, analysis, redesign, implementation and monitoring. Note that the same individual could well be responsible for multiple processes. For example, in a small company, a single manager might be responsible both for the company's order-to-cash process and for the after-sales customer service process.
- *Process Participants*. Process participants are human actors who perform the activities of a business process on a day-to-day basis. They conduct routine work according to the standards and guidelines of the company. Process participants are coordinated by the process owner, who is responsible to deal with non-routine aspects of the process. Process participants are also involved as domain experts during process discovery and process analysis. They support redesign activities and implementation efforts.
- *Process Analysts*. Process analysts conduct process identification, discovery (in particular modeling), analysis and redesign activities. They coordinate process implementation as well as process monitoring and controlling. They report to management and process owners and closely interact

with process participants. Process analyst typically have one of two backgrounds. Process analysts concerned with organizational requirements, performance, and change management have a business background. Meanwhile, process analysts concerned with process automation have an IT background.

- *System Engineers*. System engineers are involved in process redesign and implementation. They interact with process analysts to capture system requirements. They translate requirements into a system design and they are responsible for the implementation, testing and deployment of this system. System engineers also liaise with the process owner and process participants to ensure that the developed system supports their work in an effective manner. Oftentimes, system implementation, testing and deployment are outsourced to external providers, in which case the system engineering team will at least partially consist of contractors.
- The *BPM Group* (also called *BPM Centre of Excellence*). Large organizations that have been engaged in BPM for several years would normally have accumulated valuable knowledge on how to plan and execute BPM projects as well as substantial amounts of process documentation. The BPM Group is responsible for preserving this knowledge and documentation and ensuring that they are used to meet the organization's strategic goals. Specifically, the BPM group is responsible for maintaining the process architecture, prioritizing process redesign projects, giving support to the process owners and process analysts, and ensuring that the process documentation is maintained in a consistent manner and that the process monitoring systems are working effectively. In other words, the BPM group is responsible for maintaining a BPM culture and ensuring that this BPM culture is supporting the strategic goals of the organization. Not all organizations have a dedicated BPM Group. BPM Groups are most common in large organizations with years of BPM experience.

In the rest of the book, we will dive consecutively into each of the phases of the BPM lifecycle. Chapter 2 deals with the process identification phase. Chapters 3–4 provide an introduction to process modeling, which serves as background for subsequent phases in the BPM lifecycle. Chapter 5 deals with the process discovery phase. Chapters 6–7 present a number of process analysis techniques. We classify these techniques into qualitative (Chap. 6) and quantitative (Chap. 7) ones. A quantitative technique is one that takes raw data or measurements as input (e.g. performance measures at the level of tasks) and produces aggregated measurements and quantitative summaries as output. On the other hand, a qualitative technique involves human judgment, for example in order to classify tasks or issues according to subjective criteria. Note that qualitative techniques may involve quantitative assessment in addition to human judgment, as these two sources of insights often serve complementary purposes. Next, Chap. 8 gives an overview of process redesign techniques,

Chapter 2
Process Identification

Things which matter most must never be at the mercy of things which matter least.
Johann Wolfgang von Goethe (1749–1832)

Process identification is a set of activities aiming to systematically define the set of business processes of a company and establish clear criteria for prioritizing them. The output of process identification is a *process architecture*, which represents the business processes and their interrelations. A process architecture serves as a framework for defining the priorities and the scope of process modeling and redesign projects.

In this chapter, we present a method for process identification that is based on two phases: designation and evaluation. The designation phase is concerned with the definition of an initial list of processes. The evaluation phase considers suitable criteria for defining priorities of these processes. After that, we discuss and illustrate a method for turning the output of this method into a process architecture.

2.1 Focusing on Key Processes

Few organizations have the resources required to model all their processes in detail, to rigorously analyze and redesign each of them, to deploy automation technology in order to support each of these processes, and finally to continuously monitor the performance of all processes in detail. Even if such resources were available, it would not be cost-effective to spend them in this way. BPM is not free. Like any other investment, investments in BPM have to pay off. Thus, it is imperative in every organization engaged in BPM to focus the attention on a subset of processes.

Some processes need to receive priority because they are of strategic importance to an organization's survival. Other processes might show striking problems, which should be resolved for the sake of all involved stakeholders. In other words, the processes that an organization should focus on are found in areas where there is either great value created or significant trouble present (or both). To make things more complex, the subset of high-priority processes in an organization is subject to the dynamics of time. Some processes may be problematic at one point, but once

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the issues have been identified and resolved by a process improvement program, an organization can do with only periodic inspections for some time. For example, an insurance company suffering from high levels of customer dissatisfaction will naturally tend to focus on its customer-oriented processes, say its claims handling process. Once this process has improved and customer satisfaction is again within the desired range, the emphasis might move to its risk assessment processes, which are important for the long-term viability and competitiveness of the company.

Beyond the dynamics of time, what may be processes that are of strategic importance to an organization at some point may grow less important as time elapses. Market demands may change and new regulations or the introduction of new products may limit what was once a profitable business activity. For example, the arrival of new competitors offering discount insurance policies through Web-based channels may push an established company to redesign its insurance sales processes to make them leaner, faster, and accessible from the Web.

To address the imperative of focusing on a subset of key processes, the management team, process analysts and process owners need to have answers to the following two questions: (i) what processes are executed in the organization? and (ii) which ones should the organization focus on? In other words, an organization engaged in BPM initiatives needs to keep a map of its processes as well as clear criteria for determining which processes have higher priority. We have seen in Chap. 1 that there is a range of stakeholders involved in the management and execution of a business process. Generally, only a handful of such stakeholders have a full overview of all the business processes in an organization. Yet, it is precisely this insight that is required in order to identify the subset of processes that need to be closely managed or improved. Capturing this knowledge and keeping it up-to-date is precisely the aim of process identification.

More specifically, process identification is concerned with two successive phases: designation and evaluation. The objective of the *designation phase* is to gain an understanding of the processes an organization is involved in as well as their interrelationships. The *evaluation phase*, based on the understanding that is established in the previous phase, intends to develop a prioritization among these for process management activities (modeling, redesign, automation, monitoring, etc.). Note that *neither* of these phases is concerned with the development of detailed process models. The key activities that are involved with process identification which we will describe closely follow those as identified by Davenport in [10].

2.1.1 The Designation Phase

If an organization is at the very start of turning into a process-centered organization, the first difficult task it faces is to come up with a meaningful enumeration of its existing processes. One difficulty here arises from the hierarchical nature of business processes: different criteria can be considered for determining which chains of operations can be seen as forming an independent business process and which ones are seen as being part of another process. There are various views on how to categorize business processes (see the box “Categories of Processes according to Porter”). Some of these support the idea that there are actually *very few* processes within any organization. For example, some researchers have argued for the existence of only two processes: (1) managing the product line, and (2) managing the order cycle. Others identify three major processes: developing new products, delivering products to customers, and managing customer relationships.

CATEGORIES OF PROCESSES ACCORDING TO PORTER
Different categorizations for business processes have been proposed. One of the most influential is Michael Porter’s Value Chain model. It distinguishes two categories of processes: core processes (called primary activities) and support processes (support activities). Core processes cover the essential value creation of a company, that is, the production of goods and services for which customers pay. Porter mentions inbound logistics, operations, outbound logistics, marketing and sales, and services. Support processes enable the execution of these core processes. Porter lists infrastructure, human resources, technology development, and procurement as such support processes. As a third category, other authors extend this set of two categories with management processes. For example, the periodic process to assess the strength of competitors is such a management process. The distinction of core, support, and management processes is of strategic importance to a company. Therefore, if such a distinction is made explicit, e.g. at the stage of process identification or while creating a process architecture, it is likely to be a heavily disputed topic.

The question is whether an overly coarse-grained view on processes, without *any further subdivision*, is useful for an organization that strives to become process-centered. Remember that the idea of process management is to actively manage business processes in the pursuit of satisfying its specific customers. If one selects business processes to be such large entities, then the result may be that these cannot be easily managed separately, both in terms of scope and speed of action. Consider, for example, how difficult it would be to model or redesign a process when it covers half of all the operations within an organization. A realistic model of such a business process would take a very long time to develop and could become extremely complex. Also, redesigning such a large process would be a time-consuming affair, let alone the implementation of such a redesign. Depending on the situation, an organization may not have that time.

The main conclusion from this is that the number of processes that are identified in the designation phase must represent a trade-off between *impact* and *manageability*. The smaller the number of the processes one wishes to identify, the bigger their individual scope is. In other words, if only a small number of processes is identified then each of these will cover numerous operations. The main advantage of a large process scope is that it potentially increases the *impact* one can have with actively managing such a process. The more operations are considered to be part of a process, the easier it will become, for example, to spot opportunities for efficiency gains by rooting out redundant work.

On the other hand, a large scope of a business process brings along a range of issues that make it more difficult to *manage* it as a process:

- the involvement of a large number of staff will make effective communication among them problematic
- it will become more difficult to keep models of a large process up-to-date, and
- improvement projects that are related to a large process are more complex

To balance the advantages and disadvantages of a large process scope, Davenport has suggested that it may be useful to identify both *broad* and *narrow* processes. Broad processes are identified in those areas where an organization feels it is important to completely overhaul the existing operations at some point, for example because of fierce competitive forces. Imagine that an organization may have found that its procurement costs are overly high compared to its competitors. They select procurement as a broad process, which covers all of the services and products the company acquires from other parties. By contrast, narrow processes are not targeted for major overhauls; they do need to be actively monitored and are subjected to continuous fine-tuning and updating. A narrow process may be, for example, how the same company deals with improvement suggestions of its own employees.

Exercise 2.1 Explain how the trade-off between impact and manageability works out for broad and narrow processes, respectively.

Any enumeration of business processes should strive for a reasonably detailed outcome, which needs to be aligned with the organization's specific goals of process management. For most organizations, as a rule of thumb, this will boil down to a dozen to a couple of dozens of business processes. Very large and diversified organizations might be better off with identifying a couple of hundred processes. To illustrate this: Within a multi-national investment firm, which employs close to 3,000 staff and holds assets in the range of € 300 billion, 120 different business processes have been identified. To each of these business processes a process owner is assigned, who oversees the performance of the process and monitors the achievement of its objectives in terms of customer satisfaction, profitability, and accountability. Detailed process models are kept up-to-date, both as a means for documenting planned changes to any process and for satisfying the requirements of financial authorities. By contrast, for a small medical clinic in the Netherlands, which employs medical specialists, nurses, and administrative staff, 10 different treatment processes have been identified. A few of these have been mapped in the form of process models and are now in the process of being automated with a business process management system. For all other processes, it is sufficient to be aware of the distinctive treatment options they can provide to different patient categories.

Exercise 2.2 What are the potential drivers for the described investment firm to identify a large number of processes?

In addition to a rather detailed view on what business processes exist, an understanding must be developed about the *relations* between the various processes. In a situation where organizations define both narrow and broad processes, to avoid confusion, it is important to map how narrow processes relate to broader processes. A broad process like order management, for example, can be related to the more narrowly defined processes of order booking, billing, shipment, and delivery. All of these can be considered sub-processes of order management. We can call this an example of *hierarchical* relations between processes. Processes may also be related to one another differently. Billing, in the example we just used, is an *upstream* process compared to shipment: for the same order the bill is sent out usually *before* the ordered goods are shipped. Another way of expressing this relation is, of course, that shipment can be considered a *downstream* process in comparison to billing. This illustrates how processes can be *sequentially* related.

Exercise 2.3 Discuss in how far order management might be sequentially related to booking, billing, shipment, and delivery.

Most of the time, the insight into the relations between processes may be less than strictly exact. The most important goal of capturing dependent relations is to gain an understanding of how the performance of a process is related to that of another. If one would, for example, redesign an existing process it is useful to understand which processes depend on the outcomes of such a process. Such downstream processes may need to be prepared for receiving information or goods in another frequency or form than before and measures should be taken to prevent any disruptions.

Exercise 2.4 At this point, we discussed hierarchical and sequential relations between business processes. Can you think of other types of relation that are useful to distinguish between processes? As a hint, you might want to think about the purpose of identifying the relations between business processes.

While the designation of business processes and their inter-relationships is subject to different design choices and preferences, some general guidance is available. First of all, several so-called reference models for business process identification exist. These are developed by a range of industry consortia, non-profit associations, government research programs and academia. The best-known examples are the Information Technology Infrastructure Library (ITIL), the Supply Chain Operations Reference Model (SCOR) by the Supply Chain Council, the Process Classification Framework (PCF) by the American Productivity and Quality Center (APQC), the Value Reference Model (VRM) by the Value Chain Group, and the Performance Framework of Rummler–Brache. Reference models standardize what can be seen as different processes, with unique characteristics and delivering distinguishable products, and how their performance can be measured. Their largest value is in the identification of regulatory or highly industry-specific processes, or when performance benchmarking against peers and competitors is the issue that a process-centered organization is after. In other cases, these reference models may still be useful in identification exercises in the form of a checklist. For example, an organization can use the APQC's PCF to inventory the processes in the framework they use, flag those they do not use, and add its own unique processes. We will take a closer look at the PCF in Sect. 2.2.

A second stream of support is available in the form of specific design approaches to develop a so-called *process architecture*. A process architecture is an organized overview of the processes that exist within an organizational context, which is often accompanied with guidelines on how they should be organized. Design approaches for business process architectures use a certain logic to arrive at an identification of business processes. In Sect. 2.2, we will go into more detail with respect to a specific design approach.

Finally, what is worth noting with respect to the designation phase is that processes change over time, deliberately or not. This naturally implies that process identification is of a continuous nature. To avoid the situation that one becomes bogged down in the stage of process identification, the activity should be considered as an exploratory and iterative endeavor. When a certain stable overview is created it may very well be usable for a period of two to three years.

2.1.2 The Evaluation Phase

As stated before, not all processes are equally important and not all processes can receive the same amount of attention. Process management involves commitment, ownership, investment in performance enhancement, and optimization. Therefore, processes that create loss or risk demand for consolidation, decommissioning, or outright elimination. Various criteria have been proposed to steer this evaluation. The most commonly used ones are the following.

Importance This criterion is concerned with assessing the strategic relevance of each process. The goal is to find out which processes have the greatest impact on the company's strategic goals, for example considering profitability, continuity, or contribution to a public cause. It makes sense to select those processes for active process management that most directly relate to the strategic goals of an organization.

Dysfunction This criterion aims to render a high-level judgment of the "health" of each process. The question here is to determine which processes are in the deepest trouble. These processes are the ones that may profit most from process-centered initiatives.

Feasibility For each process, it should be determined how susceptible they are to process management initiatives, either incidental or on a continuous basis. Most notably, culture and politics involved in a particular process may be obstacles to achieve results from such initiatives. In general, process management should focus on those processes where it is reasonable to expect benefits.

Note that all of these criteria assume that there is certain information available. For example, to assess the strategic *importance* of a process it is of the utmost importance that an organization has an idea of its strategic course. It is sufficient if such strategic considerations are defined at a very abstract level. At this point, for example, many organizations see the strategic benefit of being able to change the kind of products it provides to the demands of customers. Zara, the Spanish clothing retailer, is a prime example of an organization that follows a measure-and-react strategy. It sends out agents to shopping malls to see what people already wear for determining the styles, fabrics, and colors of the products it wants to deliver. Such an organization may look with specific interest at the production and logistic business processes that are best able to support this strategy.

Similarly, to determine the *potential dysfunction* of a business process an organization needs information. Here, we do encounter a "chicken and egg" problem. Many organizations that are not working in a process-centered way do not have a good, quantitative insight into the performance of their individual processes. One of the process-centered initiatives that such an organization may be after would exactly be to put the systems and procedures in place to collect the data that are needed for a performance assessment. In such cases, an organization will need to use more qualitative approaches to determine which of their processes do not perform well, for example depending on the impressions that management or process participants have about the efficiency or effectiveness of the various processes. Another approach would be to rely on customer evaluations, either gathered by surveys or spontaneously delivered in the form of complaints.

The criterion of *feasibility* needs some attention too. It has become common practice for organizations to undergo a continuous stream of programs to improve their performance in one dimension or the other. Consider Philips, the multinational electronics company. It has gone through an intermittent range of improvement programs since the 1980s to boost its performance. The same phenomenon can now be observed within many telecommunications and utility organizations. Since the profitability of products sharply changes from one year over the other, this requires continuous changes to product portfolios and market priorities. In these kinds of volatile context, it may happen that managers and process participants become tired of or outright hostile towards new initiatives. This kind of situation is not a good starting point for process management initiatives. After all, like other organizational measures, such initiatives also depend on the cooperation and good intentions of those directly involved. While we will not deal with the subject of change management in much detail in this textbook, it is important to realize that political sensitivities within an organization may have an effect on the success rate of process management efforts too.

BPM MATURITY ASSESSMENT

A more detailed approach to look at the evaluation phase is based on maturity. BPM maturity assessment is a body of techniques to determine the level of systematic process thinking in an organization. A BPM maturity assessment essentially involves two aspects. The first aspect is to assess to what extent a given organization covers the range of processes that are ideally expected from it. The second aspect is to assess to what degree these processes are documented and supported. Therefore, a maturity assessment is aimed at establishing a baseline for discussing the completeness and the quality of the set of processes executed in an organization.

One of the most widely used frameworks for maturity assessment is the Capability Maturity Model Integrated (CMMI) framework. This framework distinguishes a number of so-called process areas. Several of these areas are specific to a particular domain in the various CMMI specifications. The domain-independent areas include: process management, project management, and support.

The coverage of process areas and the degree of their support provide the basis for a maturity assessment in terms of the five CMMI maturity levels:

Level 1 (Initial): At this initial stage, the organization runs its processes in an ad-hoc fashion, without any clear definition of these processes. Control is missing.

Level 2 (Managed): At this stage, project planning along with project monitoring and control have been put into practice. Measurement and analysis is established as well as process and product quality assurance.

Level 3 (Defined): Organizations at this stage have adopted a focus on processes. Process definitions are available and organizational training is provided to enable stakeholders across the organization to be engaged in process documentation and analysis. Integrated project and risk management are in place. Decision analysis and resolution are also in place.

Level 4 (Quantitatively Managed): At this stage, organizational process performance is tracked. Project management is performed using quantitative techniques.

Level 5 (Optimizing): At this stage of maturity, the organization has established organizational performance management accompanied with causal analysis and resolution.

The assessment of an organization in terms of these levels leads to a so-called *appraisal*. Appraisals can be conducted internally within an organization (also called self-appraisals) or by an external organization with expertise in maturity assessment. Different types of appraisal are distinguished and defined in the Standard CMMI Appraisal Method for Process Improvement (SCAMPI).

Question Given all the discussed criteria, does an assessment of the importance, dysfunctioning, and feasibility always point me to the same processes to actively manage?

No, there is no guarantee for that. It may very well be that a strategically important process is also the process that can be expected to be the most difficult one to manage, simply because so many earlier improvement efforts have already failed. An organization may not have a choice in such a situation. If a strategic process cannot be improved, this may turn out to be fatal for an organization as a whole. Think of a situation where the process to come up with new products creates much turmoil and conflicts within an organization: If the issues cannot be sorted out, the company may stop functioning quickly. In other settings, it may be more important to gain credibility with process management activities first. This can be accomplished by focusing on problematic processes of milder strategic importance but where there is a great desire to change. If successful, an improvement project at such a place may give credibility to the process management approach. These are not choices that can be easily prescribed without taking the specific context into situation. The various evaluation outcomes should be balanced to reach a list of those processes that should receive priority over others.

Question Should all processes that are dysfunctional, of strategic importance, and feasible to manage be subjected to process management initiatives?

The general answer to this question is that for most organizations this is not feasible. Recall again that process management consumes resources. Even when there is a clear incentive to, for example, redesign various existing business processes, most organizations lack sufficient resources—people, funds, and time—to do so. Only the largest organizations are able to support more than a handful of process improvement projects at the same time. A good case in point is IBM, an organization known to have process improvement projects going on within all its existing business processes on a continuous basis. Another caveat of carrying out many simultaneous process management efforts is that these will create coordination complexity. Remember that processes may be linked to each other in various respects, such that measures taken for one process should be synchronized with those taken for other. As Davenport [10] describes:

> Most companies choose to address a small set of business processes in order to gain experience with innovation initiatives, and they focus their resources on the most critical processes. Each successful initiative becomes a model for future efforts.

What *is* happening in some organizations is that widespread efforts are made to at least *model* all important business processes, delaying the decision to make the step to more advanced BPM efforts (e.g. process redesign or automation). The idea is that process models are a cornerstone of any further BPM efforts in any case and that their existence will help to better understand where improvements can be gained. Creating a model of a process leads to the valuable insight how that process works at all, and can provide a good basis for small improvements that can easily be implemented. On the downside, such an approach bears the risk that major improvements are missed and stakeholders develop a feeling of a lack of return for the efforts. It should be stressed here, too, that the actual modeling of business processes is not an element of the process identification stage.

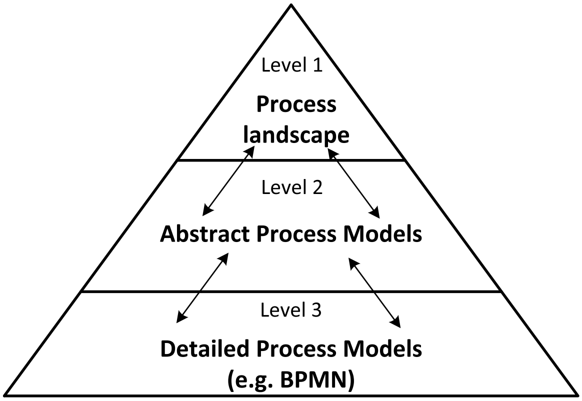

Fig. 2.1 The different levels of detail in a process architecture

In this section, we have described the process designation and evaluation phases on a high level of discourse. Now, we will turn to a specific technique to come up with a process design architecture.

2.2 Designing a Process Architecture

A process architecture is a conceptual model that shows the processes of a company and makes their relationships explicit. Typically, these relationships are defined in two directions. On the one hand, processes can be in a consumer–producer relationship. This means that one process provides an output that the other process takes as an input. In the first part of the book, we distinguished the quote-to-order process and order-to-cash processes. The output of the first one (the order) is the input to the second one. Note that this is the same kind of ordering as the upstream-downstream relation we distinguished earlier. Beyond the consumer–producer relation, a process architecture defines different levels of detail. This is illustrated as a pyramid in Fig. 2.1.

The part of the process architecture that covers the processes on level one is known as the *process landscape model* or simply the process architecture for level one. It shows the main processes on a very abstract level. Each of the elements of the process landscape model points to a more concrete business processes on level two. This level two shows the processes at a finer degree of granularity, but still in a quite abstract way. Each element on level two points further to a process model on level three. The process models on this third level show the detail of the processes including control flow, data inputs and outputs, and assignment of participants, as we will discuss in the modeling chapters.

The most important challenge for the definition of a process architecture is the definition of the process landscape model, i.e. capturing the processes on level one. The process architecture on level one has to be understandable in the first place, showing not much more than approximately 20 categories of business processes of a company. Furthermore, it has to be sufficiently complete such that all employees of the company can relate to it with their daily work, and accept it as a consensual description of the company. Therefore, it is important to define the process architecture in a systematic way, with a specific focus on the derivation of the process landscape model.

Several perspectives and approaches have been defined for process architecture definition. Here, we will concentrate on an approach developed by Dijkman [14]. This specific approach leads to a process architecture on level one along two dimensions: case type and business function. The *case type* dimension classifies the types of cases that are handled by an organization. A case is something that an organization (or part of it) handles. Typically, a case is a product or service that is delivered by an organization to its customers, such as an insurance (a service) or a toy (a product). Note that, depending on the part of the organization for which the process architecture is designed, the cases can represent products or services that are delivered to the customers of the organization. However, they can also refer to products or services that are delivered by one department of the organization to another department. For example, think of setting up a workplace for a new employee by the facilities department.

Cases can be deliberately classified, using any number of properties. For example, an insurance company handles insurances, which can be classified according to product type (home insurance, car insurance and life insurance), but also according to the channel that the company uses to interact with its customers (telephone, office, and internet). A combination of these properties can also be used to classify cases. In the insurance example, cases would then be classified using both product type and channel (home-insurance via telephone, home-insurance via office, car-insurance via telephone, etc.).

The *function* dimension classifies the functions of an organization. A function is, simply put, something that an organization does. Typically, a hierarchical decomposition of functions can be made: A function consists of sub-functions, which, in turn, consist of sub-sub-functions, etc. For example, a production company performs purchasing, production, and sales functions. The purchasing function, in turn, can be decomposed into vendor selection and operational procurement functions. Figure 2.2 shows an example of a business process architecture for a harbor authority, which uses the case type and function dimensions to structure its processes.

The figure shows an organization of processes by *case type* in the horizontal dimension and by *business function* in the vertical dimension. The function dimension shows what the organization does: handling pre-arrival of sea ships, which involves notifying the relevant parties about the estimated time of arrival of the ship and what the ship is carrying; handling the actual arrival of the ship, which involves guiding the ship to its dock; etc. The case type dimension shows the types of cases that the organization handles: sea ships, trucks, trains, and inland transportation by barge. There are three processes that are created to handle these types of cases, using the different functions. These three are shown as covering the various functions and case types. The inbound planning process is used for handling pre-arrival of sea ships. The inbound handling process is used for handling arrival and trans-shipment of sea

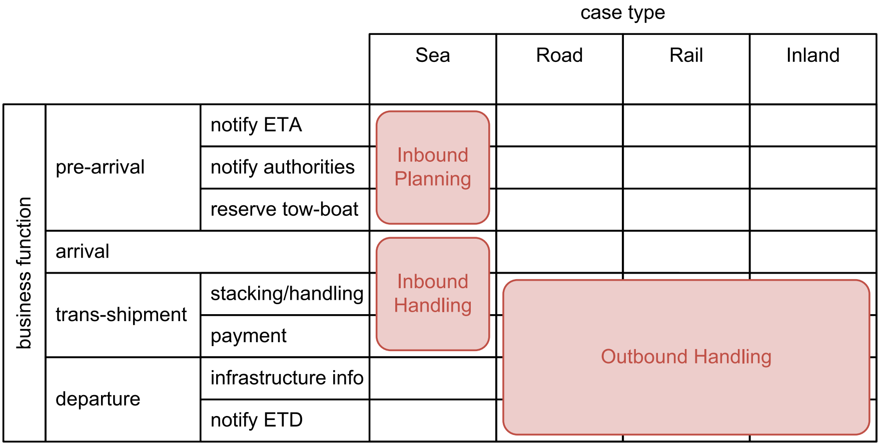

Fig. 2.2 A process architecture for a harbor authority

ships and the outbound handling process is used for handling trans-shipment and departure of trucks, trains, and barges.

To arrive at a business process architecture in a similar sense as we described here, we propose an approach that consists of the following four steps:

1. identify case types
2. identify functions for case types
3. construct one or more case/function matrices, and
4. identify processes

We will now discuss these steps in more detail.

2.2.1 *Identify Case Types*

In the first step, a classification of case types is developed for the organization. This is done by selecting the case properties that will be used for the classification. The main purpose for identifying different classes in this dimension of the process architecture is to determine the different ways in which (similar) processes are handled in the organization. It is important to have this in mind, because the only properties that should be included in the classification are the ones that lead to different organizational behavior. Properties that may distinguish cases yet do not lead to different behavior should not be included. For example, a stationary store sells many different types of product. However, it sells all these types of product in the same manner. Therefore, 'product type' is not a useful dimension when classifying the cases that are handled by a retail store. An insurance company also sells different types of product (insurances) and, in contrast to the retail store, the products that it sells are handled differently. For example, for a life insurance a declaration of health must be filled out, but for a car insurance this is not a requirement. Therefore, the ‘product type’ is indeed a useful property to classify the types of cases that are handled by an insurance company; this is not the so for classifying the types of cases that are handled by a retail store.

A classification of the types of cases that an organization handles can be developed using any number of properties. However, some of the more commonly used properties are:

- Product type: this property identifies the types of products that are handled by an organization. These can be hierarchically decomposed. For example, an insurance company handles damages and life insurance products. In the class of damage insurances, a further decomposition is possible into car insurance and home insurance; similarly, within the class of life insurance a further decomposition is possible into healthcare insurance and accident insurance.
- Service type: if (a part of) an organization handles services rather than products, this property identifies the types of services that the organization handles, similar to the way in which product type identifies the types of tangible deliverables.
- Channel: this property represents the channel through which the organization contacts its customers. We can, for example, distinguish: face-to-face contact (over the counter), telephone or internet contact.
- Customer type: this property represents the types of customer that the organization deals with. An airline, for example, may distinguish frequent flyers from regular travelers.

Note again that, although these are the most commonly used properties to distinguish different case types, there are certainly other properties that can be used. Any property that distinguishes types of cases that are handled differently can be used. For example, if an organization does things differently in North America than in Europe, cases may be classified according to location. Another example: if cases are handled differently depending on the expertise that is required to handle them, they may be classified according to expertise.

Also, note again that the classification can be developed using any number and combination of properties. If a company sells insurances in both North America and Europe and handling of insurances differs on those continents because of local regulations, then a classification of cases according to both product type and location can be used.

Exercise 2.5 Consider the case of a bank and the classification criteria product type, service type, channel, and customer type. In how far are these criteria related to each other?

2.2.2 Identify Functions for Case Types

In the second step, a classification is developed of the business functions that are performed on the different case types. This step requires that each of the case types is examined in detail and for each case type the functions that can be performed on it are identified. Potentially, the functions that are performed in an organization can be related to existing classifications that are proposed by reference models. We already mentioned a number of these. A small part of APQC's PCF is shown in Table 2.1. Such reference models can serve as a starting point to develop a classification of business functions and may be adapted to the specific needs of the organization.

Whether this identification of functions starts with a reference model or not, it requires interviews with different people in the organization. These interviews serve to either identify the functions directly, or to check to which extent the functions from a reference model apply to the organization. The interviews must both be held with employees that are involved in the different cases that the organization handles and with product (and service) managers of the different products and services that the organization handles. It is, therefore, important to observe that the different people involved may very well use different terms for similar business functions. Homonyms and synonyms are problematic in this context. For example, what is called 'acquisition' in one part of the organization may be called 'market survey' in another (synonym). At the same time, two functions called 'implementation' may represent different activities: one may represent the implementation of software, while the other represents the implementation of new regulations in the organization (homonym). Apart from being aware of the various terms that are being used, an intricate understanding of the operations of an organization is important to sort these issues out. Frameworks like APQC's PCF can help to avoid terminological issues right from the start.

In addition, functions may be organized differently. Consider, for example, Fig. 2.3. It is taken from a real-world case and shows parts of the functional decompositions of two departments from the same organization, one in Europe and one in North America. The European department distinguishes between purchasing and sales, where both purchasing and sales are split up into operational functions. These functions concern sourcing and order-to-pay for purchasing on the one hand and marketing and sales operations for sales on the other. The North American department distinguishes between sourcing, marketing, and order handling. Here, order handling involves both order-to-pay and operational sales activities (but is not decomposed any further).

Clearly, in the example of this organization, a negotiation step may be required between the different people involved to unify the functional decompositions across its European and North-American parts. This is particularly called for if the functional decomposition is more than just a modeling exercise. It may also represent actual organizational properties. In the case that is illustrated in Fig. 2.3, managers are in place for the different functions at the different levels of decomposition. In Europe, a manager is appointed for sales, another for procurement, and lower-level managers for sourcing, order-to-pay, marketing, and operational sales. In North America, there are managers in place for sourcing, marketing, and order management. Therefore, when the functional decompositions of the departments needs to be harmonized, the management structure also must be subjected to harmonization.

A functional decomposition should not be confused with a decomposition according to case type. It is possible that an organization is structured according to

Table 2.1 Level one and level two of the APQC process classification framework

1.0 Develop Vision and Strategy
1.1 Define the business concept and long-term vision
1.2 Develop business strategy
1.3 Manage strategic initiatives

2.0 Develop and Manage Products and Services
2.1 Manage product and service portfolio
2.2 Develop products and services

3.0 Market and Sell Products and Services
3.1 Understand markets, customers, and capabilities
3.2 Develop marketing strategy
3.3 Develop sales strategy
3.4 Develop and manage marketing plans
3.5 Develop and manage sales plans

4.0 Deliver Products and Services
4.1 Plan for and align supply chain resources
4.2 Procure materials and services
4.3 Produce/Manufacture/Deliver product
4.4 Deliver service to customer
4.5 Manage logistics and warehousing

5.0 Manage Customer Service
5.1 Develop customer care/customer service strategy
5.2 Plan and manage customer service operations
5.3 Measure and evaluate customer service operations

6.0 Develop and Manage Human Capital
6.1 Develop and manage human resources (HR) planning, policies, and strategies
6.2 Recruit, source, and select employees
6.3 Develop and counsel employees
6.4 Reward and retain employees
6.5 Redeploy and retire employees
6.6 Manage employee information

7.0 Manage Information Technology
7.1 Manage the business of information technology
7.2 Develop and manage IT customer relationships
7.3 Develop and implement security, privacy, and data protection controls
7.4 Manage enterprise information
7.5 Develop and maintain information technology solutions
7.6 Deploy information technology solutions
7.7 Deliver and support information technology services

8.0 Manage Financial Resources
8.1 Perform planning and management accounting
8.2 Perform revenue accounting
8.3 Perform general accounting and reporting
8.4 Manage fixed-asset project accounting
8.5 Process payroll
8.6 Process accounts payable and expense reimbursements
8.7 Manage treasury operations
8.8 Manage internal controls
8.9 Manage taxes
8.10 Manage international funds/consolidation

9.0 Acquire, Construct, and Manage Assets
9.1 Design and construct/acquire nonproductive assets
9.2 Plan maintenance work
9.3 Obtain and install assets, equipment, and tools
9.4 Dispose of productive and nonproductive assets

10.0 Manage Enterprise Risk, Compliance, and Resiliency
10.1 Manage enterprise risk
10.2 Manage business resiliency
10.3 Manage environmental health and safety

11.0 Manage External Relationships
11.1 Build investor relationships
11.2 Manage government and industry relationships
11.3 Manage relations with board of directors
11.4 Manage legal and ethical issues
11.5 Manage public relations program

12.0 Develop and Manage Business Capabilities
12.1 Manage business processes
12.2 Manage portfolio, program, and project
12.3 Manage quality
12.4 Manage change
12.5 Develop and manage enterprise-wide knowledge management (KM) capability
12.6 Measure and benchmark

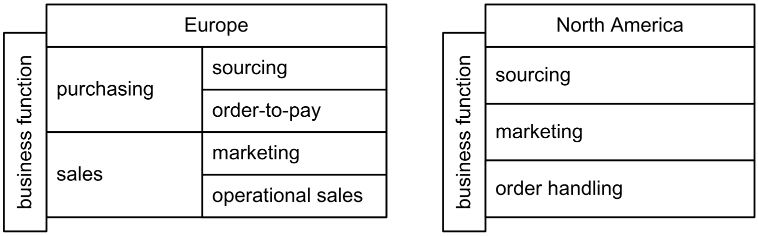

Fig. 2.3 Different functional decompositions within the same organization

both business function and other properties. It may then be tempting to develop the functional decomposition further according to these other properties. However, these other properties should be reflected in the case type dimension rather than the function dimension. For example, an organization can be structured according to business functions into a sales and a procurement department with managers leading each of the departments. It can be further structured according to location, having both a sales and a procurement department in Europe as well as in North America. In this situation, the functional decomposition ends with the decomposition into sales and procurement. Should a further decomposition according to location be relevant, then this decomposition should be reflected in the case type dimension, not in the function dimension.

An important decision that must be made when developing the functional decomposition is to determine the appropriate level of decomposition at which the functional decomposition ends. In theory, the functional decomposition can be performed up to a level that represents the tasks that are performed by the individual employee (fill-out form, check correctness of information on form, have colleague check correctness of information on form, etc.). However, for a process architecture a more coarse level of decomposition is usually chosen. Two rules of thumb that can be used to choose the level of decomposition at which the functional decomposition ends, are the following.

1. The functional decomposition should at least be performed down to a level at which functions correspond to different organizational units (with corresponding managers). For example, if an organization has both a sourcing and an order-to-pay department and both have their own managers, this is a strong indication that the functional decomposition should contain the functions that are performed by these departments.
2. The functional decomposition should include different functions for the different roles in each department. For example, if the sourcing department has buyers, who do requirements analysis and vendor selection, as well as senior buyers, who do vendor relationship management and contract management, this may lead to a decision to include requirements analysis, vendor selection, vendor relationship management and contract management as functions.

		Private Customers	Corporate Customers	Internal Customers
Management	Process			X
	Line			X
	Project			X
Operations	Savings	X	X	
	Loans	X	X	
	Checking	X	X	
Support	HRM			X
	ICT			X
	Finance			X
	Marketing			X

Fig. 2.4 A case/function matrix

Observe that these are rules of thumb, which leave room for handling them flexibly. They merely provide an aid for determining the lowest level of decomposition that should be used.

Exercise 2.6 Consider the case of a university and the level one processes listed in the APQC's PCF. What kind of more specific functions does a university typically cover in categories 2.0 Develop and Manage Products and Services and in 5.0 Manage Customer Service?

2.2.3 Construct Case/Function Matrices

The previous two steps of the described approach lead to a matrix that has the different case types as columns and the different functions as rows. A cell in the matrix contains an 'X', if the corresponding function can be performed for the corresponding case type. Figure 2.4 shows an example of a case/function matrix. The matrix shows a decomposition of case types by customer type, resulting in three case types: one for private customers, one for corporate customers, and one for internal customers. The figure also shows a functional decomposition into three main functions and a subsequent decomposition of those main functions into ten sub-functions. Management and support functions are only performed for internal customers, while operational functions are performed for private and corporate customers.

A case/function matrix can be split up into multiple matrices for the purpose of improving readability. We would typically split up a case/function matrix in case a partition of the matrix' functions and case types is possible such that all X's are

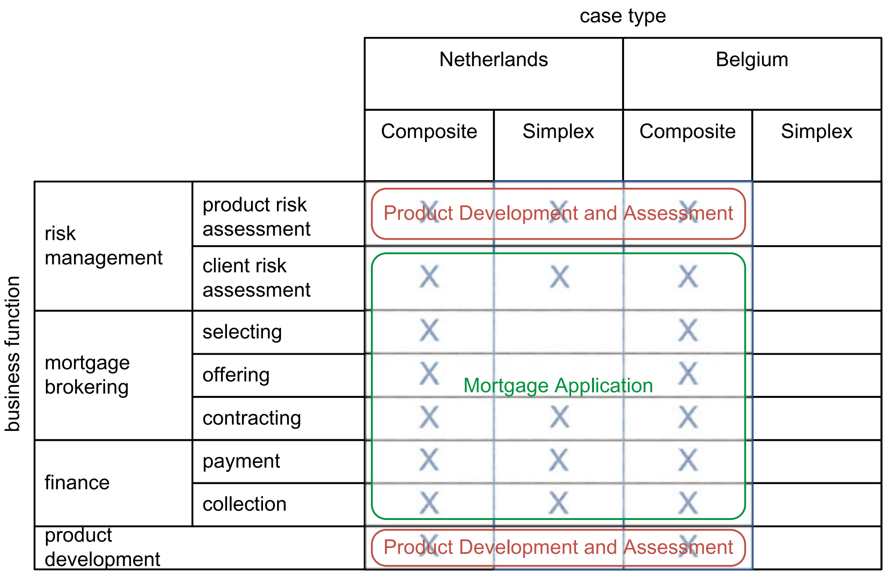

Fig. 2.5 A case/function matrix evolving into a process landscape model (applying Guideline 1)

preserved. For example, the matrix from Fig. 2.4 can be partitioned into, on the one hand, a matrix that contains the management and support functions and the internal customers and, on the other, a matrix that contains the operational functions and the private and corporate customers.

2.2.4 Identify Processes

In the fourth and final step of the proposed approach, we determine which combinations of business functions and case types form a business process. To determine this, we need to find a trade-off between two extremes, one in which the entire matrix forms one big process and one in which each single cross in the matrix forms a process. We establish this trade-off by the use of the general rule that, in principle, the entire matrix forms one big process which will only be split up in case certain rules apply. These rules can be formulated as eight guidelines. When a guideline applies, this may lead to a separation of processes between rows (a vertical split) or to a separation of processes between columns (a horizontal split). Some of the guidelines (Guidelines 5, 6, and 8) can only lead to vertical splits, while others (Guidelines 1–4) can only lead to horizontal splits. Note that the guidelines are not absolute: they may or may not apply to a particular organization and they are not the only rules that should be considered in specific cases.

Figure 2.5 shows the running example that we will use to explain the guidelines. The figure shows a case/function matrix for a mortgage broker, which brokers mortgages both in the Netherlands and in Belgium. It distinguishes between simplex and composite mortgages. A composite mortgage can be adapted to the specific requirements of a customer, by composing it from different types of loans, savings accounts, life insurances and investment accounts. A simplex mortgage consists of a pre-defined package of a loan, a savings account and a life insurance. On these different types of mortgages, various business functions can be performed. Risk assessment involves assessment of risk of both individual clients, who are in the process of applying for a mortgage, and mortgage products as a whole. Mortgage brokerage involves the selection of a particular mortgage package based on the requirements of a particular customer and subsequently offering that package to the customer and closing the contract. The financial functions involve paying out the mortgage and subsequently collecting the monthly payments. Finally, product development is the periodic review of the mortgage products and their components.

Guideline 1: If a process has different flow objects, it can be split up vertically. A flow object is an object in the organization that flows through a business process. It is the object on which business process activities are being carried out. Typically, each business process has a single flow object, such that flow objects can be used to identify business processes. Consequently, if multiple flow objects can be identified in a business process, this is a strong indication that the process should be split up.

Figure 2.5 illustrates the application of Guideline 1 to our running example. One flow object for the mortgage brokering process is a mortgage application on which activities are carried out during a mortgage application by a client. These activities include a risk assessment and paying out the mortgage to the client. Another flow object in the mortgage brokering process is a mortgage product on which activities are carried out periodically to assess the risk of the product as a whole and to evaluate and develop the product. Consequently, we can split up the mortgage brokering process into two processes, one that has a mortgage application as a flow object and one that has a mortgage product as a flow object. We call the former the mortgage application process and the latter the product development and assessment process.

Guideline 2: If the flow object of a process changes multiplicity, the process can be split up vertically. This is due to the fact that in a business process a single flow object is sometimes used, while at other times multiple flow objects of the same type are used. This is typical for batch processing, in which certain activities are performed for multiple customer cases in batch at the same time. If, in the same process, the number of flow objects that is processed per activity differs this may be a reason for splitting up the process.

Have a look at Fig. 2.5, where the mortgage application process is performed for a single mortgage application. By contrast, the collection of payments happens for all mortgages in batch by the end of each month. Using Guideline 2, this may be taken as the reason for splitting the process and having Mortgage Collection as a separate process.

Guideline 3: If a process changes transactional state, it can be split up vertically. According to the action-workflow theory, a business process goes through a number of transactional states. In particular, we distinguish: the initiation, the negotiation, the execution and the acceptance state. In the initiation state, contact between a customer and a provider is initiated. In the negotiation state, the customer and the provider negotiate about the terms of service or delivery of a product. During the execution state, the provider delivers the product or service to the customer and during the acceptance state, the customer and the provider negotiate about the acceptance and payment of the delivery. A transition in a process from one state to another is an indication that the process can be split up.

To illustrate this guideline, consider again Fig. 2.5. Suppose that during the negotiation state the mortgage broker and the customer negotiate about the selection of mortgage products, ultimately leading to a contract being signed by both parties. Only during the execution state the mortgage is paid out to the customer and the monthly payments will be collected. By the logic of Guideline 3, we therefore split up the process into a mortgage application process and a Mortgage Payment process.

Guideline 4: If a process contains a logical separation in time, it can be split up vertically. A process contains a logical separation in time, if its parts are performed at different time intervals. Intervals that can typically be distinguished include: once per customer request, once per day, once per month and once per year.

To clarify Guideline 4, consider Fig. 2.5 again. Mortgage selection, offering, and contracting are performed once per mortgage application, while payment and collection for mortgages is performed once per month. By the logic of Guideline 4, it would make sense to split up mortgage selection, offering, and contracting from mortgage payment collection. Note that the passing of time in itself is not a reason for splitting up a process, because within each single process, time passes. For example, between the activity of entering mortgage details into a computer system and approval of the mortgage, time passes, but the unit of time remains the same: both activities happen once per mortgage application. Therefore, we would not split up the process between these activities. Another way of looking at Guideline 4 is that the process can be split up, if it must wait for a time trigger or a trigger by a new flow object. For example, the approval of a mortgage can be performed directly after the mortgage details are entered, without having to wait for a trigger. However, after having processed the mortgage application, the process must wait for the payment collection date trigger to continue with payment collection. Therefore, we would split up the process between these functions by the same logic of Guideline 4.

Guideline 5: If a process contains a logical separation in space, it can be split up horizontally. A process contains a logical separation in space, if it is performed at multiple locations and is performed differently at those locations. It is important to note that it is not sufficient for processes to just be separated in space. The separation must be such that there is no choice but to perform the processes differently for the different logical units.

To clarify this guideline: in case a process is performed at different locations within the same country, there is not necessarily a reason to perform it differently at those locations. Consequently, there is no reason to split it up. In fact, organizations should strive to make their processes as uniform as possible, to benefit from economies of scale. Indeed many organizations nowadays started projects in which they aim to make their processes more uniform across different locations, where processes became different purely for historic reasons or because the different locations did not share information about their process flow. As another example, the processes from Fig. 2.5 are performed at two different locations in different countries. However, still not all of these processes should differ at these two locations. For example, mortgage payment and collection may be the same in Belgium and the Netherlands. However, risk assessment, mortgage brokering and product development may differ between the Netherlands and Belgium, due to country-specific rules and regulations.

Guidelines 6 and 7 are more straightforward and can be described as follows.

Guideline 6: If a process contains a logical separation in another relevant dimension, it can be split up horizontally. Like with the separation in space, it is not sufficient for processes to just be separated. The separation must be such that there is no choice but to perform the processes differently for the different logical units.

Guideline 7: If a process is split up in a reference model, it can be split up. A reference process architecture is an existing process architecture that is pre-defined as a best-practice solution. It structures a collection of processes. For example, if a reference financial services process architecture exists, its structure can be used as an example or starting point to structure your own process architecture.

Figure 2.6 shows the results of applying Guidelines 2 through to 7 to the case/function matrix from Fig. 2.5, which itself resulted from applying Guideline 1 to our running example. Figure 2.6 shows that after applying Guidelines 2 through 7 as discussed above, there are six processes: Product Development and Assessment Netherlands (PD NL), Product Development and Assessment Belgium (PD BE), Mortgage Application Netherlands, Mortgage Application Belgium, Mortgage Payment, and Mortgage Collection.

The final guideline that we discuss here is the following.

Guideline 8: If a process covers (many) more functions in one case type than in another, it can be split up horizontally. The application of this last rule depends upon the current decomposition of processes. If applied, it is necessary to look at the current decomposition of processes and check if, within a process, (many) more functions are performed for one case type than for another, i.e.: whether a process has many more crosses in one column than in another. If so, this is a strong indication that the process should be split up for these two case types.

For example, when looking at Fig. 2.6, we see that the Mortgage Application Netherlands process has many more function for composite mortgages than for simplex mortgages. By the logic of Guideline 8, we would split up this process for composite and simplex application. The application of all of these eight guidelines yields a process architecture for level one. The result can be seen in Fig. 2.7, which is the finalized process landscape model for our example.

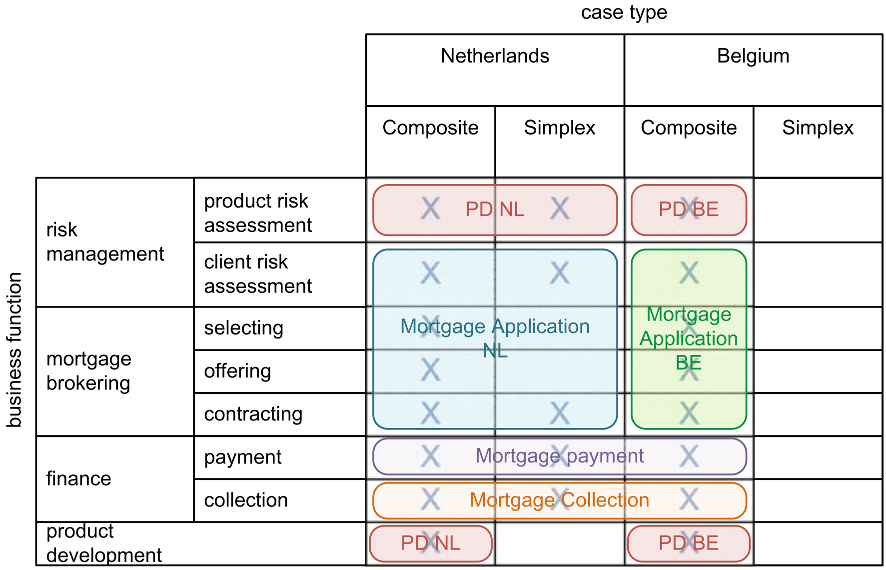

Fig. 2.6 A case/function matrix evolving into a process landscape model (applying Guidelines 2–7)

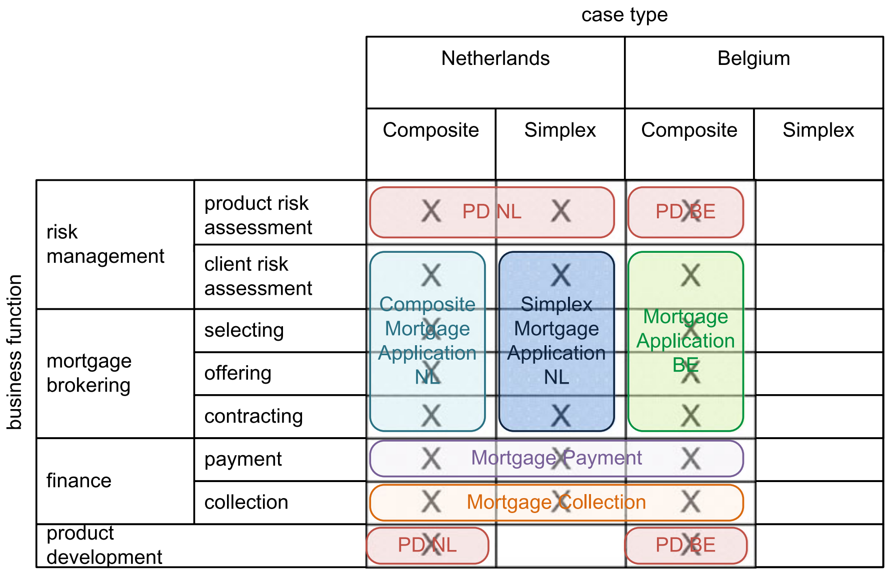

Fig. 2.7 A case/function matrix evolving into a process landscape model (applying Guideline 8)

Table 2.2 Consumer–producer relationships between processes

Consumer	Producer
Mortgage Payment	Composite Mortgage Application NL
Mortgage Payment	Simplex Mortgage Application NL
Mortgage Payment	Mortgage Application BE

2.2.5 Complete the Process Architecture

The approach that we discussed previously and which we emphasize in this part of the book leads to a process landscape model that covers the processes on level one of the pyramid in Fig. 2.1. As stated, this level only provides a very abstract insight into each process within the process landscape: It mainly shows how processes differ from each other in terms of the cases and functions they cover.

There are two things that are missing with respect to the general, encompassing characteristics of a process architecture as we discussed in Sect. 2.2: (1) the consumer–producer relationships between the processes, and (2) the levels of detail as provided by the pyramid in Fig. 2.1.

With respect to the consumer–producer relationships, we can take a broad or narrow perspective on the use of an output from one process as the input of another. For our running example, it may be that the product development process uses aggregated figures about how the mortgage application process is carried to determine what the needs of clients are and, in this way, what attractive new products may be. This would be a rather broad interpretation of the consumer–producer relationship.

What is often most important to know stems from a narrower perspective, namely which consumer–producer relationships exist between processes with respect to the *same* flow objects. In Fig. 2.7, it can be seen that mortgage application (both in the Netherlands and Belgium) and mortgage payment are split up, which was done following the logic of Guideline 3. This is a situation where the flow object of one process is consumed piecemeal by another; the only difference is the transactional state that the flow object is in. Specifically with respect to redesign initiatives these relations are most important to remember and make explicit, since changing one process has direct implications for the performance of the other. We can capture this narrow interpretation of consumer–producer relationships for our running example as is done in Table 2.2. Each row in this table provides a single consumer–producer relationship, where the consumer process continues to work on a flow object that is the output of the producer process.

Let us now focus on the other aspect that makes a process architecture for level one rather restrictive in comparison to our general notion of a process architecture. This concerns the high level of abstraction of the processes that are distinguished by the process landscape model. To focus on the other levels of the pyramid of Fig. 2.1, the question is what kind of additional detail they should offer. We focus here on the missing insights into (a) the *various steps* that are taken within each process and (b) the *organizational units* that are involved in carrying these out. These two elements should be added to obtain the models for level two of what we mean by

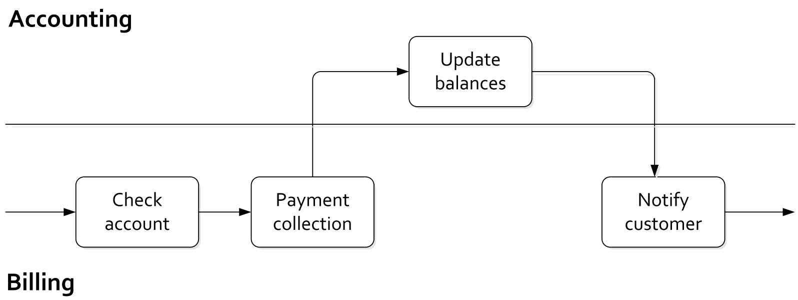

Fig. 2.8 A process map for the mortgage payment process

a process architecture. It is common to refer to a model on this second level as a *process map*.

To provide an example of a process map, we focus on the mortgage payment process that is identified in the process landscape model of Fig. 2.7. The related process map can be seen in Fig. 2.8.

As this figure shows, the identified mortgage payment process from the process landscape model has been decomposed into four main steps that can be associated with this process. Moreover, two organizational units are identified that are associated with these steps, i.e. Accounting and Billing. In other words, a process map provides more detail about the control flow and includes additional information with respect to the involved resources for a process.

Even a process map can still be said to provide an abstract view on a process. First of all, we can still see that the flow throughout the steps in a process map is highly simplified. It is common, like in Fig. 2.8, to only show a linear progress along the various steps in a process map: alternative paths, potential exceptions, iterations, etc. are all left out. For the organizational information that is added in a process map, too, the information is abstract: we can only see references to units but not the specific kind of participants that are involved.

Exercise 2.7 Give an example of an alternative path, a potential exception, and an iteration that would show up in a more detailed model of the mortgage payment process.

Secondly, there are many aspects beyond control flow and resource information that are not covered in *any* level of detail in a process map. Think about the data that are being handled in the process, the reports and files that are passed on, the systems that support the various steps, the time that is involved with carrying out these steps, etc.

In practice, process maps have turned out to provide a deeper level of insight into the processes from the process landscape *regardless* of the goals one pursues for the specific processes. In other words, an insight into the steps and involved organizational units has its value for any type of process-oriented initiative. By contrast, a further insight into, for example, the data that are being processed within each step