José Osvaldo De Sordi

Management by Business Process

A Managerial Perspective of People, Process, and Technology

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To my friend Reed Elliot Nelson
for his guidance and knowledge sharing,
main resource of the researcher.

Foreword

The purpose of this book is to address the structuring, operation and management of organizations from the perspective of business processes, using the Management by Business Process (M-B-BP) approach as a tool. In this sense, we have observed two major challenges to ensure that our message is understood by readers. These challenges are linked to the understanding of two central terms that can be impaired due to cognitive biases linked to false synonyms arising from more widespread literature and, therefore, better known to readers. The first bias is to ensure that the reader understands the differences between the entities "business process" and "process". The predominant knowledge is from the secular operational process texts associated with manufacturing production and service delivery. The second bias to be avoided is associated with technology-centric approaches, such as the Business Process Management (BPM) approach, widely disseminated in the first two decades of this century. As a way to combat these biases, throughout the book we need to make it clear to the reader that the business process is much broader than the process entity, as well as involves other entities as relevant as technology.

Considering the diversity of topics and work fronts associated with the M-B-BP approach, we adopted a subtitle that mentions and represents this breadth: "A Managerial Perspective of People, Process, and Technology". Thus, this book presents a comprehensive proposal in the sense of giving the reader a holistic view of the main components necessary for the successful implementation of the M-B-BP approach. To facilitate and optimize the reading of these various topics, I present in this preface the suggestion of some trails for reading the thirteen chapters according to the interests of the reader. Among the potential groups of readers interested in the subject, I highlight four, that is, four different tracks: one for those interested in technological aspects, of the technologies in support of the M-B-BP approach; another directed toward the strategy and competitiveness of companies; another toward worker issues, more specifically motivation with the work environment; and another for managers interested in the operation, management and development of organizations.

For readers who have little knowledge of what the M-B-BP approach is, I strongly recommend reading the introductory and conceptual chapters, i.e., the first three chapters:

Chapter 1—Introduction to the Management by Business Process approach;
Chapter 2—Discerning Between Functional Management and Business Process Management;
Chapter 3—Management by Business Process Technical Vocabulary.

For readers with an interest in the technological aspects of the M-B-BP approach, I recommend reading four chapters:

Chapter 4—Ontologies and Techniques for Business Process Specification;
Chapter 7—Technologies in Support of Management by Business Processes;
Chapter 8—Analysis of the components of Business Process Management System (BPMS) Technology from the Perspective of a Practical Case;
Chapter 12—New Technologies and New Business Demands in the M-B-BP Context.

For readers with an interest in business strategy and competitiveness, I recommend reading three chapters:

Chapter 2—Discerning Between Functional Management and Business Process Management;
Chapter 10—Organization as a Business Process;
Chapter 11—Maturity Models for Business Process Analysis.

For readers with an interest directed at the well-being and performance of workers in organizations, I recommend reading three chapters:

Chapter 6—Process Management and the Attractiveness of Jobs;
Chapter 9—Office Focused on Business Process Management;
Chapter 13—Impact of the Management by Business Processes in the Structural Variables of the Organization.

For readers with an interest in the management activities of organizations, I recommend reading six chapters:

Chapter 5—Approach to Management by Business Process;
Chapter 6—Process Management and the Attractiveness of Jobs;
Chapter 9—Office Focused on Business Process Management;
Chapter 10—Organization as a Business Process;
Chapter 11—Maturity Models for Business Process Analysis;
Chapter 13—Impact of the Management by Business Processes in the Structural Variables of the Organization.

I hope that the reading can bring to readers the rescue of concepts and techniques from the last decade of the twentieth century, when proposals for organizations structured from business processes emerged. The rapid technological advances of

this century brought much more light, brightness, and attention to technological aspects, somewhat overshadowing the other equally important topics for the implementation of structured administrative approaches and directed to business processes. The technocratic utopia and little attention to other aspects reduce the results and the possibilities of administrative approaches to bring effective gains to the business environment. Hence the importance of the holistic view of the theme, as proposed in this book.

I wish you a good time reading and may it bring you inspiration for your professional performance.

Jundiaí, São Paulo, Brazil José Osvaldo De Sordi

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Introduction to the Management by Business Process Approach

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Objective of This Chapter
By the end of this chapter the reader will have a good understanding of what the Management by Business Process (M-B-BP) approach is, characterizing it with respect to its central element, the business process. This will enable the reader to distinguish the entity "business process" from the entity "process".

1.1 Terminology: Management by Business Process Versus Business Process Management

An important aspect for understanding the term Management by Business Process (M-B-BP) is the meaning we assign to the preposition "by" connecting the nouns "management" and "business process". Before exploring the meaning of the preposition "by" in the context of the M-B-BP approach, we will highlight the difficulties of correctly understanding prepositions by different readerships. Even in the scientific environment, where researchers deal with reading and writing texts as part of their daily activities, the difficulty is observed. As an example, McGrath and O'Toole (2012) explored the meaning of four prepositions (on, for, with, by) to better understand the involvement of the researcher in relation to the research object according to the variations of the Action Research strategy. Le Boterf (1999) when exploring the Management by Competencies subject pointed out that although it was very common in the literature the use of different prepositions such as "management of competencies", "performance management based on competencies", among others, the best option would be the adoption of the term "management by competencies". Le Boterf pointed out that the particle "by", when used in the

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formation of adjunct, indicates end, purpose, destination, desire. Thus, the expression "management by competencies" inspires the idea that the management effort is intended to leverage, develop, and mobilize the competencies.

Although the term most commonly used in international literature is Business Process Management (BPM), in this book we adopt the term Management by Business Process with the intention of highlighting the semantic value of the preposition "by" as explained by Le Botert (1999). Thus, the term M-B-BP indicates that the one who practices it will develop the work of his company having as central desire and inspiration the development and leverage of business processes. Another reason for not adopting the term BPM is its wide use, in texts of different purposes and scope, making the term very close to a buzzword. Observing this plethora of uses and meanings, some authors end up adjectivizing the term BPM, for example, with the term "traditional" or "conventional", to highlight the different perspectives associated with the same denomination. As an example, Szelagowski and Berniak-woźny (2020, p. 219) wrote: "By describing in detail the core elements with the function of BPM CSFs, the authors clearly refer to traditional process management". Another difficulty regarding the term BPM is its strong link with the software for M-B-BP implementation. There is a diversity of software as well as books focused on the technologies that assist in the implementation of the M-B-BP approach. In short, there are so many uses for the term BPM that it ends up having little semantic value and low conceptual accuracy.

That said, in this book, the concept of M-B-BP focuses on a conception of work, its planning and operationalization from a process-centric perspective. The organizations and their managers that adopt the M-B-BP approach assume as their predominant mindset the business process. The other entities and actions of the organization are all conceived and executed with business processes as the central parameter, which is considered the organization's main resource. At the opposite extreme is the concept associated with the execution of any company process, the action of "management of the process" that occurs in all organizations. This is the most commonly found understanding for the term BPM, contemplating the dominant vision of operations engineering, derived from the mechanistic process derived from the Industrial Revolution. The origins of the term management of the process are from the mid-eighteenth century, when the Industrial Revolution began, with the division of work into sequential activities aiming at process mechanization. A classic example of management of the process are the 18 operations to manufacture a pin described in Smith's (2007) famous book Wealth of Nations.

1.2 Its Origin: The Introduction of the Business Process in Organizations

During the twentieth century there was an administrative movement to seek the specialization of functional areas around their core competencies. This movement began with Taylor's Scientific Management concepts (1915), almost at the same time that Henry Ford revolutionized manufacturing processes, inaugurating his

continuous production line. The peak of functional departmentalization and specialization occurs with the total quality movement, introduced in the West from the 1980s. The search for excellence of the areas solved localized problems, not covering the structural issues of the organization. It was observed that performing several functions with excellence did not imply in the satisfaction of the final customer, because many of the problems were motivated by deficiencies in communication and in the interaction of work among the various functional areas of the company.

The difficulties of interaction between the company's areas received various denominations, such as "organizational gaps" or "nebulous areas". Research has shown that the main factors behind these organizational gaps were hyperspecialization, with the insertion of many functional areas and their subdivision into sub-areas. In addition to the very sectioned organizational structure, a proliferation of hierarchical levels among employees was also observed. In this myriad of levels lies the creation of hierarchical barriers, in which supervisors only speak with supervisors, managers with managers, and directors with their peers. Thus, the overlapping of hierarchical barriers with the barriers between functional areas, constituted an isolationist scenario and distancing between the areas and between the people of the organization, creating real empty spaces that hinder the flow of internal communication.

The search for effective solutions led companies to review their organizational structures, architecting and understanding them no longer exclusively from groupings of activities around their functional areas, but from the customer's perspective. The administrative focus has changed from the workflow of functional areas to the organization's business processes. We will explore the characteristics of the business process in subsection [1.3], but one of them is its orientation to the end customer. The business process is focused on those who enjoy and pay for the company's products or services, those who are the main justification for the company's existence. This perception of business process was consolidated with the Business Process Reengineering (BPR) movement that occurred during the 1990s. Although BPR events have been considered a failure from the managerial perspective, due to the high risk of radical change, one of the contributions of this movement was the introduction and dissemination of the business process concept. The Business Process concept brings with it a broader and more holistic view of work organization, similar to the vision of the general practitioner, of considering the whole within a perspective of added value to the final customer.

After the BPR movement of the 1990s, business processes started to be introduced in the organization through smaller and lower risk projects. These projects are usually called Business Process (Re)Design (BPR/D), encompassing the introduction of both: (a) new business processes (Business Process Design); and (b) restructuring of processes with a traditional and hierarchical structure into a business process perspective (Business Process Redesign). Examples of business processes introduced in the last decades in organizations include: customer relationship management (CRM), supplier relationship management (SRM), supply chain management (SCM), product life-cycle management (PLM), among others.

Actions such as BPR/D promoted a strong reduction in the time between business transactions. It also caused the reduction of organizational actors that added little value to the final customer and raised costs, bringing the company closer to its public customer, as well as to its partners and suppliers. This exposed the fragility of the business management models practiced until then, all endowed with strong direction and specialization of functional areas (functionalist vision).

Whether by marketing appeal, since it has become modern to talk about consulting services, software and other resources oriented to business processes, or by technical-managerial conviction, the truth is that many of the recent business practices implemented in organizations ended up implementing and directing companies by business processes. This diversity of entrepreneurial attitudes adopted by organizations has provided several results, being very common today to find hybrid organizational structures, part organized around functional areas and part organized around business processes. We will call these hybrid structures the function-process approach. These organizations end up operating with a matrix structure type organizational structure (Stanford, 2007), similar to the one practiced by project-oriented companies. Instead of having overlapping functional structures with structures for projects, the overlap occurs between functional structures with structures for business processes.

1.3 Its Central Entity: The Business Process

The concept of work division in activities and the perception of the result of this work by the end customer are the main characteristics of the business process definitions present in seminal works about M-B-BP. We present below some of these definitions developed by the main authors in the area of business processes. Hammer and Champy (1993, p. 38) defined business process as "a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer". Davenport (1993, p. 18) indicated that "a process is simply a structured, measured set of activities designed to produce a specified output for a particular customer or market". Harrington (1991, p. 9) described a business process as "any activity or group of activities that takes an input, adds value to it, and provides an output to an internal or external customer". Finally, Rummler and Brache (1990, p. 65) indicated that "a business process is a series of steps designed to produce a product or service. […] result in a product or service that is received by an organization's external customer".

In a more detailed and explanatory way, we describe below several characteristics associated with the business process pointed out by several researchers (Cao et al., 2013; Shafagatova & Van Looy, 2021; Smith et al., 2002):

- *customer-centric*: designed with a view to creating value for customers in a unique and differentiated manner, meeting their explicit and/or implicit needs;
- *intangible and abstract*: a business process is focused on what should be done (logical conception) and not on how it should be done (physical conception).

The how can be obtained from the analysis of other smaller elements, which will be structured from the understanding and vision of the business process. By smaller elements, we mean: processes, subprocesses and other decompositions until arriving at the task level, all ordered in time and space from the initial conception of the business process;

- *extensive and complex*: they involve great diversity and quantity of information flows between companies. Some examples of these flows would be those related to payments, authorizations, material movements, requests, receipt notifications, order and commitment hits between companies;
- *distributed and segmented*: they are executed within the limits of one or more companies, by means of several applications or information systems, operating on different technological platforms and with different configurations and specifications;
- *durable*: the execution of one of its occurrences (instance of the process) may take years or even decades to complete, for example, the financing of the house;
- *difficult to understand*: due to the diversity of actors and activities, complexity and dynamism of the environment in which they operate (constantly changing), as well as their abstract nature, business processes require much expertise in modeling and documentation (always updated);
- *rare and restricted*: just as the macro objectives of an organization are limited to a few, business processes are also limited to a few within an organization. If the business processes comprised are numerous (more than a few units) there is probably some conceptual problem, considering "process" as "business process";
- *relevant and strategic to the organization*: focused on meeting an objective of the organization directly linked to the interests of customers, i.e., they interfere directly in the performance of the organization as a whole;
- *dynamic and non-routine*: they require great agility to respond to the various demands of the business environment, such as new customer preferences or new positioning of competitors, political and legal changes, among other events that occur in open systems. The flexibility to meet and accommodate unforeseen and random (ad hoc) aspects of specific instances also stands out;
- *Automated*: in most of the activities of the business process, there is a lot of software of different size and nature being used to execute and control the activities. Remember that these business process activities are usually performed by many entities internal and external to the company, such as suppliers, customers, government agencies and other actors;
- *people-dependent*: people's judgment and intelligence are constantly required, due to the need to handle exceptions as well as not all activities being structured enough for full automation.

From this diversity of concepts and characteristics explored and discussed during the last decades, we can define the Business Process entity as being:

an extensive work in terms of activities, duration, and actors involved, conducted in a dynamic and complex environment, recognized as important for the organization due to the imperative of adding value to end customers.

In order to exemplify the concept, we will present the decomposition of the CRM business process (n) in terms of processes (n–1), as well as the subprocesses (n–2) for one of its processes. Srivastava et al. (1999) decomposed CRM into ten processes: (i) selecting and qualifying desired suppliers; (ii) establishing and managing inbound logistics; (iii) designing and managing internal logistics; (iv) establishing and managing outbound logistics; (v) designing work flow in product/solution assembly; (vi) running batch manufacturing; (vii) acquiring, installing, and maintaining process technology; (viii) order processing and fulfillment; (ix) managing multiple channels; (x) and managing customer services such as installation and maintenance to enable product use. As an example of subprocess, they presented the decomposition of process "(viii) order processing and fulfillment" into five subprocesses: "order taking, internal order transmission, order completion, order shipment, and payment completion" (Srivastava et al., 1999, p.169).

1.4 Its Foundation: The General Systems Theory

At the beginning of the twentieth century, the principles of scientific administration (Taylor, 1915) led to the hyper-specialization of work and to vertical organizational structures focused on specific functions. The BPR movement brought the concepts necessary to rethink the mechanistic version of scientific administration. As highlighted by Davidson (1997, p. 34): "Process engineering (or reengineering) starts as an updated version of Taylor's early twentieth-century scientific management, focusing on changing production and business processes instead of time and motion studies for physical tasks". In practice, instead of thinking fragmentedly in the excellence of each activity, we started thinking in the whole, in the business process. This is the application of one of the principles of the General Systems Theory (GST), which states that "the whole is greater than the sum of its parts" (von Bertalanffy, 1968). The manager who practices the M-B-BP approach starts to have a more holistic view and begins to organize and structure the company in a more organic and less mechanistic way.

The M-B-BP approach is also referred to as a systemic approach to managing organizations because it makes use of several GST canons. Thus, for a better understanding of the M-B-BP approach it is essential to master some GST concepts. This theory emerged in the mid-1920s, when the Hungarian biologist Ludwig von Bertalanffy studied the self-regulation of organic systems. These were understood as open systems, that is, interacting with the environment, incorporating beneficial changes, and neutralizing the harmful ones (principle of regenerative

self-regulation of systems). In this way, GST emerges as a criticism to the reductionist scientific approach that predominated at the time, which reduced entities (for example, an animal) to the individual study of their properties and their constituent parts or elements (organs or cells).

GST directs the researcher's analysis to the whole, that is, to the relationships between the parts that interconnect and interact organically and systematically. In Organizational Management it resulted in a new administrative approach: the systemic approach to organizational management. Conventional approaches derived from scientific administration did not consider the external side of the organization, worked with the specialization of internal issues in a watertight manner, simplified the companies' structures and, consequently, the management as a whole. These conventional approaches end up not helping the manager to understand and manage all the complexity associated with organizations.

From the application of GST concepts, organizations began to be managed considering the increasing complexity of the business environment. The limited and simplified view of the scientific school of management had been questioned since 1918. Researcher Mary Parker Follet insisted that managers should consider the company as a whole (holistic model), not just its individuals and groups (Graham, 1995). She drew attention to external factors, such as the environment, politics, the economic scenario, technological trends, among other factors that strongly interfere with the performance of organizations.

The systems approach to management is grounded in two of GST's main concepts: (a) interdependence of parts, and (b) complex treatment of complex reality. The concept of interdependence of parts refers to the composition of entities; the whole of an entity is composed of parts of others, and these are interdependent in relation to the whole. The complex treatment of complex reality is the statement of the great difficulty of modern society that requires specific techniques to deal with this type of thinking.

To exemplify the idea of interdependence between the parts of a whole, let us imagine the human eyeball system, its parts and the many interrelationships between them. In the retina there are two types of photosensitive cells: cones and rods. When excited by light energy, they stimulate adjacent nerve cells, generating a nerve impulse that propagates through the optic nerve. The eyelids are two folds of skin lined internally by a membrane called the conjunctiva. They serve to protect the eyes and spread over them the liquid we know as tears. Eyelashes or lashes keep dust and excess light from entering the eyes, and eyebrows keep sweat from the forehead from entering them. The lacrimal glands produce tears continuously. This liquid, spread by the movements of the eyelids, washes and lubricates the eye.

For business managers, the self-managed organization, a concept incorporated from the principle of regenerative self-regulation of GST, is configured as the ideal scenario. In this environment, the functioning becomes independent of the concrete substance of the elements that constitute it, because these can be replaced without damage to the whole, and the whole assumes the tasks of the part that failed. In other words, the complexity of the parts that compose a system must be known,

and this knowledge is fundamental for the definition and division of the parts. In this context, the main aspects to be considered when defining the parts of a system are: the continuity of the system operation and the ease of replacement of defective or problematic parts of the system.

Having exposed the importance of the systemic vision for the M-B-BP approach, we next explore other important GST concepts, such as: system, stimulus, data, and information.

System A system is a set of interconnected elements, whose transformation in one of its parts influences all the others. Originating from Greek, the term "system" means "to combine", "to adjust", "to form a whole". It can be said that there is a cause-effect relationship between the parts that make up a whole (system). Returning to the example of the eyeball, several parts can be identified: iris, cornea, lens, optic nerve, sclera, choroid, among others. One can imagine countless systems of different sizes, from the molecular system to the solar system. Examples of systems are: the hydraulic system of a vehicle, the financial system of a country, the transportation system of a city, the respiratory system of a human being, and the accounting system of an organization. Within an organization, there are several systems in operation: planning and production control, materials management, human resources management, financial management, among others.

Stimulus A system must respond to stimuli; in the example of the eyeball, the presence of light stimulates adjacent nerve cells in the eye. In the organizational environment, there are several sources of stimuli for information systems. GST recommends that for analysis and identification of such stimuli, the macro-environment should be considered, weighting as much as possible all the great complexity of the current systems. In the business environment, a stimulus is called a "business event". Some examples are: receipt of a purchase order, receipt of cash from a customer's payment into a checking account, and receipt of a customer complaint. Business events require actions on the part of the organization, and these, in their great majority, are perceived and handled through information systems.

Data One of the most common forms of perception of a stimulus in organizations is the arrival of data that characterize an event in the business environment. Imagine an electronic commerce (e-commerce) environment: the customer provides his data to the selling organization through one of the web pages that make up the virtual store. Thus, the event "purchase order" is characterized in the organization by the arrival of a set of data: customer name, credit card number, order date, requested product, product quantity, delivery address, among others. Conceptually, the term data is used to characterize the simple observation of a state, easily registered through attributes that characterize it. In the example above, it is a set of attributes of a "purchase order".

Information When you work, interpret and contextualize a set of data for a specific purpose, you generate information. In the example, the following information might

be generated from the total of accumulated sales order data: the total number of purchase orders received by the organization during the month, the total number of these carried out and how much each product line represents in the total number of orders for the period. It is interesting to note that information systems end up treating data by means of different actions: creating, altering, deleting or simply reading them. From the data analysis, one can generate the information that presents the greatest potential to add value to organizations. There are several categories of information systems and among these are those directed to the performance of business transactions and those focused on the analysis of operations, i.e., some types of information systems deal almost exclusively with data while others are exclusively focused on generating information.

1.5 Its Challenge: To Be an Alternative to the Functionalist Approach

In the post-World War II period, the evolution of consumer markets and the implementation of new production technologies led to growth and fierce competition among industrial organizations. During this period, large business conglomerates were formed, structured vertically and supported by broad functional divisions, which operated independently from one another. Verticalization, following the principles of Scientific Management, led to the proliferation of organizational structures in which specialization divided the work into functions. Multinational giants, such as the conglomerates of the large European food industries or the large automobile industries in the United States, are good examples of this business movement. The managers dedicated to these functional areas created vertical management pipelines, which culminated in the distancing between the functional areas of the company, as well as in the difficulty of perceiving the business objective common to all of them.

The large organizational structures were driven by a very high number of hierarchical levels, prevailing specialization and segmented work with an intense focus on the search for functional efficiency. This resulted in the difficulty of a broad view and understanding of the larger objectives of the business that should integrate the various organizational areas. This structure started to be questioned with more emphasis in the last decade of the twentieth century, with the search for better integration between the business transactions aiming at the reduction of time and distance between the companies and their interlocutors. B2B solutions helped reduce the distance between companies, B2C solutions brought companies closer to their consumer public, similarly B2E and B2G solutions facilitated company communication, respectively, with their employees and with governmental agencies. This movement exposed the weaknesses of business management models practiced until then, all endowed with strong direction and specialization around functional areas (functionalist vision).

The main characteristic observed in these functionally structured organizations is the breakdown of communication paths between departments and between areas through the creation of functional barriers that isolate multidisciplinary areas that should act jointly on the same processes. Added to this is the proliferation of hierarchical levels of management which, in turn, encourages the creation of hierarchical barriers, in which supervisors only talk to supervisors, managers to managers and directors to their peers. The superimposition of one matrix over another, i.e., the barriers associated with hierarchical levels with the barriers associated with functional areas, configures a process of isolation and obstruction of communication between the various areas and sub-areas of the organization.

The functional administrative approach is reductionist in terms of directing the managers of organizations toward their segments, toward individuals and activities that are grouped into functional areas. For this reason, the functional management approach is considered a typical example of the reductionist scientific approach. Throughout this book, only the term functional management will be used to characterize this administrative approach. It is important to note the inadequacy of functional management for the work model of contemporary organizations. The problem tends to get worse, considering that organizations are increasingly turning to labor-intensive organized work. In contrast to work organized sequentially or in the form of a pool, intensive work is characterized by the high complexity of activities, the dynamism of the work environment and the strong coupling between entities internal and external to the organization (Bell & Kozlowski, 2002).

In the 1990s, the systemic approach to organizational management came to be called M-B-BP, due to the new concepts incorporated into organizational studies by the BPR movement, especially the concept of business process. Thus, consider as synonymous the terms "systemic approach to management of organizations" and the M-B-BP. All these designations are found in the available literature and in classic works of administration. The term "systemic approach" is more frequently used in older academic texts, while in more recent texts the terms M-B-BP or BPM are used. For the reasons already pointed out in subsection [1.1] we will use in this book the term M-B-BP.

Questions for Reflection

(a) Search Google and scientific repositories (Jstor, ProQuest, EBSCO, Web of Science …) for the terms "management by process" and "management of the process". Which one is more frequently used? What is the reason for this?
(b) Name two dimensions of the organizational structure of traditional companies (structured and managed by functional areas) that hinder the process of organizational communication.
(c) Explain how the M-B-BP approach can assist in solving this communication problem.

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2 Discerning Between Functional Management and Business Process Management

Objective of This Chapter
At the end of this chapter the reader will be able to differentiate the Management by Business Process (M-B-BP) approach from the traditional and predominant approach to managing organizations, management grounded in functional areas.

2.1 Distinctive Characteristics Related to People

The people who collaborate with the organizations are the main resources of the organization to perform the work and, especially, to achieve their goals and objectives. The way companies organize people to perform the work directly affects the performance of workers. There is no single and standard structure that can be considered ideal. This is a contextual issue of the business environment of each company, to be considered by managers when the company is constituted. Of these contextual variables, as an example, Nembhard and Bentefouet (2014) highlighted five factors to be analyzed to ascertain the demand or not for multifunctional work: (a) ratio between generalist and specialist workers; (b) amount of activities to be performed multifunctionally; (c) level of heterogeneity of the workforce; (d) total number of employees available for selection; and (e) organization of tasks (parallel/serial). Molleman and Slomp (1999) identified three factors: (a) quantity of skills per employee; (b) redundancy distribution in terms of the quantity of employees per activity; and (c) efficiency distribution, understood as the employee's processing time for the activity.

To present and discuss the way workers are organized in the M-B-BP approach, we will compare it with companies organized into functional areas (functionalist view). We will discuss the differences based on five dimensions: people allocation,

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operational autonomy, performance assessment, chain of command, and empowerment of individuals. After the presentation and discussion of these five dimensions, already with a greater understanding of the organization of work in the M-B-BP approach, we will analyze in more detail one of the main characteristics of work in this approach: the multifunctional role of the worker. As a result, we will highlight with more information and property that the process-oriented company (process-centric) requires workers organized in a way that enables multifunctional work.

2.1.1 People Allocation

In the functionalist perspective, which characterized the work during the twentieth century, the professional had a career within his/her functional area. The professional would climb up the ladder as he or she had greater mastery and professional skill in his or her functions. A young person could enter the commercial area as a trainee salesperson and then progress and carry out his/her entire career within the same area, occupying positions such as: junior salesperson, full salesperson, senior salesperson, sales coordinator, sales manager, sales director, and vice-president of the commercial area. Thus, in the functionalist vision, a worker could progress in his career over time, but always with a link to only one functional area, he would never be linked to more than one area. The position held was quite specific in terms of characterizing a set of activities and skills quite delimited within that function. Thus, for the people management department everything was very simple, an employee is linked to only one functional area and occupies a clearly determined and very specific position.

In the M-B-BP approach, professionals are associated with business processes instead of functional areas. Work teams are formed by professionals with different profiles and skills, each one playing a different but complementary role and activity. Each professional can be allocated to one or more business processes, and their allocation time to each process is quite dynamic, negotiated by the worker with each of the managers responsible for the business processes. Another aspect to note is that the function performed in each of the business processes, although they have a common core, may have great variations in terms of the techniques and skills required. For example, a marketing professional may act in two business processes of the company, one directed to products and the other to services, which may require different techniques and methods. The variation is not only in dedication time, activities and techniques applied, but also in terms of scope and responsibility in relation to the process. In one process he may be responsible for marketing actions, in the other he may cooperate punctually as a specialized technician.

In short, in the functional organization, people are distributed by functional departments, together with their peers or similar in terms of professional expertise, with very well-defined roles. In the organization managed by processes, which adopt the M-B-BP approach, people are allocated in one or more teams focused on

business processes, composed of professionals with different profiles, training, and skills. Each professional performs different roles and activities that complement each other to carry out the workflow to serve each of the instances of the business process effectively.

2.1.2 Operational Autonomy

In the functional organization, all tasks are performed under strict hierarchical supervision, while in the M-B-BP approach great effort is made to strengthen individuality, delegating authority to employees to make decisions that are essential to the accomplishment of the work. Thus, the M-B-BP approach strengthens and values the employee's autonomy, a characteristic widely disseminated in the academic environment and spread in the Anglo-Saxon literature under the rubric of "empowerment". This is the opposite of the situation found in functionalist management, where command-and-control management, also known as "mechanical bureaucracy", predominates.

The evolution of communication technology, the advent of the internet, and the phenomenon of business globalization, which occurred at the end of the twentieth century, caused the reconfiguration of commercial transactions in the world, mainly due to the reduction of execution time of processes. Traditional companies with hierarchical organizational structures, structured and managed from functional areas, demand that the executors obtain authorization from the hierarchical levels of supervision to carry out their activities. This leads to extreme difficulty for these organizations to remain competitive in terms of reducing response time to customers. The M-B-BP approach is an answer in this sense, by changing the functional management—verticalized—for an administration directed to the final customer and with autonomy for the executors of the business processes. As a result, employees become more productive, better qualified and with lower operating costs. This new management vision shifts the power of decision from the traditional hierarchical levels (superiors) of supervision and control to the executors of the business processes.

In the M-B-BP approach not only the business process managers, but also their operators, become responsible for maintaining the productivity and quality of the process as a whole. Thus, in process management, not only "autonomy for", but also "responsibility for" is attributed in a differentiated way. Obviously, this implies a differentiated profile for the organization's staff, that is, it demands training employees to play multiple roles. Observe the situation described below, typical of a supermarket, and realize the diversity of training demands for its employees:

> Imagine a supermarket that has a business process focused on quality customer service. In this same supermarket, there are moments during the day of greater presence of customers in the store, with the risk of starting to form long lines at the checkouts to receive payment. Within the proposed M-B-BP approach, an employee with autonomy and trained to operate a checkout for payment, may stop performing the function he or she is performing at that

moment (for example, replenishing products in the gondola) to open another box for payment and help serve customers. This occurs as a result of the perception and initiative of the employee, without the need for orders and commands to do so.

It is observed that the contingent of professionals to be trained in the operation of a cashier to receive payments from customers ends up being much larger than in a conventional organization, where there is a group of professionals who perform exclusively the function of operating a cashier for receiving customer payments.

To explore and exemplify autonomy in the work environment, we will explore the work materials used by Hackman and Oldham (1976) to conduct their research. They discussed in their research the aspects that motivate workers and make work more enjoyable. They identified five dimensions of work that motivate workers: autonomy, feedback, identity, significance, and variety. Regarding autonomy to conduct work, they observed the following conditions in the field:

- Autonomy to judge and solve problems;
- Autonomy in the choice of procedures and activities to be performed;
- Autonomy for choosing the work schedule and programming;
- Autonomy to set working hours;
- Autonomy to set the pace at which the work will be carried out;
- Autonomy for choosing equipment and tools;
- Autonomy for choosing the working method;
- Autonomy for choosing criteria for evaluating the work;
- Autonomy to make the necessary decisions;
- Autonomy to define when to carry out personal activities;
- Autonomy to define the objectives of the work;
- Autonomy to define the scope of work;
- Autonomy to carry out the work independently of others;
- Autonomy to control the physical conditions of the work environment (lighting, temperature, etc.).

After half a century of research developed by Hackman and Oldham (1976), obviously there are other aspects that could be included, such as the autonomy to decide on the workplace (whether in the company or at home office). What is important to note here is how many aspects can be included or subtracted from the collaborator's decision making authority, as well as to observe that the more autonomy, the greater the employee's satisfaction and, consequently, the better the service to customers of the business process.

2.1.3 Performance Assessment

In the functional organization, people are evaluated by their functional performance, according to the objectives and goals of the functional area to which

they are linked. In organizations that adopt the M-B-BP approach, the evaluation of professionals is always linked to business processes. As business processes are focused on the end customers, the measurement of employee performance is always aligned with the perception and interests of the end customer. Here we have an important aspect for the proper design of jobs, those that motivate employees. The motivating factor is the significance of the task, characterized here by the perception of the impact on other people's lives and/or work (Hackman & Oldham, 1976). Note in the example below how employee evaluation aligned with the business process gives significance and meaning to the worker's role:

> Imagine an employee who performs the hygiene work in an Intensive Care Unit (ICU). This worker in the functional perspective would be linked to a cleaning and hygiene area and would be evaluated by the number of failures found by a supervisor. The indicator would be perceived as a mechanism to control work compliance. In the M-B-BP approach, this same worker will be evaluated by a broader and corporate level of abstraction, the business process, perceived and valued by the end customer. In this case, the indicator could be the rate of hospital infection per procedure performed in the ICU or the rate of deaths per procedure performed in the ICU. These are more important and sensitive indicators, both for the worker and the final customer of the business process: the patient or the patient's family. The professional in question starts to perceive himself no longer as a cleaning agent, but as an agent of hospital infection control, giving a nobler sense to his work. It is important to note that this indicator will be the same used for other professionals associated with the business process, such as physicians, instrumentalists, and nurses, i.e., it strengthens the team feeling based on common goals.

Since, at M-B-BP, workers are often involved in more than one business process, either constantly or occasionally, an interesting and complementary way to evaluate professionals is to listen to the network of workers. For this, it is recommended to periodically question the employees about who they helped in the organization during the last period, as well as the inverse process, asking about the people who helped them to perform their activities. The idea is to identify and value the collaborative work among professionals who work along the organization's business processes. The valid answers are the strong relationships, i.e., those bidirectional, in which both parties provide the same information: A informs that helped B, and B informs that was helped by A. The other unidirectional answers need further investigation.

In organizations with hybrid function-process approaches, the assessment is more complex and laborious, considering that the employee remains linked to a functional area at the same time that he or she works together with one or more business processes (Davenport, 1993). The central question in this situation is who evaluates the employee, the person responsible for the business process or the manager of the functional area?

Concluding the performance assessment topic, we have that in the functional view the focus is on the individual's functional performance. The functional area has several similar actors to be evaluated, performing a very similar set of activities, so it is easy to make a comparative analysis of performance among members of the functional team. Very often, a competitive dynamic is established almost

naturally among the individuals of the functional area. From the M-B-BP perspective, the various employees who are involved in the business process are assessed by the same indicator. This encourages collaborative work, considering that the success of one is equal to the success of all those involved in the business process.

2.1.4 Chain of Command

In the functional organization, all work and workers are organized and allocated functionally under the strong supervision of coordinators, managers, and other superimposed hierarchical levels, who command both the execution of the work and the development of the professionals involved. In the organization with the M-B-BP approach only the business process is managed by the process owners, who direct their attention exclusively to the constant addition of value to the product or service delivered by the process. The process manager or "process owner" is not the boss of the professionals that work in his process, he does not give orders or command the employees. The process managers negotiate and exert influence on the employees. Thus, the chain of command in a company that adopts M-B-BP is not based on command and control, but on negotiation and collaboration. The typical figure of the "boss" disappears in the organization managed by processes as highlighted by Hammer (1997, p.128):

> A "boss" is a creature of the pyramid: a single person who stands above you, telling you what to do and how to do it. In a process-centered environment the role disappears. More precisely, it is dispersed among many people, none of can accurately be called your boss.

From the point of view of work management, the focus of managers is changed from supervision and control of employees to training and motivation of these. The lack of a clear line of command for workers is pointed out by many authors and practitioners as one of the greatest difficulties for the insertion of professionals who have worked for a long time in organizations with a classic hierarchical structure, organized by functional areas, in organizations centered on processes that are organized and managed according to the premises of the M-B-BP approach.

The professional who works in organizations focused on processes needs to have good communication and insight into the work to be done to be able to negotiate with those responsible for business processes. In this negotiation aspects are discussed such as deadline and agenda to perform the work, resources needed for the work, definition of products and/or services to be delivered, among other aspects that are part of the internal negotiation. The absence of a superior brings greater freedom and rights to the worker, as well as greater demands in terms of competencies, both in terms of knowledge, skills, and attitudes expected of the professional.

2.1.5 Empowerment of Individuals

It is important to differentiate the empowerment topic from the autonomy topic for a better understanding of the theme addressed in this subsection. Autonomy is defined in terms of predefined themes where the one who delegates autonomy to the other understands that this other (employee, for example) is fully able to decide for the best option. "By definition, autonomy means the freedom to act on what one knows" (Kramer & Schmalenberg, 1993, p. 61). In short, it deals with authorizations for decisions limited to a set of themes with a set of predefined alternatives. The empowerment action, on the other hand, is broader and embraces unanticipated issues, unlike autonomy, which is specific about some issues. "Empowerment is feeling that one is enabled to act on that which you don't know that you know" (Kramer & Schmalenberg, 1993, p. 61). The central idea of empowerment is the delegation of decision making power on some issue, not as circumscribed as in autonomy, associated with the responsibility for decisions.

As an example of situations of employee empowerment in relation to their performance with the company's business processes we have:

- Decision power to change the workflow planned for the context of a given instance of the business process, due to unusual issues that occurred with that instance/customer. Obviously respecting the governance issues, including: the record of the justification, date, time, and history of the conditions of the variables of the processing of that instance when the decision is made;
- Decision making power to hire training, services or software that it deems necessary to overcome difficulties or exploit opportunities associated with the business process;
- Power to convene meeting with business process team to address unusual issues;
- Power to suspend the operation of the business process due to an imminent risk situation.

The M-B-BP approach, as well as the managers who adopt it, by delegating empowerment to employees working in the company, aim to build a work environment in which employees feel part of the business process. The feeling of empowerment increases employee engagement, constituting a healthier relationship between employee and company. The feeling of empowerment can be broken down into feelings of freedom, power, and authority, while the adjective healthy can be broken down into satisfaction, motivation, and involvement. Thus, the empowerment of employees generates greater speed in decision making associated with the business process, improving the performance of the process, while valuing and motivating the human capital of the company.

2.2 Distinctive Characteristics Related to Process

2.2.1 Organizational Structure

In the functionally organized company the structure is hierarchical, its departments work in isolation, directed to their own objectives. It is usually said that the organizational structure of these companies is conceived according to the concept of "functional silos", which execute and manage a set of very specific and specialized activities. In the organization managed by processes the hierarchy is reduced. In the latter, the levels that do not add value to the results are eliminated in favor of a vision focused on the value proposition. The focus is restricted to what adds value to the final customer of the product/service of each business process.

Ostroff (1999) comments that the organizational chart of a company is a visual representation of its structure, quite useful to demonstrate the functional departments, the hierarchical levels of command and the allocation of people. However, it conveys little concerning the business processes that sustain the organization as a whole and that permeate various functional departments of the organization. The M-B-BP approach, by prioritizing the business process, causes several changes in the organizational structure, such as: displacement of much of the decision making process, which, before, was in the hands of hierarchical superiors, for the "process owners" and operators; elimination of hierarchical and functional communication barriers of the organization; leaning of hierarchical levels of decision; reconfiguration of the skills required for process-oriented work; strengthening of external partnerships and outsourcing of non-core activities for the organization, among the most important. Drucker (2009, p. xx) strengthens this structure model when he argues that "Most large companies have cut the number of layers by fifty percent, […] Organizations will become fatter and fatter".

Returning to the supermarket example discussed in Sect. 2.1.2, we have that in M-B-BP employees are hired and made available based on the roles to be performed, and not by functional positions occupied. Thus, in M-B-BP the organization's employees are understood as nodes of a work network, and not as a resource belonging to a box in the organizational chart. The organization no longer operates through vertical functional structures, but rather through matrix structures and multifunctional teams focused on business processes.

2.2.2 Performance Measures

While in the functional organization the work is evaluated focusing on the performance of fragmented work of the functional areas, in the company managed by processes the performance of each process is valued. In the M-B-BP approach the business process performance indicators are like metrics for evaluating the final objectives of the process. They indicate the performance at the end of processes, informing whether the value proposition to the end customer is being met, i.e., they serve as a measure of customer satisfaction, employees and other stakeholders. To

ensure the ascertainment of correct performance indicators, that is, those that really make sense from the standpoint of the business process as a whole, Burlton (2001) suggests focusing on the collectivity of business process customers in the broadest sense of the word, encompassing the perception of all its stakeholders.

Common and visible objectives to all those involved in the process provide greater motivation and, consequently, better results are achieved, as highlighted by Hammer (1997, p. 159):

> In a task-centered organization "satisfactory performance" was all that could be expected from employees, and it was all that was truly needed. Fragmented processes so homogenized individual work that outstanding personal performance would inevitably be bleached out in the wash. The final result was only as good as the worst link in the chain that produced it. In such a context, making a strong effort was likely to be a waste. So why bother? It was far more important to avoid mistakes than to excel. This is not the case in process-centered organizations. High-performing process performers can produce a high-performance result. Adequacy no longer suffices. Excellence is required.

As the business process is constantly evolving due to its essence ("dynamic and non-routine", as characteristics described in Sect. 1.3), the recent history of the business process performance indicators serves as a parameter for performance evaluation of the new business process. Thus, the organization is able to compare the performance of the old process with the results obtained by the new process resulting from the restructuring project.

2.2.3 Nature of Work

In the functional organization the concepts of Taylor's "Scientific Administration", Fayol's "Classical Theory", Weber's "Bureaucracy" prevail, in which the maximum amount of work must be performed in the shortest amount of time, and the activities are strongly structured and specialized with their respective work groups. The work performed by professionals in functional organizations is repetitive and with a very restricted scope in terms of what is done by the employee. In organizations managed by processes, the nature of the work is quite diversified; a professional may perform several activities along the business process, both operational and managerial activities. As emphasized by Hammer (1997), people who work in process-oriented organizations cease to be employees and become professionals; they cease to have jobs and start managing their own careers.

The most striking feature of the nature of work in process-centered companies is the attractiveness and motivation generated in employees. The M-B-BP contemplates well all the five dimensions of the jobs that most motivate the workers. According to Hackman and Oldham (1976) there are five dimensions: autonomy, feedback, identity, meaningfulness, and variety. Below is a brief description of how the M-B-BP meets these five dimensions:

- Autonomy: as already highlighted in this chapter, professionals in M-B-BP have not only operational autonomy [2.1.2] but also empowerment [2.1.5]; fundamental conditions for employees to optimize the business process continuously;
- Feedback: as the indicator for evaluating the business process and the employees is the same, as observed in Sects. 2.1.3 and 2.2.2, structured from the perspective of what is sensitive and valued by the end customer, it becomes simpler and easier to provide feedback to all involved with the business process. The ears are the same, the final customers, as well as the central object of feedback too, those few things that are necessary to satisfy the customers and that are associated with the indicator variables. Thus, there is not a multitude of indicators for different audiences as occurs in the functional organization, broken down into several hierarchical levels and different areas. In short, feedback is much simpler and easier to be given to all employees;
- Identity: as the worker participates throughout many moments of the work for the fulfillment of the process instance, he/she perceives the business process as a whole, perceiving the delivery of value to the end customer. Workers engage and identify with the business process, that is, there is no work without clear purpose or identity;
- Significance: as the indicator is linked to something of value to the client, this is usually enough to give significance to the activities performed by workers. Customer feedback also helps to highlight the significance of the work performed;
- Variety: the demand for multifunctional work brings the necessary diversity to the worker.

2.2.4 Organization of Work

In the functional organization, each area is structured by departments that operate separately from the others; in the organization managed by processes, the work is organized by multifunctional business processes. In the functional organization there are work teams specialized in a specific group of activities, corresponding to the scope of the functional area. In the organization managed by processes the work is organized by business processes, in order to provide the necessary synergy and interaction between professionals of different skills and competencies required by business processes.

Most large organizations have implemented business processes overlapping the functional structure, however, emptying the role of these areas as executors of the final work. Functional areas now focus more on hiring and training professionals with certain skills. This trend was already perceived by Drucker (1988, p. 47) in the late eighties: “Traditional departments will serve as guardians of standards, as centers for training and the assignment of specialists; they won’t be where the work gets done”.

This hybrid function-process matrix structure, overlapping functional areas with business processes, brings an inconvenience to employees, a dual line of command. It is characterized by the combination of the authority of the functional area to which the professional is linked with the managers of the business processes with which the employee must negotiate his or her performance. Thus, the most typical characteristic of this matrix structure is to break with the concept of unity of command. The strength of this matrix structure is that it allows the grouping of specialists, which minimizes the number of them required while allowing sharing of specialized resources among the various business processes. This brings a more effective use of human resources, in a more integrative and responsive way.

2.2.5 Scale of Organizational Values

Researchers have worked on understanding which organizational values help in the successful implementation of the M-B-BP approach. Schmiedel et al. (2013, p. 301) identified four core values: customer orientation, excellence, responsibility, and teamwork. Customer orientation "refers to the proactive and responsive attitude toward the needs of process output recipients". Excellence "refers to the orientation toward continuous improvement and innovation to achieve superior process performance". Responsibility "refers to the commitment to process objectives and the accountability for process decisions". And teamwork "refers to the positive attitude towards cross-functional collaboration".

The seminal authors of M-B-BP had highlighted teamwork as the main difference in organizational values between functional organizations and process-oriented ones. They highlighted that in the functional organization the emphasis is on results achieved internally, in the context of the department itself, proliferating among the functional areas the feelings of competitiveness, mistrust, job insecurity, and friction. The organizations managed by processes, on the other hand, privilege the openness of communication, transparency in the work, the sense of collaboration and mutual charging among all those involved throughout the operation of the business process. This facilitates the development of participative work among those involved in the execution of the process work.

In B-M-BP, workers seek to behave within the expectations of the wider social group, those involved in the business process, internalizing the values and norms that, implicitly or explicitly, the group prescribes for them. Thus, it is established among them an expectation of responsibility regarding the execution of each of the instances of the process, covering information transparency, mutual cooperation, trust, and other important values for the work in collaborative networks.

2.3 Distinctive Characteristics Related to Technology

2.3.1 Utilization of Technology

In the functional organization, IT tools are represented by several large information systems focused on the performance of business transactions of specific functional areas. In the organization that practices the M-B-BP, business processes demand integration and interactivity between different areas internal and external to the company (Zhang et al., 2004, p. 149):

> Today businesses are interacting and collaborating more often in the context of a business value chain involving a variety of partners to deliver products and services. Business to business (B2B) connectivity, Enterprise Application Integration (EAI) and general business collaboration processes are becoming more critical in operating and managing efficient enterprises.

Thus, in process-oriented organizations, there is a strong demand for specific technological resources for integration between information systems, a software layer called Enterprise Application Integration (EAI), in order to allow intercommunication between the various information systems of the functional areas (legacy systems) according to the dynamics of the order required by the business processes.

The management, or "orchestration", of business processes is also performed by a specific software layer called Business Process Management System (BPMS). This layer constantly receives information through the EAI software layer, indicating the operation status of each instance of the business process, regardless of the institution and the computing platform in which processing is taking place. With the data of the instances in progress along the process, the BPMS system is capable of providing the business process manager a continuous update of the performance indicators, informing bottlenecks and critical path, exception occurrences, among other important information to the business process management. Thus, we have that, in the information technology architecture of companies that practice the M-B-BP two differentiating components: the EAI and the BPMS.

2.3.2 External Relationship

Externally, the functional organization aims at competition through constant pressure on customers and suppliers, while the organization managed by processes favors the collaborative process through business partnerships in which all have their sustainability ensured.

One of the greatest consequences of the globalization phenomenon was to consolidate respect for local culture and the environment as the most correct way to operate business in the world. This larger vision paved the way for business alliances, allowing organizations around the world to add knowledge and act

together in the international market. Drucker (2009, p. 121) reinforces this idea when he argues that:

> [...] however, alliances are becoming the dominant form of economic integration in the world economy. [...] As in structural and institutional trade, businesses make little distinction between domestic and foreign partners in their alliances. An alliance creates a systems relationship, a family relationship in which it does not matter that one partner speaks Japanese, another English, and the third German or Finnish. And while alliances increasingly generate both trade and investment, they are based on neither. They pool knowledge.

2.4 Consolidation of the Differential Characteristics Between the Two Approaches

Table 2.1 presents in its first column the twelve characteristics that we used to compare the two administrative approaches compared in this chapter, respectively, functional management and M-B-BP. This table can be understood as a model of interpretation, which consolidates the texts of this chapter. The reflections on the characteristics of the M-B-BP approach can be used to explain the broad complexity involved in the business processes of organizations. This should be considered to avoid simplistic and partial administrative initiatives in the way of implementing and managing business processes. The knowledge presented can be applied, for example, to the planning of initiatives for implementation of new business processes, for revision and improvement of existing ones, or for valuation and comparison of existing processes. In short, it is knowledge that contributes to the discernment of the complexity related to business processes.

2.5 Business Architecture According to the Management Approach

The concept of business function is quite old in business administration, its origins dating back to the 1920s, when Frederick Taylor studied the complexity of processes based on the systematic analysis of work procedures, introducing the concepts of efficiency, specialization, and process measurement. From these studies derived the administrative attitudes of measuring process performance and definishing perfis and skills required of executors, that is, the specialization of activities and professionals. Specialization led to the concentration of mastery of a specific technicality around a few professionals, and of these, in areas or departments of the companies, which were also specialized in the execution of certain business functionalities.

The specialization of the organization's professionals around certain competences, or rather in their work functions, helped to consolidate the organizational structure around functional areas in which specialists remained stationed. Most

Table 2.1 Main differences between functional management and M-B-BP

Feature	Functional management	M-B-BP
People allocation	grouped together with their peers in functional areas	process teams involving different profiles and skills
Operational autonomy	tasks carried out under close hierarchical supervision	strengthens individuality by giving authority for decision making
Performance assessment	focused on the functional performance of the individual	focused on business process results
Chain of command	strong supervision of overlapping hierarchical levels	based on negotiation and collaboration
Empowerment of individuals	aimed at adjusting the function to be performed	addressing the multiple competences of multifunctionality required
Organizational structure	hierarchical structure, departmentalization—vertical	based on process teams - horizontal
Performance measures	focus on the performance of fragmented work of the functional areas	integrated vision of the process in order to maintain a constant line of added value
Nature of work	repetitive and with a rather narrow/mechanistic scope	quite diverse, focused on evolutionary-adaptive knowledge
Organisation of work	in functional area procedures, more linear	through multifunctional, more systemic processes
Scale of organizational values	exclusive targets of areas generate distrust and competition among them	communication and transparency at work generating a climate of mutual collaboration
Utilisation of technology	information systems with focus on functional areas	integration and orchestration of information systems
External relationship	poorly targeted, greater focus on the internal sphere	strong encouragement through collaborative partnership processes

Source The Author

companies continue to be organized and managed according to the vision of business functions, operating with "functional silos". In order to have visibility of the corporate functions performed by the companies, it is enough to analyze their organizational charts. Most of the declared areas or "organizational boxes" represent a strong core of activities and specialized professionals around an object or entity of interest. Typical examples of functional areas in companies include: production, human resources, finance, materials, and sales.

In the last two decades of the twentieth century, new theories and administrative practices were continuously applied, such as reengineering, multifunctional

work teams, benchmarking, and performance indicators, among others. This movement brought into the Business Management area several concepts, techniques, and tools from other areas, mainly engineering, more specifically operational management practices. This movement was a response by organizations to new business demands imposed by globalization and strong competitiveness among organizations. One of the major results of this movement was the introduction of the concept of business processes as a way of structuring and managing companies.

Companies that structured their management and operation through business processes started to be labeled as "process-oriented" companies, differentiating themselves from those structured and managed from functional areas, called "based on functions". The vast majority of large traditional "process-oriented" organizations have not ceased to have their functional areas, although objectives, products and services, metrics, fluxo of activities, and other managerial aspects are definited and analyzed within the business process view. Few companies have managed to completely change their management style through business processes. Most corporations operate from a "process-function" structure, in which the structure of "functional silos" prevails, providing support for the operation of the various business processes.

There are important management situations which are best handled through the functional structure of specialization of work and professionals. Just to mention a few functional control situations, we have the technical upgrading of purchasing or sales professionals working in conjunction with the various business processes, the discussion of salary issues and specific benefits for these groups and the specific rules and procedures that should represent the standard and culture of the company with regard to its operations in purchasing and sales. All these aspects are easier to discuss, analyze, and manage when looking at the total number of work and people performing the function in question.

The way in which operational and managerial activities are organized defines the business architecture of the company. According to what has already been presented, we can discern at least three architecture proposals: structured based on functions or functional areas, based on business processes, or a mixture of these two, which we call function-process architecture. In the following sections the several business architectures will be discussed, in addition to the means employed by organizations to improve their current architectures or even the means to transform them into a new one.

2.5.1 Evolutionary History of Business Architectures

There is a profound evolutionary change that has been taking place in organizations and in the very managers who run the businesses. The most macro way to analyze these changes in management is through the study of business architecture itself. Periodically, the business world changes its paradigms and, consequently, the way of doing business. We can analyze the evolution of business architectures from

several angles: political power, economic power, social power, strategic resources, business structure, managerial control, infrastructure employed, among other ways.

The first business structure began with the emergence of industries during the English Industrial Revolution, which took place at the end of the nineteenth century. The initial business architecture of industries operated through integration between vertical areas: from the acquisition of raw materials to the production line, from this to distribution and then to the final customer. Ford is the universal example of this model, which was called vertical business architecture and was based on specialized divisions of massive manpower, with a rigid command structure, similar to the military models adopted in the First and Second World Wars. This type of architecture predominated until the late 1980s.

This architecture became specialized in the early twentieth century, during the 1920s and 1930s. Verticalized companies expanded greatly when the same activities were performed in different geographic areas. The same things were produced, but in larger quantities, and delivered to a larger customer base, usually through networks of stores (chain-store movement). This type of horizontal business architecture was well characterized by the Sears chain of stores, with its operation centered on a chain of stores, considered a milestone of horizontal integration. After World War II, in the Pax Americana era, North American industry showed strong growth. The business architecture was very simple and companies acted alone as a complete manufacturer, both in the local and foreign markets. The strategy to reduce costs was to conduct a price war among its suppliers, which generated a lack of capital for modernization and the inability to compete in the globalized economy.

In this same period, Japan had been developing and improving its industry with a business architecture structured from the vertical-horizontal concept called keiretsu. In the horizontal structure were the large manufacturing companies, also known as "mother companies", and in the vertical structure, the companies that provided services to one, and only one, of the large manufacturing companies. The large groups in the horizontal structure provided security and stability to the small and medium-sized companies in the vertical structure. Research shows that historically, the small Japanese suppliers in the vertical structure have more than a 90% chance of extending the contract with the large manufacturers, which encourages the long-term investment plan of these small companies in custom assets (investments associated with the relationship) and constant innovation in optimizing the production flow of goods or services. This has allowed large companies to share their costs with smaller companies. Keiretsu member companies collaborate in the production and development of products, delivering new products in much shorter time intervals than those achieved by North American and European verticalized companies that acted quite independently of their suppliers (Targowski & Carey, 2000).

In the 1980s, the business architecture structured on the concept of keiretsu, conceived from a vertical-horizontal structure, led Japan to the position of largest producer of manufactured goods, especially in the automobile industry, with excellent commercial results. The keiretsu is a secular relationship model of feudal

Japan and, for this reason, was naturally incorporated into the reality of the business world. In the second half of the 1980s, General Motors (GM) began an automation process with the aim of achieving the flexibility of the Japanese model, but the goals were not achieved. Later studies showed an emphasis on very concentrated investments in technology, with insufficient work on restructuring processes. In this sense, Venkatraman (1991) commented that the strategy of employing technology by organizations should exploit its capacity in generating new and effective business processes, rather than merely automating outdated business functions.

The success of the Japanese industry motivated a wave of study and analysis of the business architecture used by these companies, which helped North Americans and Europeans to analyze the business model practiced by them. These industries shifted from a verticalized and independent model to a networked and collaborative model. Using the concepts of keiretsu, a culture of cooperative alliance was developed among manufacturers, researchers, suppliers, and financiers. This business architecture model receives different denominations; most researchers and practitioners highlight the collaborative environment and networked processes in this new model; for this reason, we call it business architecture through collaborative processes. We present below some characteristics of this business architecture model:

- research and development through consortiums between peer companies to obtain technologies to be used in distinct products;
- financing from companies that coordinate the supply chain, enabling strategic suppliers and start-ups to work with promising technologies;
- competing engineering developed by partners operating through confident and organized alliances;
- distributed production in different continents using contracts with strategic and global suppliers.

The structuring of the business architecture by means of collaborative processes occurred in the 1990s, marked by the global economy and extremely computerized by the introduction of internet resources. The main characteristic of this post-industrial era is multinational companies that operate without considering borders or countries and compete with products and services through factors such as innovation, price, and time. This business architecture was shaped in order to meet the demands of cooperation and partnerships between peer companies, research centers, and suppliers where the main requirement is to operate through the use of few hierarchical levels, with a results-oriented communication chain of their work teams. The collaborative business processes are the main structure for operation and management of this new business architecture.

Regardless of the name given to this new moment in the world economy, be it "post-industrial era", "knowledge society", or other labels, the important thing is to recognize that current business imperatives are different. They demand a new

environment and a new attitude from companies, among which business architecture itself through collaborative processes. We present below some characteristics of this new business environment, as described by Targowski and Carey (2000):

- from a specific group of stakeholders, normally restricted to owners, to a larger group, comprising several shareholders and other stakeholders;
- local action, but with the aim of thinking and profiting globally;
- customers and not executives run the business;
- knowledge is a strategic resource, as important as the company's capital;
- cooperate to compete by using alliances and learning from others;
- lead time, innovation, quality and utility are requirements to satisfy the customer;
- results-based measurement culture is more effective than task-oriented objectives;
- one should not separate "doing" from "thinking";
- networked, rather than hierarchical, structures give flexibility to the business;
- teleinformatics and democracy have made geografia less restrictive from a business point of view;
- The integration of the automation islands forms an outstanding enterprise infrastructure.

2.5.2 Initiatives to Change Companies' Business Architectures

Changing the traditional functional structures of large organizations to business processes is not an easy activity. It imposes many risks and requires a lot of work and dedication from the organization. In the 1990s, BPR [1.2] projects were the natural path for companies willing to take the high risks and apply for a radical improvement of their performance. According to Hammer and Champy (1993) the BPR proposal is fundamentally the rethinking, the radical redesign of the company's set of business processes, as they aim to achieve significant improvements in contemporary performance indicators: cost, quality, service, and skill. In short, the BPR proposal is a rapid and radical change without being tied to current processes, i.e., it starts from a "blank sheet of paper" that gives total freedom to innovation.

Many researchers consider the movement to implement BPR, which occurred during the 1990s, a great failure, characterized by limited adoption and questionable results. It is not the objective of this paper to analyze the validity or otherwise of the BPR practice, but to describe its collaboration in the dissemination and implementation of concepts related to management by business processes. The BPR movement was one of the main forums for discussing and alerting managers of the importance of business process management. The new business environment required much more than functional areas with good performance. The concepts and other positive aspects of BPR stimulated the development of new proposals

that were less radical and more suitable for the implementation of business processes. Here we highlight the proposals of BPR/D [1.2] covering the gradual and continuous design or redesign of business processes.

The growing contingent of cross-functional business processes available in organizations today stems from several business actions, including:

- new companies designed and incorporated already within the concept and practices for the adoption of M-B-BP;
- occasional actions by companies to design or redesign their business processes using the BPR/D proposal;
- implementations of enterprise information system solutions that have sensitized the company to reorganize itself to take advantage of some of the best practices available in software algorithms;
- in addition to the execution of BPR projects, something that occurred very occasionally.

The totality of these initiatives eventually created a process-oriented culture and practice in modern organizations. After more than three decades of business process filosofia, the common sense of the moment is that role-based companies are obsolete, hierarchical, and resistant to change and growth. In contrast to these, process-oriented companies are seen as modern, strong, and business development-oriented. Contemporary executives' own understanding of business operation has profoundly changed. Instead of understanding business processes as a set of distinct units with well-defined boundaries, they now understand them as a grouping of interconnected fluxes of work and information that cross the structures of the organization and have as their final goal the customer at the end of the business process.

The coexistence and combination of business processes with functional areas, segmented and necessary for the execution of the various activities that make up the business processes, can create conflicts of interest in the organizational environment: horizontal processes pull employees in one direction, while the management structure of vertical areas pulls them in another. This challenge is referred to by researchers as "function-process conflict". Studies show that there is no simple solution to it, as BPR/D initiatives are useful for planning new business process structures. This leads to the initial situation of overlap between functional areas and business processes, possibly with different levels of function-process conflicts to be managed.

One path being used by companies to resolve, or even reduce, these conflicts is the implementation of the techniques, concepts, and culture associated with the M-B-BP approach. Business processes are implemented or redesigned through BPR/D initiatives, which will be operated and managed on a daily basis through the M-B-BP approach, the central theme of this book. Figure 2.1 describes these business actions in terms of changing your business architecture. Note that the actions that actually change the architecture are twofold: BPR, which proposes a broad change to all business functions through a project, and BPR/D, a one-time

action that may occur for one or more of the organization's business processes at different times. The M-B-BP approach, as we will see throughout the chapters, is a good means of both avoiding the tendency for the company to revert to its previous operating modes and for continuous improvement of business processes. The M-B-BP approach incorporates all the techniques and concepts of business process improvement (BPI) projects, as we will see in a later chapter, dedicated to the detailed description of its phases and activities.

In Fig. 2.1, we have fi made a point of citing BPI actions due to the frequent confusion surrounding the concepts of BPI and BPR. BPI initiatives alone do not ensure that the business process framework is embedded in the organization. BPI can be applied in any process structure, either by functional areas (process management) or in organizations centered on business processes. The history of BPI actions corresponds to continuous improvement programs in organizations; they are specializations of the total quality management (TQM) principles of the operation management area focused on business processes. BPI projects aim to make continuous and incremental improvements to the processes of functional areas or to existing business processes.

Another example of significant actions that take place in organizations and that assist in redirecting the functional structure toward business processes is implementation projects for corporate information systems. The implementation of many

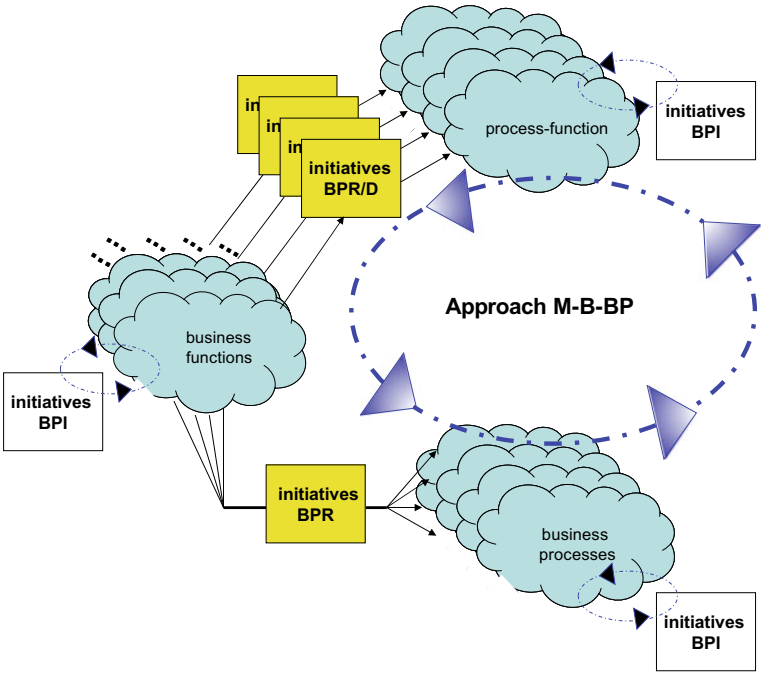

Fig. 2.1 Dynamics between process-oriented projects (*Source* The Author)

of these information systems may originate from or be motivated by BPD projects in a specific business area or object, but in many cases the opposite occurs: the company is seeking a better tool to support its operations. The process of acquiring and implementing corporate software based on comprehensive methodologies ends up questioning the company's own functional structure, directing it toward a proposal that is closer to business processes. These more comprehensive approaches involve work to discuss company processes, by understanding the current situation (as-is), comparing this reality with the best practices enabled by the future information system, for subsequent decision on the final configuration model of the system to be implemented (to-be). When well implemented, there is a work of organizational change that takes place in parallel with the work on information technology and discussion of processes, with the aim of ensuring that the post-implementation daily operation will not be reluctant to the new proposal, avoiding a return to the operating modules of the functional structure.

We can say that most implementations of the latest corporate information systems are also a means of incorporating concepts and practices of management by business processes. The corporate initiatives in the area of corporate software are many. Among them are:

- customer relationship management (CRM);
- supplier relationship management (SRM);
- employee relationship management (ERM);
- product life-cycle management (PLM);
- supply chain management (SCM);
- enterprise resource planning (ERP);
- e-procurement;
- e-sourcing.

Questions for Reflection

(a) From the analysis of the web sites of companies compare the organizational charts of companies notoriously centered on processes, highlighted even in their strategies, with hierarchical organizations centered on functional areas.
(b) Check in business texts, especially in the area of people management, as well as in scientific literature, the differentiation and emphasis given to the themes Autonomy and Empowerment of workers in process-centered organizations.
(c) Regarding BPR/D initiatives, characterize in which situations Business Process Redesign and Business Process Design actions apply.

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Management by Business Process Technical Vocabulary

3

Objective of This Chapter
By the end of this chapter the reader should have a good understanding of the main vocabularies and terms employed for the practice and study of the Management by Business Process (M-B-BP) approach.

3.1 Importance of the Common Dialect for Process Management

A business process demands the involvement of many professionals for its conception, operation, and management. A brief exploration of the themes involved and the professionals required can quickly identify a few dozen professionals. As examples of competencies, we can mention lawyers to discuss the legal issues associated with the process, information technology professionals to deal with the flow of data and information, marketing professionals to deal with messages and relationships, finance professionals to determine costs and pricing, among many others. In Chapter 8 we will detail the various roles, competencies, and professionals required to operationalize the M-B-BP approach. At this point, the aspect to be highlighted is the diversity of professionals involved, with different backgrounds and technical vocabularies.

Environments with different terminologies and jargon from different professionals provide a complex communication. In these environments it is common to find professionals using the same term or very close names (synonyms) for totally different entities (false synonyms). The opposite situation is also observed, the use of different names for the same entity. Thus, the demand for an organizational technical glossary for its processes and associated terminology is observed.

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A similar difficulty occurred in the data area with the rapid expansion of information technology resources (pervasive computing) during the 1990s. The role of Data Administrator was created to better manage the various databases of the organization. The attention to data normalization and their correct definition avoided the Tower of Babel effect. For the process environment there is the same demand, being the technical glossary of processes part of the necessary solution for an effective communication within the organizational environment.

In this chapter we will define the main entities that constitute the vocabulary of the M-B-BP approach. This information is relevant both to practitioners in the business environment and to academics, both exposed to a large contingent of texts on the subject. For readers of this book, the information will be useful even for understanding the next chapters. We will start by working on the decomposition of the term Business Process in terms of works performed, in its different levels of abstractions.

3.2 Levels of Abstraction of Work Performed by the Business Process

The term Business Process has already been explored and defined in the first chapter. We already know that they are few and important, because they are the means of delivering value from the company to customers. Although few, they cover and guide all the work performed by the company. This body of work can be analyzed from different perspectives, from macro to micro. In the highest perspective is the Business Process, in the micro is the Activity, and between these two entities there are several intermediate abstractions such as: process, subprocess, sub-subprocess, and other levels of decomposition required. We will start exploring the definitions by the smallest entity of the Business Process structure, the Activity.

3.2.1 Activity

An Activity corresponds to a logical unit of work performed within a process. Activities comprise the last level of a Business Process decomposition, that level where there is no need for further subdivision and which represents the smallest logical unit for the purposes of everyone's understanding and management of the operation. As examples we can consider an automobile company that assembles vehicles, the work "attach front glass" is an Activity that can be performed by a robot or by a worker. In a food industry, a cook follows a recipe (algorithm) to generate the product cake, contemplating several activities, one of them is "grease the form with oil". Analyzing the possibility to describe and further decompose the activity y of the recipe "y) grease the form with oil", it can be imagined in: "y.1) accessing vessel with oil"; "y.2) pouring oil over the form"; and "y.3) distributing oil evenly over the entire form". If this is judged by the current performers as too

obvious, common sense even for future workers to be hired, it means that there is no need to spend energy on further decomposition, understanding "oiling the mould" as an Activity.

It is important that we understand the concept of decomposition from general systems theory. The answer to the traditional question: "To what extent should we decompose a process?" lies in the context of the business itself. The process analyst needs to understand the culture and profile of the workers who performed that activity in that company, that is, understand the profile of the worker in terms of competencies. For that job position the people management area hires professionals with such profile. Thus, knowing the culture that prevails among the current employees and for the workers to be hired for that position, one can understand what makes or does not make sense to be detailed in the requirements specification of a business process.

Still regarding the Activities, they can be executed manually, automated, or semi-automated. By automation we mean the use of technologies, such as mechanical and digital that are implemented by means of machines, robots, and computers. As a synonym for activity we have several other terms in the literatures, such as "elementary process" or "task".

3.2.2 Subprocess

When performing the analysis and decomposition of a Business Process (n), we create different levels of detail. For the first level of breakdown of the Business Process we have the Processes (n−1), while for the last level we have the Activities (n−x, "*x*" being the amount of decompositions). Between Processes and Activities we can have different levels of decomposition: Subprocess (n−2), Sub-subprocess (n−3), and so on. It is important to note that there is no need to have the same level of detail for each of the Business Processes. Many call this myth of process analysts in wanting to level equally the various decompositions of the processes of "Santa Claus complex", i.e., wanting a decomposition diagram that constitutes a perfect triangle.

The number of levels of decomposition for each Process will be defined as a function of the complexity of each of the processes being modeled. In the example Business Process decomposition shown in Fig. 3.1 the "Sub-subprocess A2.3" is decomposed into three activities. The sister subprocesses of "Sub-subprocess A2.3", that is, the subroutines A2.1 and A2.3, need not necessarily be succeeded by Activities. For instance, for "Sub-subprocess A2.1" there can be a decomposition as: "Sub-subprocess A2.1.1", "Sub-subprocess A2.1.2", "Sub-subprocess A2.1.3", and "Sub-subprocess A2.1.4".

The most recurrent name for the diagram presented in Fig. 3.1 is "decomposition diagram". The software that proposes to be specialized tools in the automation of the M-B-BP approach makes the process decomposition diagram available with different features for visualization and analysis: open a decomposition diagram from a given process, i.e., see only its children on screen, without displaying the

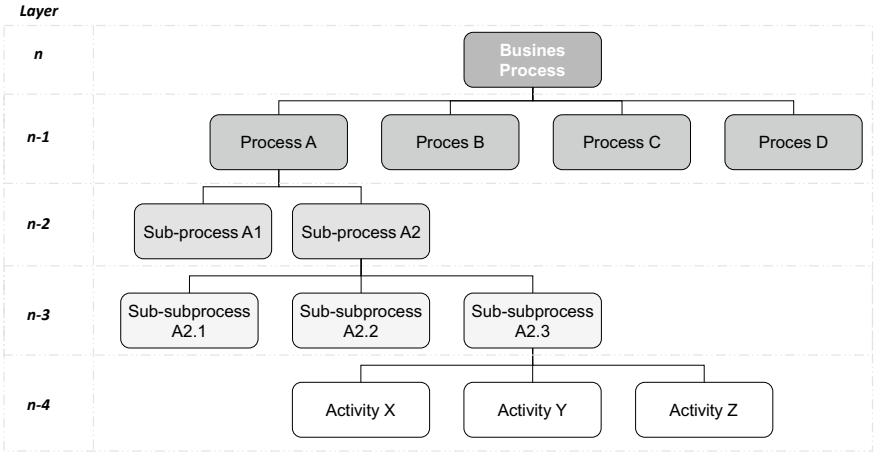

Fig. 3.1 Example Business Process decomposition diagram (*Source* The Author)

upper process layers or, still, do not display processes or activities that are below a certain level, i.e., a cut at the bottom of a given process. These resources are useful to focus the attention of the analyst or process modeler only on the aspects of interest for the moment.

3.3 Scope and Resource Lifecycle Management Associated with the Business Process

Professionals who work with business process management have different views of it according to the interest and purpose of the work to be developed. The forms of analysis can vary from the most comprehensive view of the business process to a more restricted view, limited to only a set of activities of a specific job. These variations of perspectives of the business process, keeping to a certain level of detail between the most general and the most specific, are called "*scope of the process analysis*". For example, let us consider the following decomposition for the business process "Customer Service" as described by Armistead et al. (1995):

- Customer Services (aims to respond effectively to customer needs as a broad, integrated business system)
  - Order Management process
  - Transport process
  - Sales process
    subprocess Customer Account Management
    subprocess Complaints Processing

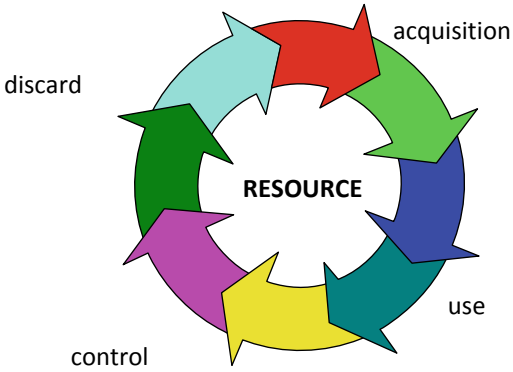

Fig. 3.2 Resource management cycle for process completeness analysis (*Source* The Author)

When we refer to the Customer Service business process, it implies that we want to address all processes subordinate to it, i.e., we talk about Order Management, Transportation, and Sales. If we refer to the Sales Process, we are only referring to the subprocesses "Customer Account Management" and "Complaints Processing".

Assembling a decomposition diagram for a business process is not always trivial; it will depend a lot on the knowledge that the group has of the process and on the capacity of abstraction and application of specific techniques for this purpose. A very useful technique is the "*management of the life cycle of the resource*" under analysis, the resource being the central entity, the one considered the reason for the existence of the process under analysis. The company's resources are many, such as employees, equipment, finances, intellectual capital, products, customers, among others. All these resources present a life cycle that requires processes of: acquisition, use, control, and disposal, as described in Fig. 3.2. As an example, let us imagine the resource "equipment", the company has several subprocesses and activities related to their acquisition, such as the specification of technical characteristics, the evaluation and selection of suppliers and the purchase. There are also several specific subprocesses for the use of equipment, such as planning, operation, and maintenance. There are also several processes focused on equipment control, such as consumption analysis, failure analysis, productivity, and costs. Finally, there is the disposal of equipment, which can occur through subprocesses such as depreciation, sales, and scrapping.

3.4 Products and Customers

Two concepts fully related to the business process are those of Business Process Product and Business Process Customer. They constitute the very essence of the M-B-BP approach, characterized in the very definition of Business Process that mentions the "imperative to add value to end customers" [1.3]. Value addition is understood as being the end result generated by the physical and/or intellectual effort of people, of work performed by machines and software, which in the

customer's perception incorporate value to the product or service delivered. This broad definition of product covers not only physical products, but also services.

The very conceptualization of a business process, describing it as a limited resource around a few units within the whole organization, characterizes it as a sum of several logical and intellectual works and productive activities. When referring to the products of a business process, it is understood that there are also services involved in this context.

The manager and the team directly related to the business process should be constantly attentive to the needs of process customers, providing for this a direct communication channel for collecting feedbacks, in addition to specifying and implementing performance indicators in levels of resource utilization, customer satisfaction levels, among other important metrics to the relationship with customers. These are some of the attitudes that allow you to keep your business processes customer-driven. The recent solutions for management by business processes studied in this book enable several facilities for monitoring and interaction of customers with business processes.

Customers increasingly assume an interesting and complex role in relation to business processes. Customers not only consume the products and services, but are increasingly interrelated and participatory, for example, acting directly in the definition and final specification of products and services generated by the business process. Thus, they are now considered not only consumers, but also part of the business process operation itself. An example of direct interaction of the customer with the product is the interaction of the customer in the selection of color, options included and other characteristics of the vehicle to be manufactured. In terms of services, we can imagine the customer defining payment options, delivery location or even characteristics that define the main activity of the service.

3.5 Instance of a Business Process

An instance represents a specific occurrence being processed or already processed (historical view) by a business process. For the Customer Service business process an instance can be any of the many customer requests served or being served by the business process. For each instance there is a large set of stored data: unique identifier of the instance, date and time of the entrance in the business process, date and time of each activity executed throughout the business process. From these basic data, several information can be generated, such as the current position of the instance inside the business process, forecast of time to finish processing, bottlenecks and critical path of the business process, among many others, generated from the registers of processed and in-process instances. Reading and analyzing data about the set of instances of a business process allows the manager to have a clear notion of the current and historical performance of the business process.

3.6 Resources Associated with the M-B-BP Approach

In addition to the most directly perceptible M-B-BP structure, such as the process, the subprocess, the activity, the product, the client, the instance in process, there are other equally important and less perceptible resources. Burlton (2001) highlighted the following resources: human resources, roles and responsibilities, organizational structure, policies and rules, information and communication technology, facilities and, concluding the list, the knowledge resource. All these items are highly relevant and are objects of discussion of a specific subsection or even a chapter in this book. Below is a brief description of each of these terms within the proposal of this chapter to work on the main technical vocabularies for the understanding of M-B-BP.

Human resources: Different professionals with different competencies collaborate with the operation and support for the various instances that are being processed by the business process. The M-B-BP approach involves reconciling the interests and moments of interaction and integration of these different professionals to obtain a good performance of people and business processes. Some of these human resources are totally dedicated to the operation and management of a business process, a situation well defined in the role of the business process manager and professionals from related areas with strong relation to the objective of the business process. An example is the sales person in the context of the Customer Service business process. Many of the human resources in organizations that adopt the M-B-BP approach are working on different business processes.

Roles and responsibilities: Business architecture grounded in business processes requires strengthening employees' autonomy to act and think, administratively labeled as employee empowerment. Business process management involves training employees to play multiple roles and empowering them to decide when to play each role. Let's imagine a supermarket that has a business process focused on customer service; at the peak of its movement, when lines begin to form at checkouts, employees from other sectors can go to the front of the store and open new checkouts in order to reduce customer service time.

Organizational structure: As observed in the supermarket example, employees should be hired and made available based on roles to be performed and not by functional positions held. In the M-B-BP approach, the organization's employees are understood as actors of a work network, and not as a resource belonging to a functional area of the organizational chart, as occurs in the traditional hierarchical approach. The organization no longer operates through vertical functional structures, but rather through matrix structures and multifunctional teams focused on business processes.

Policies and rules: They serve to direct the behavior and performance of human resources within the organization and in their interaction with business processes. Some procedures cannot be subject to interpretation or decision by each individual. The interpretation and positioning must be as simple and straightforward as possible, as in the following situations: regulatory requirements must be obeyed,

legal aspects must be respected, financial calculations must be correct and confidential information must not be shared. Precise control means must be established to follow up the compliance of the treatment of each instance of the process with the process obligations. These rules need to be addressed with absolute rigor and, for this reason, are best implemented using technological resources, especially those of information and communication technology. Obviously every policy and rule is subject to discussion, as we will observe in the phases of investigation and improvement of the business process, but in the daily operation of the business process the rules and policies must be strictly followed.

Information and communication technologies: Technologies play a fundamental role in extensive and complex business processes, especially information and communication technology. These are used to automate rules and activities, to monitor performance, and to create collaborative work environments. The computational infrastructure is essential for the communication of people and for the integration of the different information systems involved throughout the process.

Facilities: This topic includes several other resources, in addition to those already mentioned, necessary for operation and management of business processes: meeting rooms, work environments, machinery, equipment, and other necessary artifacts.

Knowledge: The daily operation of the various phases and activities of the business process, involving facilities, technologies, policies and rules, organizational structure, roles, responsibilities, and human resources, provides an accumulation of data about them. The organization that practices M-B-BP by collecting, storing, and treating such data in a contextualized way, generates information that from deeper reflections on them, can bring new content, that is, knowledge about the business process. Knowledge is one of the main resources that when generated and shared with the organization provides strategic opportunities for improvement or even transformation of the business process and its results.

3.7 Business Event and States that Characterize It

The workflow of a process describes the sequence of execution of several activities that compose it, indicating the possible activity or activities of execution after the conclusion of each one of its activities. The complexity increases as there are blocks of activities that are executed in parallel, which generates a dependency relation between the result obtained from these activities and the decision about the path to be followed for the continuation of the process workflow. The most used technique to meet this need of workflow routing in M-B-BP is the "workflow diagram". An example of such a diagram is shown in Fig. 3.3. It is interesting to note that there must be an understanding of the process trigger, that is, the possible business events that trigger the execution of a given process. In Fig. 3.3, the business event is characterized by the circle with the denomination "E1". If the conditions of the event "E1" are met, the activity A1 will be triggered, that is, its operation begins.

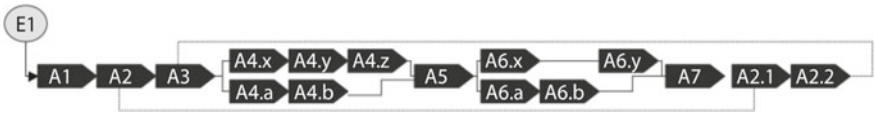

Fig. 3.3 Example of a workflow diagram (*Source* The Author)

The business event covers a wide range of occurrences that can trigger a business process. It can be, for instance, the reaching of the tenth working day of the month, which triggers the process "pay employees"; it can be the arrival of a quotation request through the internet, which triggers the process "answer the commercial proposal request" or, still, several other process triggering mechanisms. These types of events can be classified as:

- temporal: after reaching a predetermined period; for example, the tenth working day of the month;
- based on a specific action: when a defined and pre-established event occurs, such as the receipt of data that make up an RFQ for the sales area;
- rule-based: combines the occurrence of two or more events as described above in a logical operation.

In general, the business events to be handled by a business process are quite diverse. The study of these events is fundamental to understand all the dynamics and complexity of the business process. A good technique for the analysis of events of this type is the state transition diagram. The state is an abstraction of the conditions or moments of a certain entity related to the process. As for the concept of entity, at this point it is enough to understand that it is the logical abstraction of a physical or abstract resource related to the business process. To exemplify the state changes of an entity, we will analyze the state transitions for the entity "Billing". As seen in Fig. 3.4, there are five events that cause a change in the state of the entity Billing, two of them described in the figure itself. The first business event described in Fig. 3.4 is "E2". It shows the transition of state from "expected" to "overdue", motivated by a temporal event—"within 15 days after the expected payment date". This event not only changes the state of the "collection" entity, but also triggers the subprocess "notify overdue customers" of a workflow diagram (similar to Fig. 3.3). The second event described, "E4", is a time event—"within 365 days after the expected payment date".

The state transition diagram of the main entities involved with the process is a useful tool not only to help define and describe the business events that trigger the process workflows, but also to validate the completeness of the process decomposition diagram, that is, if we are considering all the activities required for the management of a business process from the perspective of its main entities.

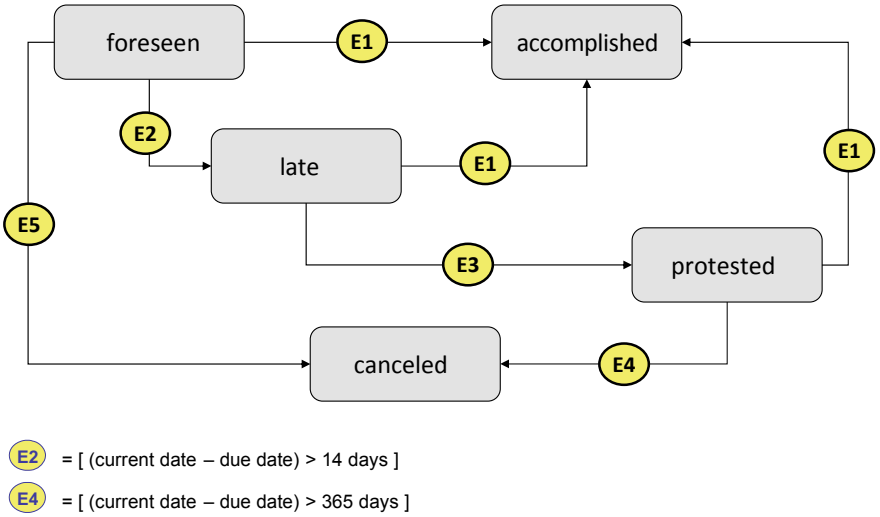

Fig. 3.4 State transition diagram for the "Charge" entity (*Source* The Author)

3.8 Data, Information, Knowledge, and Intellectual Capital

The several data manipulated during the operation of a process must be well described and documented. Many times they are used as parameters in the logical operations that compose decision rules for the routing of the process flow of activities. In the example of the state transition diagram, Fig. 3.4, we have the description of the rule that characterizes the occurrence of the temporal event "E2". Notice that the operation occurs between the parameter "current date", that is, the date of the operational system in which processing occurs, subtracted from the "due date", one of the attributes that describe the entity "collection". Attribute is any unit of information that helps to describe an entity; for example, the entity "customer" can be described by the attributes: name, address, telephone number, among others.

The most appropriate practice for the description of attributes is in the data modeling, as in the entity-relationship model techniques and the entity and attribute description sheets. As an example, we present in Table 3.1 the description sheet of the entity "collection".

The attribute *Code* is able to identify a collection and, therefore, there will not be two titles in collection with the same code; we say that this is an identifier attribute (ID) of the entity "Collection". As not all collections have a *Fine*, this attribute is marked as optional and may not have a value marked or may have, at most, a value linked to this attribute, represented by the text *<0,1>*, which can also be understood as *<minimum occurrence, maximum occurrence>* for a certain attribute. The detailed description of an attribute involves information such as:

Table 3.1 Example of a descriptive sheet for the entity Charging

Entity: *Collection*
Description: entity that describes the amounts receivable from our customers as a result of sales transactions that occurred
Attributes: <1,1> Code (ID) <1,1> Name of the transferor <1,1> Name of the drawee <1,1> Value <1,1> Expiration date <0,1> Fine <1,1> Percentage added per delay time <1,1> Delay time unit
Relationships with other entities: Charge (is canceled by) <0.1> Cancellation authorization Cancellation authorization (cancels payment of) <1,1> charge Charge (for the purchase of) <1,M> Product Product (billed by) <0,M> Collection

Source The Author

Table 3.2 Example of a descriptive sheet for the Delay Time Unit attribute

Attribute: *Unit of delay time*
Description: determines the period of time for which the Added Percentage for delay time will be applied
Format: alphanumeric
Size: four characters
Possible values: p.d. (to the day), p.m. (to the month), or p.y. (to the year)

Source The Author

description, format, size, and possible values to be assumed. As an example, we present below the description sheet for the attribute *Unit of delay time* (Table 3.2).

Knowing what to do with data, in terms of comparison, sum, and many other possible arithmetic and logical operations, allows us to generate *knowledge* related to the business process. The application of knowledge to the business process can occur deliberately in a structured way, through software algorithms, instruction manuals, or through other means that are able to assist or even deliberate a decision in the context of the business process. This type of structured knowledge is called explicit; its opposite, that which is not structured, which resides in the mind and in the practice of each professional involved with the process, is called tacit knowledge.

The M-B-BP approach involves considering with the sets of knowledge, whether tacit or explicit, also referred to as *intellectual capital* tied to the process. The verb "to consider" means to do knowledge management (*knowledge management*): create, capture, or buy knowledge; store it in the appropriate format and place; distribute or make it available to the relevant actors; use it and learn from its application; and develop it based on what was learned from monitoring its daily use.

3.9 Business Rule and Its Exceptions

Understanding the abstractions of events, states, entities, and attributes is fundamental for understanding one of the main concepts related to business processes, the *business rule*. This term is often used with different meanings. We can define it as the declaration of policies and practices that determine what is possible, desirable or even impossible in the business operation. The set of business rules should be understood as a whole, often they must be read together to determine the practice or policy to be applied to each specific case (Shao & Pound, 1999). Imagine an educational institution that has the following business rules: first rule, "Every student who has not enrolled for more than two years should be marked and treated as an inactive student"; second rule, "Every student with outstanding financial obligations, whether credit or debit, should remain active". Now consider the following situation for two students of this institution: (a) regarding the enrollment, both students have not enrolled for more than 24 months; (b) regarding the payments, one of them has paid all the fees and the other has a financial pendency with the institution, an unpaid monthly fee. Given the business rules of the institution described below, what procedure should be taken for each of the students? If we analyze only the first business rule in isolation, both students would be marked and treated as inactive students. Considering the interdependence of the two business rules, the operational treatment given must be different: the student with outstanding financial obligations remains active, while the other is marked as inactive.

Note that the events are stated in the texts of the two rules: "for more than two years" and "with financial pendency", both temporal events, the first explicit and the second implicit. The implicit is justified by a probable third rule: "Students who do not pay the monthly fee until the tenth day after the due date should be marked as debtors". The entities related to these business rules in the case under analysis are: student, enrollment and payment; the central attributes of these entities are: last enrollment date, student's academic status, student's financial status, and last payment date. The possible states are: "active" and "inactive" for the student's academic status, and "pending" and "unrestricted" for the student's financial status.

The implementation of a business rule can be done through documents used in the process operation or through technology, more specifically through the algorithms of the software used in the process. Implemented through technology or documents, the business rules represent desirable limitations in human behavior or information systems (software), allowing the organization to meet the requirements of legislation, norms of regulatory bodies or entities, company policies, and other procedures that the company has to respect and follow.

Business rules can be classified as restrictive, structural, and behavioral. The restrictive ones establish valid situations for a certain action to be executed, such as: "Only managers can give discounts" and "The student must have one, and only one, academic record". The behavioral rules are related to some dynamic aspect of the business: "When overdue payments are settled, change the student's status to inactive". The behavior highlighted in this case was "the occurrence of a

payment execution by the customer", establishing what should be done in response to this behavior perceived as an event of interest for the business. The structural rules define the main entities of the business: "The enrollment binds the student to the course" and "The tuition is obtained from the value for the standard credit multiplied by the number of credits in which the student is enrolled".

Business rules receive increasing attention from academics and practitioners. Ross (2003) is one of the experts on the subject, having highlighted ten basic principles for correct understanding and use of business rules:

- business rules should be explicitly written and published;
- business rules should be expressed in plain language;
- Business rules must exist independently of workflow and procedure;
- Business rules should be built on facts; facts should be built on concepts and represented by terms;
- business rules should guide or influence behavior in the desired path;
- business rules must be motivated by important and identifiable factors;
- business rules shall be accessible to authorised parties;
- business rules must have only one source;
- business rules should be specified directly by those who have relevant knowledge to do so;
- business rules must be managed.

Among the various contributions of Ross' work we highlight his direction in evidencing to IT professionals that business rules represent business logic, not programming logic or software. His research also contributes to the business area by saying that rules are not work flows and procedures, but their intelligence; it is the knowledge of rules that gives direction to flows. The main idea is in the management of a business rules bank, of easy access and interpretation, whose value increases as they are shared, integrated, and reused by a larger number of business processes of the organization.

During the operation of a business process, a situation may occur that is not predicted by the descriptions of its business rules. This situation characterizes what we call *exception to the rule*. With the dynamism of business environments, exceptions are increasingly present in day-to-day processes and organizations. There are surveys that show a high rate of utilization of important resources of the organization just for the treatment of exceptions. If there is no way to predict the occurrence of an exception, which characterizes its very essence, the business process managers should have mechanisms throughout the process that allows the identification and treatment of the emergence of these occurrences.

The M-B-BP approach recognizes the importance of exceptions and highlights them as one of the important objects to be identified, handled, and managed. The simple fact that an exception is something not foreseen does not mean that its occurrence does not need to be treated by the organization. In the current M-B-BP proposals, in the technical specification of logical decisions for routing the process workflow, there is always a situation or routing point foreseen when all foreseen alternatives are denied. It can be understood as an alternative that represents the following logic: "not satisfying any of the previous alternatives, do such and such

a thing". In terms of notation for the description of business processes, this feature is called exception event handling, which usually results in a notification to the process manager or a competent entity. The indication of the exception serves not only for that instance of the process not to be stopped and for someone to analyze what happened and give the necessary forwarding, but also for the knowledge management of the business rules, many times providing the inclusion of a new rule or the alteration of an existing one. These procedures help to maintain the set of rules of the business process always updated with the reality of the business environment.

3.10 Organizational Unit, Functional Area and Their Roles in Relation to the Processes

Another important abstraction to be considered in M-B-BP is the identification of the organizational areas involved and the role they play in each business process. As observed in [1.2] most organizations that adopt M-B-BP work with a hybrid organizational structure or function-process, part organized around functional areas and part organized around business processes. *Roles* portray the degree of involvement of the area with the activity, subprocess, or process that make up the business process. They can be represented in different levels of detail; a widespread typology that meets the various needs of M-B-BP comprises the roles of: execution, supervision, support, and management. The areas involved with the business process may be represented by different abstractions; for instance, the use of the concepts of organizational unit and functional areas. The *organizational unit* represents each of the areas of the organization explained in the organization chart, which can be a directorate, management, department, operational area, or advisory area. The *functional area* is a logical abstraction that aggregates sectors of the company based on the similarity of functions, independently of its classification in terms of the organizational chart. The functional area "stores" can consolidate the understanding of the various stores of a company. The same principle would apply to the functional unit "production", congregating all the production plants.

The association matrix is one of the techniques used to relate the roles played by the organizational units or functional areas in relation to the process and its activities. The matrix cells, formed by crossing areas or units with processes or activities, are used to describe the roles. In Fig. 3.5 there is an example of an association matrix that describes the relationship of some organizational units in relation to the subprocesses of a process. Note that the letter "E" represents the role of performer, the letter "A", the support activity, and the letter "G", the management activity.

3.11 Employees and Their Skills

In M-B-BP, employees and other collaborators that are involved in the business process participate in several activities throughout its execution and management. The functions performed by employees in companies structured by process-function and especially in those structured by business processes are increasingly

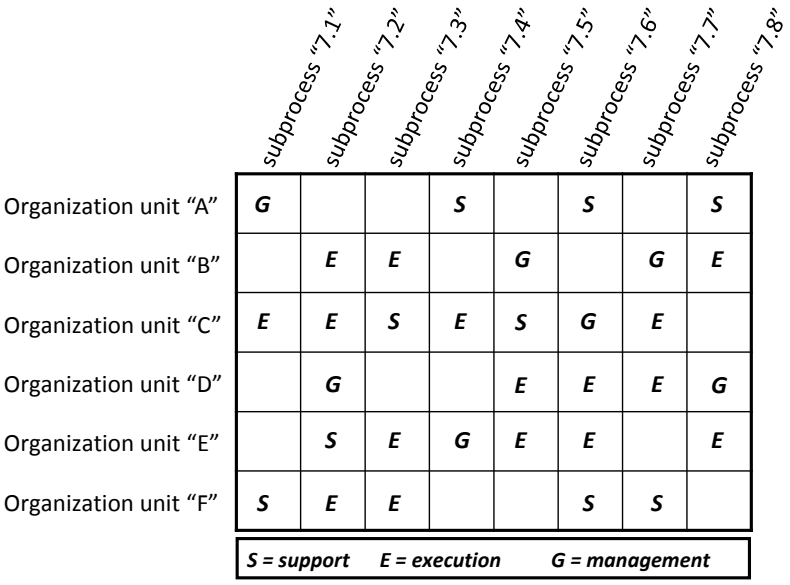

Fig. 3.5 Association matrix describing the "roles" of the organizational units in relation to the subprocesses of a process (*Source* The Author)

fluid and less stratified, with a strong tendency to be replaced by objectives. Thus, instead of working with jobs and their functional descriptions, the HR management of companies that adopt the M-B-BP approach works more with the description of their employees' competencies. The employees are professionals from the organization or third parties, involved in the execution and management of the process, while the competencies make up the set of knowledge, skills, and attitudes required of the employee in a given context. The M-B-BP involves the management of competencies, with emphasis on attitudes, considering the automation of the most simplistic roles and the direction of workers to the most complex aspects of the business process, with the treatment of exceptions.

3.12 Throughput, Lead Time, and Other Performance Indicators

In M-B-BP, the amount of transactions performed by the business process in a period of time is called throughput. In dictionaries we find a diversity of definitions for throughput, such as:

- the total quantity of something, such as data or raw material, that is processed in a given time period;
- point in the process at which inputs are converted into outputs;

- outputs generated by a production environment—for example, of a software—in a period of time;
- the rate at which the performance of a microprocessor is measured is expressed in instructions per second or jobs per hour or other unit of measurement.

Throughput is a concept widely used in several areas, such as computer science and production engineering. Both use it for the same purpose: to indicate the quantity of results or outputs generated over a period of time. Thus, when we say that the *throughput of* the sales process via internet is 17 transactions per hour, it means that the company is performing 17 sales transactions per hour. A concept that many people confuse with *throughput* is *lead time*; this represents the total average time required for the complete execution of a business transaction. When we say that the *lead time of* an Internet sales transaction is seven minutes, it means that on average seven minutes elapse between the beginning of the navigation on the company's *e-commerce site,* including the activities of searching and selecting products, entering personal data and other necessary confirmations, until the issuance of an electronic receipt delivered via the customer's electronic address (email). In dictionaries we find definitions for *lead time* as:

- the time between the start of a process or project and the appearance of its results;
- the time required to make something, measured from start to finish, such as the period between design and the start of production or the time between placing an order with a commercial enterprise and receiving that merchandise at the point of delivery.

Throughput and lead time are some of the important indicators for monitoring the performance of the business process. There are several other parameters that can be used in monitoring the performance of the business process that are generically called key performance indicators (KPI). Among the most used indicators to monitor the performance of business processes we have:

- economic and financial indicators (cost, revenue generated, profitability, return generated, etc.);
- productivity and quality indicators (*throughput*, *lead time*, errors and defects generated, time for reconfiguration of product or service, customer satisfaction, etc.);
- social and environmental indicators (professionals allocated to the process, categorizations of clients served, etc.);
- learning and knowledge (evolution of the ideas database, receipt and cataloging of suggestions, practical application of suggestions, etc.).

Each business process has its specificities in terms of critical points for its operation, these aspects are called *critical success factors* or CSF (critical *success factors*). Critical success factors can be understood as those few things that must

occur without failures or problems for the business process to be successful in its operation. For each critical success factor, we need to have one or more KPI associated. Thus, the CSF is a good way to identify the indicators for the business process.

3.13 Best Practices and Benchmarking

The business process is structured as of managerial and operational models that encompass techniques and work methods. Some of these models become reference due to the good results generated for a company or a set of companies that adopted them. These successful models for certain processes are labeled as best practices, serving in practice as a reference template to be followed by companies with similar processes and challenges. Another exercise, not of copying practices, but of comparison occurs in benchmarking. The benchmarking action occurs when we compare the values of the business process performance indicators (KPI) under our responsibility with similar ones from another organization that we aim to be equal or better. Thus, in benchmarking the values achieved by the KPIs of a certain organization become inspirational and parameters for our business process. *Benchmarking* can motivate innovation and provide renewed focus on areas that need improvement and a target of excellence to be pursued.

3.14 Process Losses

Quoting business processes that generate value-added products implies the delivery of benefits to their clients. The opposite situation obviously exists, that is, the existence of work that does not add value to customers, which we call waste or *losses* associated with the business process. The loss is a symptom of inefficient business processes that leads to increased cost and process time. Unfortunately, loss is present, even if momentarily (until its correction) in most workflows, considering the dynamism and complexity of the current work environment. Thus, combating business process losses is a constant activity of the M-B-BP approach, a continuous act of analyzing customer demands, considering the costs and benefits of the work performed in the business process context. Ohno (1988) identified the seven most common types of losses in manufacturing companies: (a) overproduction loss; (b) correction loss; (c) material movement loss; (d) processing loss; (e) inventory loss; (f) time loss; and (g) miscellaneous physical movement loss. To these losses, Prasad (1999) added one more: the loss concerning the movement of information, comprising format conversion, low quantity of information, retrieval and generation of files and unnecessary notifications, among other movements that might characterize informational loss. Although the study of losses developed by Ohno (1988) is focused on the context of the production environment, we can transpose it almost entirely to the reality of business processes.

Questions for Reflection

(a) What are the different terminologies used for representing the different levels of decomposition of a business process?
(b) What are the associations between the concepts Event, Activity, Subprocess, Process, Business Rule, mainly in terms of relationships of the type "composes" and "is composed by"?
(c) What can we say about the managerial attitude of an exception type, at a specific point in the business process, that has been repeated several times during the last six weeks?

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Ontologies and Techniques for Business Process Specification

4

Objective of This Chapter

At the end of this chapter the reader will understand what the logical structure for data storage is like concerning the logical representation of entities (objects), of the association between them, as well as of detailed description (properties) of these entities and their associations. This will help you to distinguish, for example, software with an effective (dynamic) capability in supporting the management and operationalization of the M-B-BP approach from software that is merely a static drawing generator.

An increasing set of techniques is available to model different characteristics of the business process within what is called requirements engineering. These specifications have become a means not only to assist in the logical discussion, but also to support the automatic generation of parts of the source codes (software) needed for implementation, operation, and management of business processes. Unlike the mockup used for the design of buildings and parts that serve basically for discussion and evaluation of what will be produced, in the M-B-BP approach the business process meta specifications are more long-term and useful. They become inputs for the development of algorithms for operation, management, and maintenance of the various workflows linked to the business process. This is one way to highlight the great importance attributed to the business process specifications in the context of the M-B-BP approach.

A specification comprises a set of concepts and rules of the business environment, which are associated among themselves to explain and explain all the complexity of the business process. When structuring an environment to support the M-B-BP approach, we have to define the set of techniques and concepts that we will use to specify the business processes, making clear the integrations between these techniques. Gassen et al. (2017) defined this demand as an ontological challenge to be faced by managers of organizations that adopt the M-B-BP approach.

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https://doi.org/10.1007/978-3-031-11637-7_4

To better understand this challenge, we begin by explaining the three types of entities associated with the logical representation, i.e., the meta specification, of the business process.

In the business process meta specification repository, the concepts associated to the several techniques (diagrams filled in by the process analysts) become Objects inside the repository. Objects associate themselves to other Objects, interacting and integrating among themselves to portray all the complexity of the business processes. As well as Objects, the Associations between them are also registered in the business process' meta specification repository. Both the entities of type Object and the entities of type Association can have several properties describing them, in this way we have a third type of entity to be registered in the repository of meta specification of the business process: the Property.

The techniques and conceptual representations that support M-B-BP challenges are many, linked to different activities and phases of the business process life cycle: strategic alignment, logical modeling, simulation, physical modeling, testing, among others. Considering that the algorithms and the technical expertises are quite different, we have to deal with different software and different software development companies for the composition of a suite of tools for the M-B-BP, which we generically call Business Process Management System/Software (BPMS). Hoang et al., (2013, p. 648) observed this challenge of software companies and managers of companies that adopt the M-B-BP approach highlighting the demand for integration of the various tools required:

> With the purpose of dealing with the problem of cross-enterprise collaboration, the business process management (BPM) research community has aimed to set up a linkage between business and information technology (IT) communities. However, the combination of BPM standards such as Business Process Modeling Notation (BPMN), XML Process Definition Language (XPDL) and Business Process Execution Language for Web Services (BPEL) has not been satisfied by the two communities while proceeding with the challenges of business-to-business integration (B2Bi).

BPMS projects are of corporate nature, their correct implementation eliminates problems of incoherent specifications. The hitherto sectioned view of the process, as occurs in the traditional approach to functional management of companies, implies in the analysis and monitoring of processes by means of different data repositories. The information systems area, for example, has specific tools, while the organization & methods area has others, as well as the quality area and many other groups in the company that study and analyze processes. There are many different tools and databases, which greatly hinders the company's ability to share data and generate a strong knowledge base about its processes. This environment of diffusion ends up generating a lot of incoherent information about the same process, logical inconsistencies, difficult to be analyzed and perceived, which are only revealed when inconsistencies and errors detected during the operation of the process occur.

Thus, a good understanding of what is business process ontology is fundamental to those involved with structuring and implementing the M-B-BP approach.

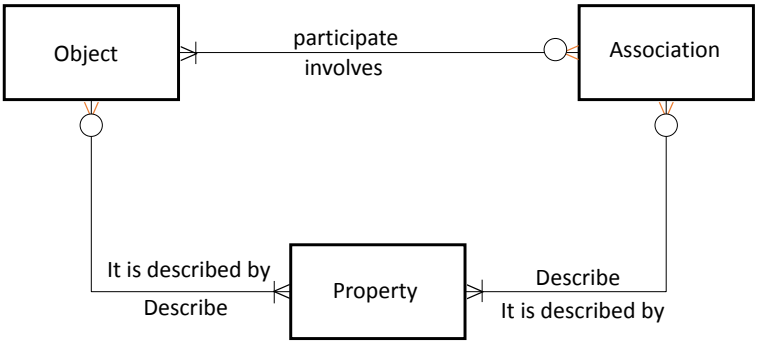

Fig. 4.1 Constituent entities of the meta specification of business processes (*Source* The Author)

In this chapter we will explore the structuring abstractions of ontology models for the BPMS suite, describing the core concepts of Object, Association [between Objects] and Property [both Object and Association]. The graphical representation of these concepts, in the form of an entity-relational model, is depicted in Fig. 4.1. After the discussion of these three central concepts, we will describe five techniques widely used in the specification of business processes, exemplifying and helping in the better understanding of the triad Object-Association-Property.

4.1 Objects

The objects contained in the data repository of a BPMS tool can be quite wide and diverse. The following are some examples of objects (concepts) associated with different M-B-BP demands. Strategic objects: mission, objective, critical success factor, problem, and premise. Corporate objects: organizational unit, site/location, and external entity. Human objects: competence-knowledge, competence-skill, competence-attitude, and role. Operational objects: process, activity, rule, and event. Informational objects: entity and attribute. Technological objects: information system, robot, and database.

4.2 Associations

Objects associate with each other, and most associations are created as the models are developed. Some examples of associations are described below. Associations between strategic objects: Mission object associated with different objects of the Goal type, describing the logic "these Goals help accomplish a certain Mission". Associations between corporate objects: object Organizational Unit associated with the object Site/location, describing the logic "Organizational Unit located in a certain Site/location". Associations between human objects: Competency-Skill object associated to the Role object, describing the logic "such Role requires the domain

of such Competency-Skill". Associations between operational objects: Process object associated to the Event object, describing the logic "this Process begins with the occurrence of this Event". Associations between informational objects: Attribute object associated with the Entity object, describing the logic "this Entity is described by such Attributes".

4.3 Properties

Both objects and associations have several properties that characterize them. These properties can be generic to all objects and associations, as is the case of the properties related to the governance of the specifications: (a) identification of the user that created the current object/association; (b) creation date; (c) creation time. Below are some examples of specific properties for different objects and associations:

- for the Process object, we have the properties: Frequency, Time, Cost;
- for the Objective object, we have the property: Importance (strategic, tactical, or operational);
- for the Entity object, we have the property: Type (strong, weak, or associative);
- for the association between the object Organizational Unit and the object Process, we have the property: Involvement Type (execution, supervision, or planning);
- for the association between the Process object and the Entity object, we have the property: Action Type (create, read, change, or delete).

The quality of the meta specification in terms of data structure for the registration of its Objects, Associations, and Properties implies directly in the ability of BPMS tools to assist in the management of the process life cycle, that is, to support the M-B-BP approach. Well-designed and compatible data structures between the different software that make up the BPMS suite allow for broad analysis, encompassing verification and complementation of quality between the different models and products generated for each step of the M-B-BP approach. As examples of products generated from compatible data structures for the business process we can mention:

- process Simulation algorithm providing information with more or less detail level, depending on the data contained in the process data model. For process activities, this model can contemplate attributes of allocated resources, such as resource quantity, estimated time, cost attributes for each resource, among other data, which directly influence in the simulation capacity;
- algorithm generation for the process automation tool (workflow) from the logical description contained in the several process description models. The logical process model differentiates a manual activity from an activity implemented by software, identifies human interaction points with the software, among other information that may be useful in the assembly of the initial workflow algorithm.

4.4 Contextualized Techniques for Understanding the Process

Although the first published study on processes dates back to the eighteenth century, when the economist Adam Smith described the steps for the production of a pin (Smith, 2007), the first graphical technique for process representation appeared only in the early twentieth century. In 1887, the American engineer Henry Laurence Gantt went to work at Midvale Steel as an assistant in the engineering department, where Frederick Taylor was the chief production engineer. In 1888, Gantt became a direct assistant to Taylor, who decades later would be considered the founder of the so-called Scientific Management. Gantt was also a practical inventor, and together with Taylor they registered six patents. Among his creations stands out the first graphical representation for work sequencing, developed in 1903, later called the "Gantt Chart".

After the Gantt Chart the next graphical method associated with process analysis appeared in 1921. In that year, Frank B. Gilbreth presented the "Process Chart" in an article published in the journal of the American Society of Mechanical Engineers. Gilbreth entered the construction industry as a bricklayer and studied the physical movements associated with the arrangement of each brick in the construction of a building. Frank developed the multilevel scaffolding to keep bricks close to the mason and increase productivity. He patented his invention as Vertical Scaffolding and created useful innovations in construction. By studying and documenting the movements associated with physical labor, he discovered that it would be possible to reduce the number of movements required to accomplish a specific task. This allowed him to effectively reduce the number of physical movements associated with the task and thus improve the process flow, reducing time consumption and increasing productivity (Von Rossing et al., 2014).

After the first quarter of the twentieth century, the techniques of process analysis based on graphical representations began to develop much more rapidly. Today we have a great diversity of graphical methods directed to different aspects of the process. In the subsections following this one, we will describe some graphical methods directed to processes and their respective central aspects.

As the number of methods grew, addressing the different objects associated with the process, new approaches emerged associating and integrating the objects of these different methods. In 1976 the US Air Force developed a comprehensive approach to specifying and designing processes that was called Integrated Computer-Aided Manufacturing (ICAM). The ICAM program initiated the development of a series of standards aimed at process modeling and analysis. The ICAM specifications were directed to the manufacturing process, but its techniques were also used for software development. This process of applying ICAM techniques with the insertion of others specific to the software development context ended up generating, in 1999, a second major approach: the Integrated Definitions (IDEF). The IDEF method comprises a set of computer languages associated with the modeling of information systems, aimed at software engineering. It also includes techniques for functional modeling, data modeling, simulation, analysis,

and object-oriented design. There are 15 modeling techniques currently present in the IDEF approach, called from IDEF0 to IDEF14.

In this same period of development and structuring of the IDEF, an equally similar and comprehensive approach appeared, aimed specifically at the software environment: the Unified Modeling Language (UML), presented in 1995. UML has its structure and origin in the concept of object classes originated from data modeling methods, especially in the Model-Entity-Relationship (M-E-R) technique. The entities of M-E-R are understood as objects, the generalization and specialization structures (gen-espec) of M-E-R are called object classes. An important aspect of UML is its ability to integrate in a same technique, i.e., in the same diagram, aspects of the data modeling and aspects of the process modeling.

Of the major approaches for process specification, the latest and most recent is the Business Process Model and Notation (BPMN), also called by some authors as Business Process Management Notation. The approach originated in 2005, when the institutions and activities developed by the organizations Business Process Management Initiative (BPMI.org) and Object Management Group (OMG) merged. The BPMN approach also presents a large set of graphic techniques for process modeling that act directly or indirectly in all the process life cycle: planning, analysis and design, simulation, operation, monitoring and improvement. The main technique for process analysis within the proposed by BPMN is the Business Process Diagram, to be discussed in the next subsection.

There is a consensus that for work focused on software development, with more emphasis on the work performed by information technology professionals, the UML method is the most appropriate. On the other hand, for process management, structuring and operation activities, as occurs with the M-B-BP approach, the BPMN is more pertinent. BPMN is based on a process-centric methodology that is more natural and intuitive for process analysts and business analysts to use. The specification work begins with the analysis of the process control and message flows. This information is part of the daily operation and management of the business processes and their users, a situation opposed to other notations employed, such as UML, which is object-oriented. The UML approach starts by the discovery of objects through diagrams of the static structure to later employ diagrams for the discovery of behaviors of these objects. Objects are not part of the usual repertoire, vocabulary, and working method of business people, which restricts the application of UML to the audience of IT specialists.

With the development of many softwares to support the management and operation of processes, such as the BPMS, it has become clearer the importance not only of the graphical display on some aspect of the process, but also to take care of ontological and semantic issues associated with data structures that store the information to assemble the graphics. As it happened with several large software platforms (suites), as in the area of project engineering, with Computer-Aided Design (CAD); in the area of operations engineering, with Computer-Aided Manufacturing (CAM); in the area of software engineering, with Computer-Aided Software Engineering (CASE); a similar movement is observed in the area of processes. BPMS suites value the initiatives for structuring protocols that allow

rational treatment of semantic and ontological issues behind the various diagrams, figures, tables, and displays. The focus is not on the graphical representation of the process in a static way, but on the integrated and dynamic representation of its components during its entire life cycle. The diagrams and their metadata are used in an integrated way to plan, design, operate, control, and improve the business processes of organizations.

For practitioners, academics, and researchers in the area of Administration, the graphic methods associated with processes are fundamental. Its contribution is recognized and valued, even in its most traditional and simplistic version, of static and watertight graph. For the business environment, the techniques of process analysis based on graphics allow the optimization of work, as in the pioneering works of Gilbreth and Gantt. It is possible to discuss and integrate the objects of the process modeling and the properties of these objects in the different moments of the life cycle of the process. Its use and support can occur since the very conception of the business, when developing the Business Model. The methods for generation of Business Models and their ontological models, called Business Model Ontology (BMO), share with the techniques for process analysis a significant set of objects, relationships between these objects, as well as properties for these objects and for their relationships (Osterwalder, 2004).

4.4.1 Business Process Diagram

The most widespread diagram for modeling processes according to the BPMN standards is the Business Process Diagram (BPD). We present in Fig. 4.2 a BPD prepared to discuss the proposition of an artifact in the form of a warning system (WS) to help public managers to perform the analysis process and issuing of opinions. It is not the objective of this book to address in an exhaustive and complete way the process specifications using BPMN, considering the great diversity of books already available on process modeling. The reference material of the BPMN developer itself is public and quite complete for those who want more information (Object Management Group, 2011). Our intention is that the reader has understanding of the BPMN techniques commonly used to specify processes, in order to serve as support for further discussions on the M-B-BP approach developed throughout this book. In this sense, we highlight in the following paragraphs the basic elements that constitute the BPMN specification, they are: participant, activity, flow, event, and connector.

Participant The entities participating in a business process are portrayed in the BPD by means of a large rectangle or a frame (rectangle with right side open) with the name of the participant written on the left side of the rectangle/frame. The semantic value of each participant is defined by the analyst or modeler of the process and can represent the internal areas of the company (finance, controlling, and accounting), the internal role of its executors (director, manager, and operational), or a technological resource (web services, web application, or information system).

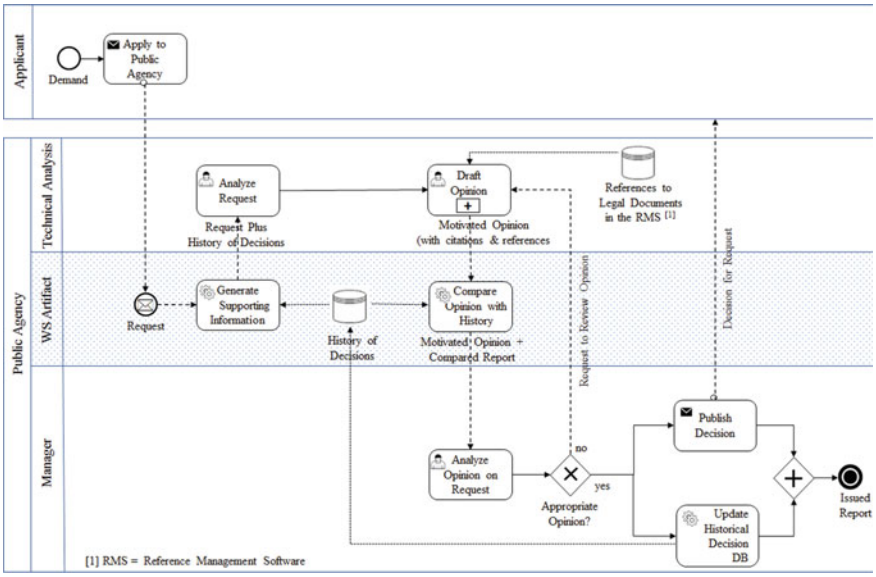

Fig. 4.2 Process of analyzing and issuing opinions aided by the WS artifact (*Source* De Sordi et al., [2021, p. 5])

In Fig. 4.2 we have two participant entities depicted: the Applicant (actor) and the Public Agency (company). For the Public Agency entity there is a breakdown of three specific entities: Manager (actor), WS Artifact (technological resource), and Technical Analysis (company area).

Activity The graphic representation of the process or activity in BPMN is given by means of a rectangle with rounded edges. The BPMN notation allows to decompose a process into several levels, each level constituting a new BPD to better explain and describe the process or subprocess of the level immediately above. In BPD notation we know if a process or subprocess is decomposed by the presence of the plus sign (+) just below its title. In the example of Fig. 4.2, the rectangle with the text "Draft Opinion" is the only one to present this sign, that is, when we select (click) this icon a new BPD will be opened. Thus, the icon "Draft Opinion" is not an activity, but a subprocess, considering that there is one more level of detail below it. All the other seven rectangles in Fig. 4.2 are not decomposable, i.e., they are activities.

The subprocesses and activities can be classified as to their operational type, observing the icon in the upper left corner of the activity icon. The types most commonly used in the specifications are: manual, represented by the person icon; automated (robot/software executor), represented by the gear icon; and sending/receiving information, represented by the letter icon. In Fig. 4.2 we have three automated activities, two of sending/receiving information, and three manual.

Flow In today's business environment, there is an ever-increasing flow of information exchange between entities cooperating in collaborative environments. To represent this communication between companies, BPMN uses the concept of Message Flow. To represent the Message Flow BPMN uses an icon composed of a dashed line, with a unidirectional arrow pointing to the recipient. Another equally important flow is the Sequence Flow that indicates the order of execution of the workflow, i.e., the order that the activities/subprocesses are executed. The sequence flow icon is similar to the message flow, only changing the style of the line, which is continuous. In the example of Fig. 4.2 we have a set of flows, some message flows and others of sequencing. The internal flow declared in the frame of the Technical Analysis participant, between the activity "Analyse Request" and the subprocess "Draft Opinion", is continuous, i.e., it is a sequential flow. In this case the executor himself is the same, in the first moment thinking and analyzing the applicant's request and in the second moment writing his opinion regarding what was requested. Finally, the last flow provided by BPMN is the Association Flow, used to link comments and information to the graphic elements of the process diagram. For example, imagine an analysis activity that is governed by a standard or even a law; we can use the association flow to connect this activity to the icon of a database or even a report with the name of the law. The association flow icon is a dotted line, without arrows, as it is only an association.

Event An event can be anything relevant that happens during the operation of a business process. Events affect the operational flow of the process and indicate causes (triggers) that are important to be considered and dealt with by the process. In BPMN notation, business events are categorized and graphically differentiated into three groups: those that can initiate a process, represented by a circle with thin border; those that can conclude the process, represented by a circle with thicker border; and the intermediate events, characterized by a circle with double dash. In the example of BPD described in Fig. 4.2 there are three events, being two initiators and one terminal.

As described in Table 4.1, the initiating events of a process may be message, time, and rule events. The terminal events of the process terminate it, indicating the last action to be performed: such as sending a message, canceling a transaction (which indicates the occurrence of an error/exception), requesting a compensatory action, or canceling some actions already performed by the process. Intermediate events are categorized as message, time, rule, exception handling, cancellation request, or compensation. There are several other representations of events in the BPMN specification described in the technical specification document of the Object Management Group (2011). This diversity of events gives a good understanding of the wide range of situations to be specified and handled in current collaborative work environments, demanding business process specifications capable of portraying all the complexity of these environments.

Table 4.1 Notation of the types of events considered in BPMN

Event	Description	Icon
Time-based initiator	A specific date or time is reached, starting the process	
Message-based initiator	A message arrives from one of the process participants, starting the process	
Rule-based initiator	A logical condition for a rule makes- if true, which requires the process to be triggered	
Intermediate based on time	A period of time can be ticked to trigger an event. It is used at the main process level as a mechanism for handling delays	
Message-based intermediate	The arrival of a message from one of the process participants triggers the event, causing the process to follow its normal flow if it is waiting for this message; otherwise, the flow will be forwarded to exception handling	
Rule-based intermediate	This type of event is triggered when a rule becomes- true. When placed throughout the process, that is, at the intermediate level, it is only justified for exception handling	
Intermediate based on compensation	Used to trigger compensating operations that undo jobs already executed, either due to failure or cancellation request during process operation	
Intermediate based on exception	It is used to handle exception occurrences	
Intermediate based on cancellation	Used to respond to a transaction cancellation request	
Termination	All process activities for that instance are terminated	
Message-based termination	This termination type indicates that a message is sent to one of the participants at the conclusion of the process	

(continued)

Table 4.1 (continued)

Event	Description	Icon
Termination based on cancellation	This termination type indicates that a business transaction must be canceled. Used in the subprocess specification to indicate the triggering of the transaction termination event at the next higher level	
Termination on a netting basis	This termination type indicates that a compensating action is required that will be initiated by an intermediate event in another process instruction ara>	

Source The Author

Connector Connectors are modeling elements that represent the logical control of the interaction of business process work execution flows and indicate the possibilities and reasons why these flows converge or diverge during operation. If a process flow does not need to be controlled, there is no need for connectors; otherwise, connector must be used. The assumption of connector is that there is a mechanism that enables or disables the execution flow to pass through one or more output flows. The most common situations that occur with the use of connectors for the operation of business processes are represented in Fig. 4.3 and described below:

- convergence of two or more parallel streams entering the connector, generating only one output stream, where the connector controls the requirement of the true situation for all its input streams in order to trigger the single output. This logic representation is called AND-join or "synchronization" because it triggers the output only when all inputs are true;
- convergence of two or more parallel flows entering the connector, generating only one output flow, where the connector controls the requirement of the true situation for at least one of the input flows in order to trigger the single output. This logical representation is called OR-join; these connectors authorize the sequence of the process from the occurrence of a true event independently of the others;
- divergence of the flow entering the connector into two or more paths, which are then executed concurrently, that is, they establish a parallel operation. This logical representation is referred to as AND-split;
- divergence of the flow entering the connector on two or more paths, so that one or more of the output flows can be considered true and therefore activated. This logic representation is referred to as OR;
- divergence of the flow entering the connector into two or more paths, so that only one is activated by the connector according to a conditional expression defined in the connector itself. This logical representation is called XOR or "exclusive

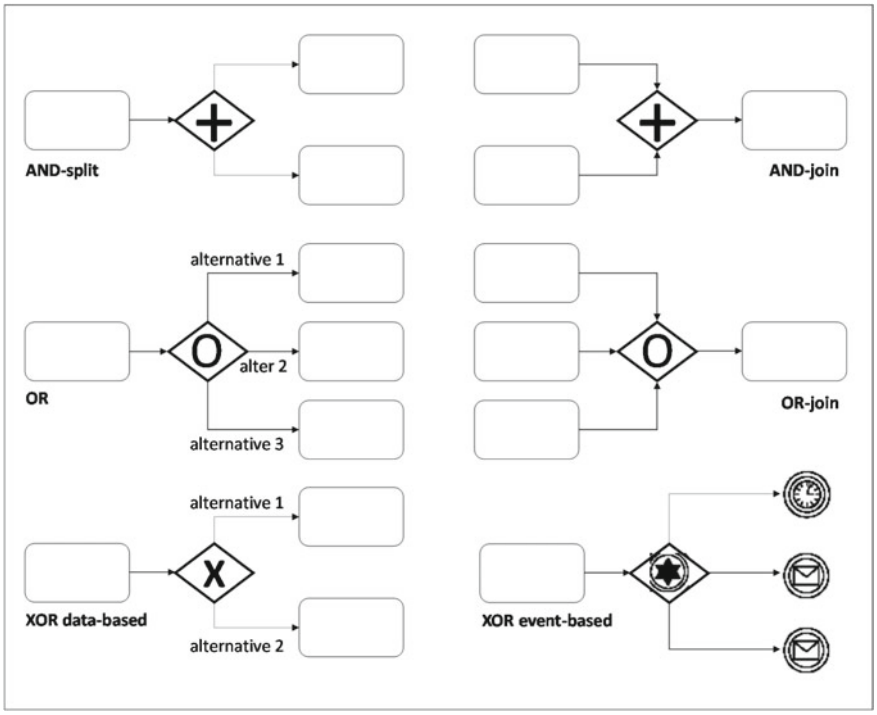

Fig. 4.3 Representation of the execution flow connectors according to BPMN (*Source* The Author)

gateway". The decision on which path or flow to follow can be made using the comparative processing between the data provided by the input flow and the rules contained in the connector for each of the possible flows. Another way to decide the path is to observe the occurrence of an event, such as the arrival of an authorization message. Thus, the process of deciding an exclusive path can be data-based (XOR data-based) or event-based (XOR event-based).

Questions for Reflection

(a) What is the importance of M-B-BP support software, the BMPS, in working with dynamic and not static diagrams?
(b) Elaborate a State Transition Diagram, similar to the one developed in Chapter 3 (Fig. 3.4), for the "Opinion" entity according to the process dynamics described in the Business Process Diagram of Fig. 4.2.
(c) Describe the logics associated to the operation and control of processes considering the relations between the pairs: Event-State, State-Event, Event-Activity, and between Activity-Event.

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Approach to Management by Business Process

5

Objective of This Chapter
At the end of this chapter the reader should have a good understanding of the main phases and activities of all phases of the Management by Business Process (M-B-BP) approach, i.e., it highlights how the daily operation of the organization that adopts and exercises the M-B-BP approach takes place.

The literature does not present a rigorous and well-defined method on how organizations should proceed to implement, operate, and evolve their business processes according to the M-B-BP approach. There is a predominant perception of some relevant phases for the M-B-BP approach, whether for the structuring and operation of the company's first business process or for the management of its business processes already in operation. Thus, in this chapter we will address those phases considered as relevant, both by academics and practitioners, they are: Process Modeling, Process Analysis, Process (Re)Design, Process Transformation, and ProcessEvaluation and Monitoring. However, before describing each of these five common-sense phases for operationalizing the M-B-BP approach, we will describe two phases prior to these and that are necessary for companies that do not yet have the understanding and culture of business processes. These two preliminary phases should be conducted by those traditional companies, organized by functional structures in which the culture and mindset focused on traditional process management predominates.

5.1 Development of the Business Process Culture

It is essential that the steering committee of the traditional organization, structured by functions, has a common understanding of the main benefits of the M-B-BP approach and of the main restrictions to be overcome for its implementation. As

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there are many ways and means to meet this purpose, we highlight four units of ideas developed by Hammer and Champy (1993). We begin with the unit associated with the disadvantages of the company structured by functional areas for the business, discussing internal barriers between areas or business units of the organization (intra-organizational). Then we will address the disadvantages associated with external barriers (inter-organizational). In the sequence, we will highlight the difficulties to overcome these two types of barriers, both intra-organizational and inter-organizational.

Among the problems arising from intra-organizational barriers, the following stand out: (i) diffuse information flow and ineffective communication; (ii) lack of an overview of the business; (iii) lack of clear responsibility for the final product; (iv) greater alienation of people; (v) very sequential and time-consuming work; (vi) problems perceived late, when the product is ready or the service executed (vii) delays and routine delays; (viii) duplicity of efforts and rework; (ix) lack of synergy; (x) inflexibility, little agility, and long cycle times; and (xi) difficulties in viewing activities that do not add value. As to inter-organizational problems one might identify: (i) loss of flexibility, time, and competitiveness; (ii) negotiation difficulties; (iii) delays in customer service; (iv) accumulation of stocks and increased costs; (v) duplication of work; (vi) need for greater internal control over quality; (vii) greater need for investments in quality and innovations; (viii) reduction of profit margins; (ix) inefficiency of the organization as a whole.

There are many difficulties that traditional organizations need to overcome in order to remove intra-organizational barriers, as well as to remove inter-organizational barriers. In the intra-organizational scope the following difficulties stand out: (i) interdepartmental competitiveness and differences of cultures and work methods; (ii) disputes for power; (iii) lack of awareness about the responsibility for the final work; (iv) increase of work for some; (v) lack of vision of the whole and difficulty in understanding the objectives; (vi) lack of focus on the customer; (vii) difficulties of communication between areas; (viii) lack of knowledge of the work of other departments; (ix) weakened informational culture due to the non-sharing; (x) lack of integration between the information systems; (xi) difficulties to work in teams. On the other hand, in the inter-organizational scope, the following difficulties are encountered in the removal of barriers: (i) difficulty in visualizing in terms of boundaries, where it begins and where it ends; (ii) patterns of inter-organizational behavior of the win-lose type; (iii) difficulties in making the spirit of partnership prevail; (iv) difficulties in sharing information between companies; (v) different levels of technological maturity; (vi) vision focused on their own gains and not on the value chain; (vii) difficulties in integrating/understanding different cultures.

Technical visits to companies that have effectively implemented the M-B-BP approach, even if from other segments, aligned with actions to acquire the concepts and work philosophy of the M-B-BP approach, are appropriate attitudes toward sensitizing managers of traditional companies. Thus, seminars, courses, presentation of success cases and visits to companies are some of the means that must be

combined for the success of this acculturation stage in the company. These activities should involve not only the internal public of the organization, but also the main interlocutors of the organization, such as customers, suppliers, and partners.

5.2 Identification of Business Processes

In conjunction with the company's acculturation activities regarding the work philosophy and management centered on business processes required for the M-B-BP approach, the company needs to identify its business processes. Business processes are those that generate added value to products and services according to the perception of customers. Thus, it becomes fundamental discussion of business processes according to the company's strategy, being clear about its main products and services, as well as their customers.

Most recent techniques, in this century, focused on the development of the Business Model or even the review of business plans already include the identification of business processes. Taking as an example the Business Model Canvas technique, there are four entities or central themes to be thought about by strategists: infrastructure, supply, customers, and finance. The infrastructure theme is broken down into three subthemes, being "key activities" one of them. According to Osterwalder and Pigneur (2010, p. 36) "the Key Activities building block describes the most important things a company must do to make its business model work". Thus, for organizations that already have a minimum culture of what business process is, as described in Sect. 5.1, the BMC turns out to be a good structure for identification or review of business processes.

It is important to note that there are process analysis and documentation techniques that are quite appropriate and flexible for building the macro view of business processes. Among these techniques is the SIPOC diagram, an acronym consisting of the initials for suppliers, inputs, process, output, and customers, i.e., it incorporates the basic principles of general systems theory in terms of input, processing, and output. Another technique that can also be useful in this phase of visualization, discussion, and explanation of the business process is the IDEF0 technique present in the Integrated Computer-Aided Manufacturing (ICAM) tool framework.

5.3 Process Modeling

The current situation understanding phase, also known as "as-is", encompasses the gathering of data about the current business process through field observation techniques, interviews, questionnaire application, document and report reading, software registry analysis, analysis of rules defined in repositories of workflow systems or BPMS, even source code analysis of conventional computer programs linked to legacy information systems. This phase aims to collect a wide range of data and information about the current business process, such as: (i) activity flow;

(ii) business rules; (iii) current performance indicators (throughput, lead time, cost, number of errors, among others); (iv) organizational structure involved; (v) actors and roles played (quantitative and qualitative); (vi) problems and opportunities recognized; (vii) inputs or inputs; (viii) products and services generated and their respective customers; (ix) technologies employed; and (x) information handled.

An important analysis to be made, from the point of view of seeking to solve the problems of integration between professionals, between area and/or information systems, is the crossing between the activities and the information handled by them. In this aspect, a very appropriate technique comes from Information Engineering: the relationship matrix "processes versus collections/data entities". In the cell formed by the intersection of these two items it is marked with one or more of the following letters: C(create), R(read), U(update), and D(delete); therefore, this technique is also known as CRUD matrix (Martin, 1991).

There are several justifications for the CRUD matrix survey, the first is that the team can only propose changes and improvements in the process from the recognition of the current stage of the process; the second is that the traditional management through functional areas makes few in the organization have a broad view of the business process from the customer's perspective. Thus, documenting the current process brings as main results:

- level the project team's knowledge of the current business process, allowing those involved to better understand the pros and cons of the current way of operating and managing the business process, thus providing all team members with fundamental information for their participation and collaboration throughout the project;
- allow the organization itself to know the current business process, since the company's day-to-day analyses are usually done sectorially, especially from a functional area perspective;
- allow the organization to have parameters for the performance evaluation of the new business process, being able to compare the performance of the old process (documented in this phase) with the results obtained by the new process resulting from the restructuring project.

In terms of software to be used as tools for this phase, the diagrammers stand out, some already described in Chapters 3 and 4, as well as the software of documentation from reverse engineering. These tools analyze the source codes of programs and elaborate documentations in the form of diagrams and documents of interest for the understanding of the current process. In practice, they make use of reverse engineering techniques of software, from source code of legacy information systems, to generate diagrams and algorithms that describe their intrinsic logic. Such resource is very useful, especially for organizations that still have several legacy information systems, operating for more than decades without updated documentation, and that are no longer being maintained and updated by the original team of analysts and programmers responsible for their design and development. Sometimes, these tools are the only way to understand part of the process logic,

implemented by means of software that are true "black boxes", even for IT personnel, who avoid messing with legacy systems from companies that have been incorporated by means of merger and acquisition processes.

5.4 Process Analysis

Carrying out the company's operation and management through business processes, according to the M-B-BP approach, requires constant analysis and evaluation of business processes aiming at their continuous improvement. In a literature review of approaches used to conduct business process analysis, Biazzo (2000) identified four main types of approaches: action analysis, process mapping, coordination analysis, and social grammar analysis. These approaches are present to a greater or lesser extent in the different techniques and diagrams used to model and discuss business processes. Just as writing is a simultaneous act of writing, reflection, and idea development (Huff, 1998), the diagrams and techniques employed in M-B-BP also serve to identify (Sect. 5.3) and analyze (Sect. 5.4, this subsection) business processes. The following is a brief description of these four approaches that configure what management theorists call organizing moves, a central part of the theory of Organizational Knowledge (Pentland, 1992, p. 527).

Action Analysis The action analysis approach encompasses three structural dimensions that portray the conditions associated with the "movement" of the business process: (a) the physical structure, which portrays both physical (sequence flow) and digital (information flow) movements, for example, as described in the Business Process Diagram; (b) the ritual structure, which covers the social requirements for talk or interaction, obtained by field observation carried out by the process analyst, unfortunately without a diagram or specific technique for its formal registration; and (c) the competence structure refers to the explicit knowledge (organizational) and tacit (individual), the latter being portrayed in the BPD, for example, by association flow with people, personal databases and other non-organizational sources.

Process Mapping The process mapping approach is complemented by the action analysis approach in the sense that it allows the visualization of several entities (participant, event, activity, flow, …) in only one or a few intertwined diagrams. This is a great analytical advantage when considering the challenging characteristics of business processes: extensive, with many actors involved, long-lasting and complex. For each ontological object portrayed in the diagrams, we can have associations with objects of the Problem type and with objects of the Opportunity type. Such resources allow the creation of knowledge bases that favor analysis and discussions. Besides the associations between objects, there is the possibility of defining properties, more specifically Indicators associated with each object, indicating the current value, the desired value, and the benchmarking value.

Co-ordination Analysis The co-ordination analysis approach is associated with the ability of many of the techniques and diagrams to allow the analyst to work with levels of detail. Thus, we can see, for example, in the BPD at the last level of decomposition the operational issues and details, while at the highest level there are only the managerial issues. This allows working in different contexts, such as operational and managerial, in a well integrated and consistent way.

Social Grammar Analysis The social grammar analysis approach by making metaphorical use of the term grammar intends to bring the idea of completeness, of the broad and infinite capacity of lexical resources for detailed description of the business process, for example, to the description of its business rules. The definition of rules for state change, as observed in the State Transition Diagram [3], demands similar levels of clarity to those obtained by grammatical rules. The complexity of the different social actors is also well served by the principles of this approach, hence the social prefix.

In a more pragmatic perspective, Grant (2016) analyzed the process analysis techniques used by twelve organizations in business process reengineering projects. He identified eight techniques widely used in these projects: Problem analysis (PA), Root cause analysis (RCA), Activity-based costing (ABC), Duration analysis (DA), Benchmarking (BM), Outcome analysis (OA), Technology analysis (TA), and Business process analysis and activity elimination (BP&AE). According to Grante (2016, p. 75), these techniques stood out in relation to others in function of the "fit between the analysis technique and the problem situation, the ease of use-of-use of the chosen technique, and the versatility of the technique". We conclude this subsection by exploring the Root Cause Analysis technique as an example of the importance of these techniques for the Process Analysis phase.

5.4.1 Causal Map and the Externalization of Systemic Archetypes

The causal map is a mathematical representation of causal relationships between variables. In the field of Management science, the causal map was initially used to study cognition patterns in organizations (Bugon et al., 1977) and, subsequently, as a tool for the analysis and diagnosis of organizational problems (Nelson & Mathews, 1991). As a support tool to M-B-BP, the causal map is a technique that enables the process analyst to associate causes and identify the interference between them. It comprises a square matrix that associates all causes among themselves and thus provides comprehensive analysis. The causal map allows the organization members to communicate the understanding of complex problems in a clear way and, by means of mathematical algorithms, they can indicate the causes with potential to generate more serious problems, such as explosive loops.

The causal analysis activity is quite common in organizations, especially in process improvement actions and in planning. In process improvement projects, root cause analysis is employed to prevent or correct undesired aspects (Kettinger

et al., 1997). In planning actions, the discussion of causes is important for the identification of critical success factors, for which the company should perform monitoring and control (Aaker, 2005). Researchers and practitioners in the field of Business Management vary somewhat in their methods of constructing the causal map, but all perform the basic steps described below.

5.4.1.1 Identifying Causes Associated with the Problem

Imagine a scenario in which a process improvement group needs to solve a problem associated with a process defect. First, a few people who know the context of the problem get together to assemble a list of possible causes. At this point, techniques such as the cause and effect diagram are usually used for idea generation (Kettinger et al., 1997). The next step is to reduce the size of the list to a limited number, typically eight to twelve factors. Include first the factors that everyone mentioned and then consider eliminating factors that were mentioned by only one person or that are synonymous. If the number is still large, consider eliminating causes mentioned later, rather than those identified at the beginning of the working session.

It is important at this point of choosing causes to ensure that causal factors are clearly defined, i.e., there is no duplication in function of semantically similar names (false antonyms). For example, one person may mention speed and another may talk about deadline to finish. Upon careful investigation, one may discover that it is the same phenomenon. Causes that may appear identical but are essentially different (false synonyms) should be recorded in order to externalize unique aspects of each one. Customer delay and employee delay are similar but not identical causes.

If the list was not developed in the presence of all, it is important that the definition of the causes be passed on so that everyone can analyze and comment. Once the list of causes has been defined, a square matrix is drawn up associating all causes with each other, i.e., the rows present all causal variables, repeating the process for the columns.

5.4.1.2 Identifying Influences Between Causes

People involved in the problem analysis must identify which relationship exists between each pair of variables, if any. A positive causal relationship takes the number 1 (one), the negative one takes −1 (minus one) and no relationship is indicated with the value 0 (zero). As an example, consider the cross analysis of the causes "unmotivated employee", "broken equipment awaiting maintenance", and "absent employee". The questions for analyzing interference between causes are designed as follows: does the occurrence of the variable "Demotivated employee" (variable described in the first row) increase, decrease, or keep unchanged the variable "Broken equipment waiting for maintenance" (variable described in the second column)? The answer to this question is the insertion of a number (0, 1, or −1) in the cell consisting of the intersection of the row describing the first cause and the column describing the second cause. For this question, the answer indicated by the group was 1, as shown in Table 5.1, indicating that unmotivated

Table 5.1 Example of a causal map

	1. Demotivated employee	2. Broken equipment awaiting maintenance	3. Absent employee
1. Demotivated employee	0	1	1
2. Broken equipment awaiting maintenance	1	0	0
3. Absent employee	0	0	0

Source The Author

employees provide more equipment breakdown and, consequently, there is a higher frequency of the cause of Broken equipment waiting for maintenance.

In the example causal map, the second question will associate the first cause row with the third cause column, i.e., does the variable Demotivated Employee increase, decrease, or leave the variable Absent Employee unchanged? The answer to this question will be recorded in the cell consisting of the intersection of the first row and the third column. The cross analyses are done successively for each line that is associated to all columns, except the column of the variable itself, that is, the descending diagonal remains with value 0. Thus, it is continued until all matrix cells are filled, which will result in a square matrix, asymmetric, with zeros in the diagonal descending cells of the matrix.

The reading of a causal map can be done in two ways, starting by reading the row or the column. When starting by reading the text of the cause described in the row, the reading logic should be: this cause described in the row influences the cause described in the column. When starting with the text of the cause described in the column, the reading logic should be: this cause described in the column is influenced by the cause described in the row.

The influence may be positive, in the sense of motivating the cause described in the column, indicated by 1; it may be negative, in the sense of demotivating and reducing the cause described in the column, indicated by −1; or it may be neutral, indicated by 0.

5.4.1.3 Identifying the Causes that Most Influence the System

To illustrate other aspects of the causal map a more complex example is required. To this effect, one resorted to research data from De Sordi et al. (2014) and Nelson (1997). Table 5.2 presents the causes identified for the context of a real estate registry office, more specifically, for the defect delay in attendance.

The sum of absolute values of the causal map's values informs for each cause how much it interferes in other causes (row sum) and how much it is influenced by other causes (column sum). The sum of rows, that is, the influence of a cause on other causes, is named by network analysis techniques as "outdegree", or exit degree, and the sum of columns is named "indegree", or entrance degree (Wasserman & Faust, 1994). The values of the outdegree variable for the ten causes in the map are described in the last column, the values for the indegree variable are

Table 5.2 Causal map for the problem of delayed service at the notary's office

	1. Volume of transactions to be processed	2. Processing time	3. Incorrect records	4. Customer dissatisfaction	5. Fines resulting from errors	6. Unavailability of specialist	7. Difficulty in communication	8. Inability to estimate research timeframe	9. Demotivated employees	10. Lack of contact with the client	*Outdegree* ($\sum$ absolute values of the line)
1. Volume of transactions to be processed	0	−1	−1	0	1	−1	0	1	0	−1	6
2. Processing time	1	0	−1	1	1	0	0	0	1	0	5
3. Incorrect records	1	−1	0	1	−1	0	0	0	1	0	5
4. Customer dissatisfaction	1	0	0	0	0	0	0	0	1	0	2
5. Fines resulting from errors	0	0	0	1	0	0	0	0	−1	0	2
6. Unavailability of specialist	1	1	1	1	−1	0	0	1	1	0	7
7. Difficulty in communication	1	0	0	1	−1	0	0	0	1	0	4
8. Inability to estimate research timeframe	1	1	1	1	−1	0	0	0	1	0	6
9. Demotivated employees	1	0	1	1	−1	0	1	0	0	0	5

(continued)

Table 5.2 (continued)

	1. Volume of transactions to be processed	2. Processing time	3. Incorrect records	4. Customer dissatisfaction	5. Fines resulting from errors	6. Unavailability of specialist	7. Difficulty in communication	8. Inability to estimate research timeframe	9. Demotivated employees	10. Lack of contact with the client	*Outdegree* (∑ absolute values of the line)
10. Lack of contact with the client	1	0	0	1	0	0	1	0	0	0	3
Indegree (∑ absolute column values)	8	4	5	8	7	1	2	2	7	1	45

Source The Author

in the last row. The outdegree variable for cause 6, Unavailability of specialists, presents a value equal to seven, indicating that it influences other seven causes of the map.

Subtracting input degrees (indegree) from output degrees (outdegree) one obtains the net influence index, that is, which variables have greater influence on the causes described in the map, subtracting the extent to which these are influenced by other variables (Nelson & Mathews, 1991). For the ten causes described in the example of Table 5.2, the net influence index, described in Table 5.3, was calculated. This index is useful to locate which causes have the greatest potential to improve organizational performance with minimal effort. In the case of the example described in Table 5.2, the two causes that have the greatest impact are, respectively: cause 6, Specialist Unavailability and cause 8, Inability to estimate research deadlines.

Cause 6, specialist unavailability, is the one that presents the strongest net influence index. It influences seven variables and is influenced by only one. In other words, in order to change cause 6, it is necessary to move little with other causes, but an improvement in this cause will bring benefits to many other causes in the system. These basic statistics can help decide where and when to act to improve system performance. More important than identifying the cause with the highest net influence index is the identification of the variables that influence each other in a systemic movement called a loop.

5.4.1.4 Identification of Systemic Loops

The most important benefit of the causal map is the ability to identify the *loops*, particularly the explosive *loops* in the system. It is a simple diagnosis that consumes very few resources, but it can identify underlying problems that are very dangerous to the organization and unlikely to be seen otherwise. The *loop* is identified by simultaneously examining rows and columns with the goal of finding reciprocal causality. In mathematical terms, one looks for the presence of a mutual causal effect in cell *Cij*, and in cell *Cji of* the matrix. The existence of causes in both cells indicates the presence of a *loop*. If both have the same sign (either positive or negative) there is a deviation amplification *loop*, if the signs are different, there is a deviation limitation *loop*.

To illustrate the diagnosis of loops, we will use the causal map described in Table 5.4, which addresses four causes associated with the analysis of the public action strategy. As it is a causal map of reduced size, it is more appropriate for exemplifying the mathematical operations associated with the algorithm for identifying loops.

The search for systemic loops in the causal map described in Table 5.4 implies the investigation of mutual interference between each causal variable of the matrix. For example, in row 1, column 2, it is observed that Poverty increases Heaping. However, in row 2, column 1, there is a 0, indicating that Heaping does not increase Poverty. Therefore, there is no loop in this combination of causal variables. In row 1, column 3, we see that Poverty increases Illness, and in row 3, column 1, we

Table 5.3 Net influence index for the causes of the problem of delayed service

	1. Volume	2. Time	3. Records	4. Dissatisfaction	5. Fines	6. Unavailability	7. Difficulty	8. Inability	9. Staff	10. Lack
Outdegree	6	5	5	2	2	7	4	6	5	3
Indegree (entry grade)	8	4	5	8	7	1	2	2	7	1
Net influence index	−2	1	0	−6	−5	6	2	4	−2	2

Source The Author

Table 5.4 Example of causal map related to social problems

	1. Poverty	2. Piling	3. Disease	4. Drug use
1. Poverty	0	1	1	1
2. Piling	0	0	1	0
3. Disease	1	0	0	0
4. Drug use	1	0	1	0

Source The Author

see that Illness increases Poverty. An amplification loop is identified between these two causal variables. The more Poor, the more Sick; the more Sick, the more Poor.

Searching for *loops in* this way—parsing the values for each pair of causal variables—is slow, tedious, and error-prone. Simple matrix operations can quickly accomplish this activity. The operations involve element-to-element multiplication (*Hadamard product*) between the original matrix (A) of the causal map and its transposed matrix (A^T). The resulting matrix (AoA^T) is a symmetric matrix, as can be seen in Fig. 5.1.

The resulting matrix data (AoA^T) is transported to the *loops* matrix and the column values are summed generating the total *loops* indicator as described in Table 5.5. This new map is the *loops* matrix, which identifies all *loops*. The analysis of the signals indicates which are amplification and which are deviation limitation. In the example there are two deviation amplification *loops*: between row cell 1, column 3, with row cell 3, column 1; between row cell 1, column 4, with row cell 4, column 1; respectively, Poverty generating Disease, and vice versa; Poverty generating Drug use, and vice versa. Both *loops* are amplification *loops*, considering there are no negative numbers.

To verify the presence of explosive loops in the causal map under analysis, it is enough to check if there is any total indicator of loops with a value greater than 1. In the example described in Table 5.5 there is a situation that fits this condition, the first column referring to the cause Poverty. The matrix indicates that the factors Poverty, Disease, and Drug Use are interconnected by deviation amplification loops, characterizing an explosive loop, a true systemic problem. In the example, the loop matrix also suggests that the cause of Amassation is not part of the package, which allows a manager to infer that eradicating slums is not as important as combating drug trafficking, disease, and unemployment.

$$\underset{A}{\begin{bmatrix} 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix}} \mathbf{o} \underset{A^T}{\begin{bmatrix} 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}} = \underset{A\,o\,A^T}{\begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}}$$

Fig. 5.1 Matrix operations for identifying loops (*Source* The Author)

Table 5.5 Example of a matrix of loops related to social problems

	1. Poverty	2. Piling	3. Disease	4. Drug use
1. Poverty	0	0	1	1
2. Piling	0	0	0	0
3. Disease	1	0	0	0
4. Drug use	1	0	0	0
Total *loops*	2	0	1	1

Source The Author

Table 5.5 does not contain negative numbers, loop that limits deviations, which makes it a dangerous table. It is important to highlight that the presence of negative numbers in the loop matrix cancels out the positive numbers, creating a limitation system of deviation loops and avoiding the occurrence of explosive loops, hence the importance of the sum of the columns of the loop matrix, i.e., not working with absolute values.

Returning to the example of the problem Delay in attending the notary's office, the loop matrix is presented in Table 5.6. It can be observed, by the total loops indicator, that there are two causes that stand out: cause 9, Demotivated employees, and cause 1, Transaction volume to process. Cause 9, unmotivated employees, is the most worrisome because it creates an explosive loop working together with causes 3, 4, 5, and 7, respectively, incorrect records, customer dissatisfaction, fines resulting from errors, and communication difficulties. The best management attitude is to improve the motivation of employees and, for this, it is essential to work to reduce incorrect records (cause 3), which hinder the employee's research work and at the same time demotivate them, as well as improve the communication process with customers (cause 7). Improving employee motivation, customer dissatisfaction (cause 4), and the occurrence of fines (cause 5) are also in the context of the explosive loop.

The greater the number of variables and the density of the causal map, the greater the difficulty in identifying loops and the greater the importance of applying the algorithm presented, which can be summarized in seven activities:

1. identify the causes associated with the problem;
2. create square matrix (causal map) for all causes identified as pertinent;
3. identify the influences between causes (filling in the causal map);
4. generate the transposed matrix of the causal map;
5. perform element-to-element multiplication (Hadamard product) between the random map matrix and the transposed matrix, generating the loop matrix;
6. sum the columns of the matrix of loops, generating the total indicator of loops for each cause in the matrix;
7. prioritize analysis for the causes that present the highest value for the total loops indicator.

Table 5.6 Loop matrix for the problem Delay in Attending the Registry Office

	1. Volume of transactions to be processed	2. Processing time	3. Incorrect records	4. Customer dissatisfaction	5. Fines resulting from errors	6. Unavailability of specialist	7. Difficulty in communication	8. Inability to estimate research timeframe	9. Demotivated employees	10. Lack of contact with the client
1. Volume of transactions to be processed	0	−1	−1	0	0	−1	0	1	0	−1
2. Processing time	−1	0	1	0	0	0	0	0	0	0
3. Incorrect records	−1	1	0	0	0	0	0	0	1	0
4. Customer dissatisfaction	0	0	0	0	0	0	0	0	1	0
5. Fines resulting from errors	0	0	0	0	0	0	0	0	1	0
6. Unavailability of specialist	−1	0	0	0	0	0	0	0	0	0
7. Difficulty in communication	0	0	0	0	0	0	0	0	1	0
8. Inability to estimate research timeframe	1	0	0	0	0	0	0	0	0	0
9. Demotivated employees	0	0	1	1	1	0	1	0	0	0

(continued)

Table 5.6 (continued)

	1. Volume of transactions to be processed	2. Processing time	3. Incorrect records	4. Customer dissatisfaction	5. Fines resulting from errors	6. Unavailability of specialist	7. Difficulty in communication	8. Inability to estimate research timeframe	9. Demotivated employees	10. Lack of contact with the client
10. Lack of contact with the client	−1	0	0	0	0	0	0	0	0	0
Total *loops*	−3	0	1	1	1	−1	1	1	4	−1

Source The Author

It is important to note that the activities described in the topic (Sect. 5.4.1.3), Identification of the causes that most influence the system, which generated the net influence index, are not included in the seven activities of the algorithm summary for identification of systemic loops. The importance of calculating and highlighting the net influence index is to emphasize that the most important cause to be worked on is not always the one with the greatest influence. In the example of the cartorio, the two causes of greatest importance to the resolution of the problem, those with the greatest total indicator of loops, are causes 9 and 1. However, both have low net influence indices, −2 (minus two) for both. This is easily seen by comparing the total loops in Table 5.6 with the net influence number in Table 5.3. This example characterizes well an important principle of the General Systems Theory (von Bertalanffy, 1968): the sum of the parts is more important and significant than the isolated analysis of each one of them.

5.5 Process (Re)Design

The design of new business processes or the redesign of existing business processes encompasses a very broad set of actions occurring with different entities and work fronts, both external and internal to the organization. In this subsection we describe actions associated with: norms and policies, both internal and external; qualitative and quantitative human and technological actors; facilities required for the operation of the different actors; the orchestration of these different entities with the clarity of what should be produced and delivered.

In the field of standards and policies, it may involve not only discussing the internal framework of these documents, which guide the conduct and procedures of the work conducted by the organization, but also engaging in dialogue with the entities responsible for the laws and regulations of a country or even entities representing the interests of countries that make up a region or bloc. The idea here is to ensure that the organization's entire business process is fully compliant with the set of laws of the countries in which it operates. This applies especially to the innovative aspects of the business process in terms of the localities in which its operations will take place. Recent examples of this context of actions for the design of new processes were the actions required for the implementation of Uber's and Airbnb's business processes in different countries. These new business models implied the discussion of labor issues for Uber drivers, especially in comparison with the category of workers who drove taxis; as well as the taxation of Airbnb, especially in relation to the rooms of the traditional hotel chain.

Another aspect is to define the quantities and profile of the various actors involved throughout the process. Each activity of the business process demands a set of competencies (knowledge, skills, and attitudes) that can be performed by different people, robots, or information systems. The diversity of alternatives brings possibilities and, consequently, greater challenges to those who elaborate the business process design. Figure 5.2 presents a set of professionals as well as

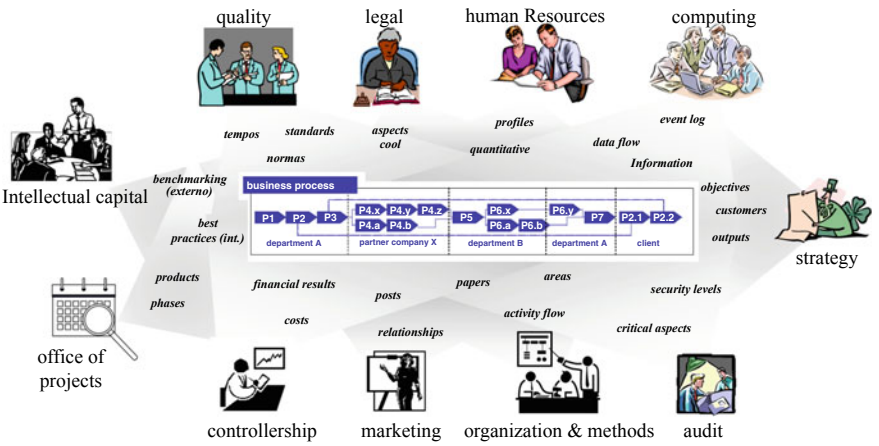

Fig. 5.2 Diversity of professionals working in the business process (*Source* The Author)

some of the central themes of their work that are necessary for the operationalization, management, and evolution of business processes. Typical examples of points of attention for the (re)design of business processes regarding the performers are portrayed in the questions: (i) Who or which are the entities that perform each activity? (ii) How and who will supervise the work performed by these entities? (iii) In the case of the human actors, how to ensure their motivation in the conduction and evolution of the work?

For the entities involved in the execution of business process activities, whether human or technological; executors, supervisors, or exercising any other role, there is the need to provide the facilities and resources that allow them to perform their work. Thus, it is necessary to think about: (a) work tables and chairs for the people involved; (b) digital space in terms of storage, processing, transport, and presentation of content; (c) lighting, ventilation, and security of the necessary environments, whether for human or technological resources; (d) infrastructure for physical and virtual interaction between internal and external entities; among many other needs of physical and virtual infrastructure necessary for business processes.

Finally, the orchestration of all these entities and resources in workflows, describing the execution orders and their points of involvement; the criteria that may alter the different paths; the products and services to be delivered throughout the business process, both intermediate and final. Here it has to be clear the attributes of the results to be delivered, facilitating even the analysis in terms of quality control. In this respect, a fundamental part of the work of (re)design of the business process is the definition of the measures or indicators of performance of the work performed.

5.6 Process Transformation

As discussed in Sect. 2.5.2 business process improvement (BPI) actions are implemented after business design or business process redesign actions. The intention with this action is to ensure that the business process does not return to the previous configuration, in the case of redesign, but mainly advances and continuous transformation of the business process according to the problems and opportunities detected in the business environment. In this subsection we will explore the actions of Process Transformation from the perspective of Knowledge Management (KM). Initially, the fundamentals of KM are presented and then the means and functionalities by which the philosophy and work techniques of KM can collaborate with the continuous transformation of business processes are explained.

5.6.1 Knowledge Management

Nonaka and Takeuchi's (1995) research in KM is focused on knowledge creation. The theoretical reference of Nonaka and Takeuchi is the philosophy, especially the works of the Japanese philosopher Kitaro Nishida. From Japanese philosophy, the authors incorporated the concept of "*ba*", which is equivalent to the concept of place in organizational theory. The "ba" space can be physical (office or break room, for example), virtual (email, teleconference), mental (shared experiences, ideas, ideals), or any combination of these. What differentiates the "ba" from everyday human interaction is the concept of knowledge creation. The "ba" is the platform for the generation of individual and collective knowledge. This platform is composed of four types of environments composed by the intersection of two dimensions: nature of the transmitted knowledge, if tacit or explicit; holder of the transmitted knowledge, if individual or organizational. The intersections of these dimensions generate four spaces for knowledge generation, called: socialization environment, externalization environment, combination environment, and internalization environment, described below:

Socialization environment: involves the sharing of tacit knowledge among individuals. This exchange of experiences and knowledge occurs from activities that value being together, spending time together and living in the same environment. For this definition, Nonaka uses the concepts of "pure experience" by Nishida, which is directly associated with Zen philosophy;

Externalization environment the externalization of knowledge involves structuring tacit knowledge, that is, making it explicit so that it can be understood by others. From the philosophical terms, the individual self-transcends, overcomes its limits, both internally and externally and, when committed to the group, becomes the group itself. The sum of ideas and intentions of each individual committed to the group becomes the mental model of the group itself;

Combination environment in this environment there is a combination of different knowledge models externalized by different groups. New sets of more complex knowledge are generated from the integration and combination of different informational assets that were generated both by internal groups and by groups external to the company;

Internalization environment the use of the explicit knowledge of the organization by individuals in their day-to-day activities, provides the internalization of this knowledge by people. This internalized knowledge is evolved by individuals who use it, converting it into tacit knowledge. And tacit knowledge, when socialized, causes the entire KM cycle to restart through the socialization environment.

5.6.2 Knowledge Management Applied to M-B-BP

One of the objectives of M-B-BP is to ensure the continuous improvement of the organization's performance by raising the quality levels of its business processes. Great organizational competence in managing a certain business process can be a high-value asset, and may even result in new businesses, totally distinct from the organization's core activities. Two examples can be cited. The airline company American Airlines, upon achieving competence in the process of ticket reservations, began to develop a highly profitable business: consulting in reservation processes for the hotel industry and for the entertainment industry (cinemas, theaters, and parks). Another example is that of some North American automakers that achieved competence in the process of selling vehicles through individual financing packages. This know-how started to be marketed by automakers as a consulting practice, with clients being real estate companies that wanted to sell their financed properties.

According to Burlton (2001), the M-B-BP approach requires leadership and process direction and may result in radical changes in the business process and at other times, review and continuous improvement of the process by means of minor adjustments. For him, the "knowledge" resource is the main M-B-BP resource, because it is the main enabler for adjustments and evolution of each of the other resources pertinent to M-B-BP. We present below some KM functions that assist in this process of continuous transformation of the business process. The functions are presented according to their pertinence to each of the four environments in which knowledge creation occurs: internalization, socialization, externalization, and combination. Before, however, it is necessary to describe some basic and pre-existing software resources (algorithms) in BPMS solutions, whose knowledge is important for the understanding of the analyses performed.

Explanation of the workflow The workflow of the process describes the sequence of execution of the various activities that compose it, indicating the possible activity or activities to be performed after the completion of each predecessor activity. The

complexity increases as there are blocks of activities that are executed in parallel, generating a dependency relation between the result obtained from these activities and the decision on the path to be followed for the continuation of the process workflow. It is a basic requirement of a BPMS solution to the existence of algorithms that allow the construction, visualization, and evolution of the workflow of the business process in a graphic way.

Explanation of events and their handling rules Business event covers a wide range of occurrences that can trigger a business process. It can be the reaching of the fifth working day of the month, which triggers the process "pay employees", the arrival of a quotation request through the internet, which triggers the process "answer the commercial proposal request" or, still, several other process triggering mechanisms. These types of events can be classified as temporal, based on specific action, and based on rules.

Control panel (management cockpit) Having the facilities of a virtual environment that allows interactivity between process managers and the possibility to monitor and analyze the current performance of the business process, selecting different angles of analysis such as goals, costs, resources, activities, throughput, times, and other attributes and performance indicators of the process. This environment is the central point for the management and control of the process.

5.6.3 Functionalities Supporting the Internalization of Knowledge

Identification of unplanned events (exceptions) The mere fact that an exception is something not foreseen does not mean that its occurrence does not need to be handled. There must be at least one process exit point for any event different from the alternatives foreseen in the event explanation environment. It can be understood as a rule of negation to all the other foreseen rules, i.e., "not satisfying any of the previous alternatives, do…". This feature is called exception event and usually results in a notification to the process manager or to a competent entity. The indication of the exception serves not only for the process instance not to be stopped and for someone to give the necessary routing, but also for the KM of the business rules, many times providing the inclusion of a new rule or the alteration of others that already exist.

Identification of bottlenecks Identify activities that are reducing the productive capacity of the process, allowing to establish rules that have throughput and execution time of the activities as parameters for the triggering of corrective actions. Notifying the process manager when a critical limitation of the business process occurs increases the probability of the business process manager discovering its causes. Through the control panel, the process manager can quickly and easily consult the current situation of the business process variables.

Realization of simulations Allows the realization of dynamic simulations of the business process, with the possibility of adjustments until the desired result is obtained. At each new simulation, values are generated for each of the performance indicators assigned to the process, allowing comparisons between the results obtained in the different simulations and with the data of the process in force. Current simulators, present in some BPMS software, allow the simulation of different scenarios combining the several organizational resources associated to the business process. It is possible, for example, to analyze the service time in function of the insertion of more human resources or microcomputers in a certain flow of process activities. In KM, the ability to simulate is one of the resources with the greatest potential for the internalization of new ideas and concepts.

Pointing of the critical path and other data of the operation in real time Pointing in real time the indicators of the process operation: performance of the moment, established goals, numbers obtained by analogical benchmarking, etc. This allows the comparison of numbers between different versions of a process, as well as its use in the simulation environment, graphically verifying the result of changes in the process. Administratively, the critical path analysis is a preferable situation to the bottleneck analysis, because the latter characterizes a corrective posture, whereas the former demonstrates concern with the continuous improvement of the business process.

5.6.4 Features Supporting the Socialization of Knowledge

Flagging of real cases (instances of the process) for further analysis To have facilities available to those involved with the business process operation to indicate and highlight to the manager any potential improvement in the business process. The improvement is exemplified through copies of the operational instances of the process that are exemplary situations and that illustrate the problem or opportunity identified. This facilitates the exposure and spontaneous collaboration of the people involved in the process operation, contributing to the continuous improvement of the process. The BPMS solution should not block the instance in execution considered exemplary and whose characteristics should be analyzed. The blocking would result in increase of the transaction time and, consequently, in damage to the client. Instead of blocking, the BPMS system makes an exact copy of the parameters of that instance of interest, at that specific moment.

5.6.5 Features Supporting the Externalization of Knowledge

Manuals and online instructions that employ the operational diagrams of the process The diagrams and other logical abstractions used for the execution

and management of processes are structured in objects, properties, and relationships stored in digital databases. These diagrams can be "assembled" in real time from the users' request, always portraying the current and operational version of the process, and are useful for clarification of doubts, discussion, and analysis of the process through practice groups and training, among other applications. These online documents can replace with many advantages the traditional user operation manuals, training materials, and help menus to assist in the clarification of doubts.

Facilities for collaborative work (workgroup functionalities) Although the business process has a manager (process owner), the definition of its architecture or structural changes in this architecture is given by a committee of professionals. In large corporations, these professionals are usually geographically dispersed, working under different time zones. Collaborative development facilities allow different people to participate through the Internet in discussions and analysis of the business process, both synchronously and asynchronously. For example, from the activity flow diagrammer, the work session coordinator could be discussing rules for a decision process or defining the profile and how many professionals will perform a certain activity, i.e., it could provide facilities for everyone to participate effectively in the evolution of the business process, regardless of time and place.

5.6.6 Knowledge Combination Support Functionalities

Operational process version management Business processes are in constant change and evolution. The alteration of their rules, activity flows, executors, and software involved in their execution is one of the situations that generate the proliferation of different process versions in a short period of time. A business process can be differentiated by several reasons, the temporal and geographic issues are some of them. As an example, consider customer orders up to a certain date being processed in a specific way, and after that date following new rules and a new workflow. In some environments, there is more than one version in place for each process, for example, to meet geographic specificities. The sharing of current or historical versions of these different processes collaborates a lot so that different groups can exchange experiences. For example, a group from the material receiving area of the Brazilian plant analyzing and testing a workflow used by the German analogous team.

5.7 Process Evaluation and Monitoring

In the M-B-BP approach, a maxim widely known to experienced managers prevails: "If you can't measure it, you can't improve it". The greatest effectiveness of the M-B-BP approach is achieved when there is a broad set of indicators, operating in an integrated manner, which help to think about the business process in a

holistic way. For the analysis of the business process as a whole or for the analysis of some business transactions of the business process, the managers and analysts of the business process define what would be the ideal situation to be achieved. When there is a transaction or even an analogous process in another company, considered as the ideal situation to be reached, we can define such analogous as being the benchmarking, the inspiration for the new business process or for one of its business transactions. Once the benchmarking is defined, we have to seek to know the values for the main indicators of the business process or of the transaction of this exemplary company. For this, the company can use several strategies: have the client experience of the benchmarking company, interview former employees of the benchmarking company, analyze available literature about the benchmarking company, among many other strategies.

In the following paragraphs, I will present some indicators that are relevant for every business process. They are grouped into four themes: Indicators in the time perspective, typical production measurement indicators, typical quality management indicators, and typical maintenance indicators. They are certainly not exhaustive, but they serve to highlight the need for this important work front in the context of the M-B-BP approach.

5.7.1 Indicators in the Time Perspective

A first analysis is regarding the update periods of the indicators. Some indicators are part of the manager's analytical routine in terms of work agenda, with periodic generation, usually monthly, quarterly, semiannually or even annually. Other indicators are part of monitoring and ensuring the continuous good operation of the business process, and these are updated more frequently, in much shorter periods, for example, last hour or last day. Thus, a good way to analyze the indicators is to divide them by the extremes, the short term and the long term. In the short term, the manager needs to know if the process is operating as planned or if there is a problem that requires immediate intervention. Examples of short-term basic business process indicators are: (i) the number of process instances created in the last hour; and (ii) the time required for a particular step. As examples of long-term business process indicators we have: (i) the number of process instances; (ii) average time required to complete a process instance; and (iii) the average time that each process step requires.

5.7.2 Typical Output Measurement Indicators

A business process must deliver products, services, or both to its customers. In this way the typical indicators of Production Engineering are very useful to monitor the processing of the instances managed by the M-B-BP approach. Below is the description of some of these indicators.

Throughput"the average rate at which 'items' are passing through 'the system. [...] (items/unit time)" (Little, 2011, p. 548);

Lead time"is a widely used measurement in manufacturing. It tells how much time it takes to start and finish something" (Rajaniemi, 2012);

Availability—"the percentage of actual time a machine [or other resource] is available" (Kang et al., 2016, p. 6339);

Production process ratio—"the efficiency of production when considering the actual unit setup time, delay time, transportation time, and queuing time" (Kang et al., 2016, p. 6340);

Allocation efficiency—"the actual usage and availability of the planned capacity of a machine, which is measured by the ratio of AUBT to planned unit busy time (PBT)", noting that AUBT corresponds "Actual unit busy time (AUBT): The actual time that a machine is used for the execution of a production order" (Kang et al., 2016, p. 6339).

5.7.3 Typical Quality Management Indicators

The attention to the quality of services and products delivered by the business process to its clients is also included in the list of performance indicators of the M-B-BP approach. Below are some typical examples of quality indicators.

Scrap ratio—"is defined as the ratio between scrap quantity and produced quantity" (Yang, 2019, p. 20);

Actual to planned scrap ratio—"The relationship of the actual SQ [Scrap Quantity] and the PSQ [Planned scrap quantity], indicating how much scrap is produced compared with the expected value" (Kang et al., 2016, p. 6341);

Rework ratio—"is the proportion of quantity need to be reworked and total quantity produced" (Yang, 2019, p. 20);

First time quality—"The percentage of good quality parts going through the manufacturing process in the first time" (Kang et al., 2016, p. 6341);

Quality buy rate—"the overall percentage of good quality parts after reworks" (Kang et al., 2016, p. 6341).

5.7.4 Typical Maintenance Indicators

A business process is a dynamic entity that requires constant changes to keep up to date with the desires of society and its stakeholders. Thus, the M-B-BP approach also requires a set of indicators that help manage the repairs performed, whether

corrective, preventive, or predictive maintenance. Below are some typical examples of these maintenance indicators.

Mean time to failure—"the average TTF over a long time period", recalling that "Time to failure (TTF): The actual time during which a machine is able to produce, starting from the completion of the repair and ending at a new failure" (Kang et al., 2016, p. 6342);

Mean time to repair—"the average TTR over a long time period", recalling that "Time to repair (TTR): The actual time during which a machine is unavailable due to a failure, i.e. under repair" (Kang et al., 2016, p. 6342);

Mean operating time between failures—"the average OTBF over a long time period", recalling that "Operating time between failures (OTBF): The actual unit production time between two consecutive failures of a machine" (Kang et al., 2016, p. 6342);

Mean delay time— "the average AUIT over a long time period", recalling that "Actual unit idle time (AUIT): The actual time when the machine is not executing order production even if it is available" (Kang et al., 2016, p. 6342).

Questions for Reflection

(a) What differences would you highlight for the operationalization of each of the seven phases of the M-B-BP approach considering two extreme scenarios: (a) on one side companies experienced in the approach, with several business processes already in operation; (b) on the other side traditional companies, organized by functions and that are seeking to implement their first business processes.

(b) Consider the scenario of organizations that already operate and manage several business processes through the M-B-BP approach. What would be the most impacted phases in terms of adequacy or even specific and differentiated operations to deal with two quite routine situations: (a) significant changes in an existing business process (redesign); and b) implementation of a new business process (design).

(c) Search in repositories of scientific articles (Web Of Science, EBSCO, ProQuest, JStor, …) identifying texts that deal with the M-B-BP approach. Based on them, analyze and compare the phases worked out by different authors with the seven phases described in this chapter.

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Process Management and the Attractiveness of Jobs

6

Objective of This Chapter
By the end of this chapter the reader should have a good understanding of how some of the characteristics of the Management by Business Process (M-B-BP) approach can make workers more motivated with their work and with the challenges of the organization.

6.1 The Challenge of "Attitude" in the Modern Company

With the facilities provided by the junction of information technology resources with telecommunications resources, what we call today Information and Communication Technologies (ICT) is constituted. The combination of these resources generated the necessary conditions for the creation of what we now call the Internet of Things (IoT), pervasive computing, among other denominations, which characterize the extensive use and application of ICT in our daily lives. As for the work carried out by organizations, a considerable advance in the application of ICT resources can be observed, providing facilities for automation and management of this work. Their use is growing in the realization and monitoring of physical operations, including office automation and even support for intellectual activities, such as visioning and planning. We walk in the direction of human work in organizations to be applied predominantly in the noblest functions, in terms of strong intellectual demand, leaving the manual activities and logic more simplistic for automation, enabled by the new technological scenario.

Within this line of having workers performing predominantly nobler and more intellectual functions in companies, we can imagine a growing valuation of workers as a strategic resource. Their performance and action will occur in critical issues, for example, in the resolution of exceptions and unheard of questions. Thus,

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competent workers, already valued today, must be even more perceived and valued as relevant to the organizations. As for the quantitative aspect, it is difficult to know if there will be an increase or decrease of job openings; there is a collective intuition indicating a reduction of conventional work due to automation. As for the qualitative aspect, the profile of workers, there is consensus that more and more intellectual skills will be demanded of workers.

With this direction for the more intellectual and less physical work, we have that of the various types and profiles of current workers, two of them should stand out and predominate: the profile of Information Worker (IW) and, especially, the Knowledge Worker (KW). To define these terms, we conducted a content analysis of the many terminologies and definitions available. Before presenting the result of the analysis and the resulting definition, it is important to define two other terms, exploitation and exploration. In the area of Innovation, March (1991, p. 71) defined exploration with more radical innovative movements, encompassing actions such as "variation, risk taking, experimentation, play, flexibility, discovery, and innovation". As for exploitation, he indicated a more incremental innovation perspective, associating it with actions such as "refinement, choice, production, efficiency, selection, implementation, execution". Making use of these two terms, we define the IW and KW entities as follows (De Sordi et al., 2020, p. 65):

> The term knowledge worker applies to professionals whose work is highlighted by the continuous, systematic and predominant expansion of organizational knowledge through the mechanism of exploration. The term knowledge worker applies to professionals whose work is highlighted by the continuous, systematic and predominant expansion of organisational knowledge through the mechanism of exploration.

For the discussion of what is the best training and profile of future workers, researchers and practitioners have worked and explored various concepts, techniques, and models. Within this set of knowledge, a very important theme is that of Competence, composed of three entities: Knowledge, Skills, and Attitudes (Baartman & de Bruijn, 2011). Exploring the idea behind these three concepts, which breaks down the larger concept of Competence, we have: Knowledge as "knowing", Skills as "knowing how to do", and Attitude as "knowing how to act". Of the three concepts, Knowledge and Skill can be more easily worked on by universities and companies. Knowledge can be captured by various activities, such as reading, discussion, and analysis of texts and cases; while the skill can be obtained by activities in laboratories, simulators, workshops, among other resources. On the other hand, attitude is an expectation of the employer regarding the behavior that is expected of the employee in a given situation. Here there are many more uncertainties and difficulties in terms of ensuring that a given behavior will manifest itself in a given employee when a given situation occurs.

The insertion of M-B-BP in organizations presumes the performance of IW and KW, with knowledge and technical skills to act promptly in order to treat the instances of the business process that are classified as unexpected and unheard of. Thus, the attitude is very much demanded in this exception handling scenario. In

M-B-BP there is also the need for strong worker engagement for the continuous improvement of the business process (exploitation), as well as for its innovation (exploration). Good levels of knowledge and skill alone are not enough for these work fronts; they require initiative, that is, concrete attitudes from the workers.

6.2 Motivational Practices and Their Effects on Attitude

An important aspect that directly interferes in the behavior of workers is job satisfaction, i.e., the feelings of the person in relation to the work he/she does in the company. Satisfaction impacts the results of important performance indicators for Business Administration, such as absenteeism and turnover. Thus, in order to have better responses from workers in terms of expected attitudes, i.e., appropriate behaviors, employee satisfaction must be considered and effectively managed by managers. One of the theories quite explanatory of the subject of worker satisfaction is Job Design, which turns to the discussion of the characteristics of jobs that make them more attractive and, therefore, with greater motivational potential.

6.2.1 Motivational Theories: Job Design

Even today, there is a lack of literature that associates process improvement approaches with job (re)design theories. This demand has existed for some time, considering the criticisms linked to the lack of attention of process improvement projects to the well-being and motivation of employees (Micklethlwait and Wooldridge, 1996), as well as the literature that points to the Job Design approach as fundamental to the success of process improvement projects (Bisson & Folk, 2000; Kettinger et al., 1997). The lack of texts is easily observed when searching in scientific article databases, such as JStor, ProQuest, and Ebsco, using as criteria the association of keywords of the two themes: job design, work satisfaction, job satisfaction, or job motivation, associated with keywords such as process improvement, process (re)design, or reengineering.

The theory of job planning, also known as Job Design, proposes the structuring of jobs considering the important dimensions for the motivation of its executor. The model of job characteristics of Hackman and Oldham (1976), also known as Job Characteristics Model (JCM), is one of the central theories of the Job Design approach (Grant et al., 2010). The scales developed by Hackman and Oldham (1975) and by Sims et al. (1976) are important references for measuring work motivation, being widely used for measuring the motivational potential of jobs in organizations.

The proposal to use the Job Design practice as an important technique for projects of process improvement, for the creation and adaptation of workstations in order to make them more attractive to employees, is present, for example, in the researches of Kettinger et al. (1997). Job Design is a frequently researched practice in the area of people management (Foss et al., 2009). It relates to a well-defined

challenge of the organizational context, employee motivation. According to Grant et al. (2010), in recent decades, research concerning Job Design has played a key role in connecting theory and practice in the field of people management.

The model presented by Hackman and Oldham (1974) proposes that the work results are related to work characteristics, with critical psychological states, and are mediated by individual differences. For them, the five essential dimensions of work are: skill variety, task identity, task meaning, autonomy, and feedback. Positive personal and professional outcomes, such as high internal motivation, high job satisfaction, high performance, low absenteeism, and low turnover, are achieved when three critical psychological states are present at work: experiencing work meaning, experiencing responsibility for work results, and having knowledge of work results.

The five essential dimensions of work, in terms of presenting greater potential for motivation, are defined thus (Hackman & Oldham, 1974):

- Task variety—The extent to which a task involves different activities to be performed. It can be understood as the degree of skills required from the worker to perform a given job;
- Task identity—The extent to which a task is performed from start to finish by the same worker. It comprises the degree to which he/she is perceived in terms of the comprehensiveness of his/her work, of being able to complete a task as a whole;
- Significance of the task—The extent to which a task has significant impact on other people, the organization, and/or society;
- Autonomy—The extent to which the task provides the individual with freedom and independence to schedule and perform their work;
- Feedback—How much information the employee receives regarding the work for which he/she is responsible. The sources of information can be superiors, peers, customers, or the work itself.

The application of the theory of Hackman and Oldham (1974) in the evaluation of the possible motivating impact of the job characteristics in organizations occurs through the calculation of the Index of Motivating Potential (MPI), according to Eq. (6.1). The MPI helps to identify the reality of a constituted scenario, in this case the job, before the perception of its occupant, the worker who occupies the position. In terms of actions aimed at restructuring the jobs, identified as unattractive, the Job Design theories do not present practical guidance on what to do to make the job more attractive.

$$\begin{aligned} \text{IPM} = &((\text{task significance} + \text{task identity} + \text{skill variety})/3) \\ &\times \text{autonomy} \times \text{feedback} \end{aligned} \tag{6.1}$$

6.2.2 Template for Analysis of Motivational Aspects Associated with the Jobs

To go beyond the IPM calculation, seeking to give suggestions and ideas on how to adapt and configure workplaces so that they are more attractive, we prepared a literature review on Job Design. From this literature review, we prepared an artifact in the form of a *template*, serving as a suggestion for discussion of possible motivational aspects associated with new jobs to be designed or redesigned. The main technique employed was the content analysis applied to the texts of articles on Job Design, which helped to identify and highlight the characteristics of the five essential dimensions of work. As criteria for the selection of articles, it was defined the need for the text to cite the two most important and traditional groups of Job Design authors: Hackman and Oldham (1975) and Sims et al. (1976). The search was conducted in the electronic bases of scientific articles ProQuest and EBSCO, covering articles published in the period from 2001 to 2011.

The next figures present the characteristics of the jobs identified from the content analysis of the articles of the sample, i.e., of researches on motivation associated with the *job design* theory. The characteristics contained in these figures are associated, respectively, with the dimensions: autonomy, described in Table 6.1; *feedback*, described in Table 6.2; identity, described in Table 6.3; significance, described in Table 6.4; and variety, described in Table 6.5.

Of the five dimensions of work associated with motivation, the autonomy dimension was the most cited in the texts of the 48 articles in the sample analyzed. This dimension was also the one that presented the highest number of identified characteristics, which is consistent with the perception of researchers in the area: "*autonomy is a job dimension that received much attention in the literature*" (Lloyd, 2008, p. 25). Of the 37 characteristics described in the "*Template* for suggestion and discussion of possible motivating aspects of jobs in creation or in redesign", see Table 6.6, identified from the analysis of the research sample (disregarding the three highlighted in italics and bold, not originating from the research sample), 14 of them (38%) are associated with the autonomy dimension.

In the articles of the sample it was observed motivational characteristics associated with other contemporary motivational theories, distinct from the *job design* theory. This generated the *insight to* confront the motivational characteristics of jobs, according to Job Design, with the concepts and characteristics associated with other contemporary theories of motivation at work. Thus, for the constituent characteristics of the *template* generated from the 48 articles in the sample, described in Table 6.6, a few motivational characteristics, not directly associated with job *design* theory, were added. For this reason, these characteristics were highlighted by italic and bold font in Table 6.6.

The perception of task identity is a fundamental element for the attribution of meaning to work by the worker. This was an important challenge for jobs in the industrial era due to the application of Taylor's principles in the design of tasks. This challenge remains quite current, because although the largest employer

Table 6.1 Motivational characteristics, identified in recent literature, associated with the Autonomy dimension of the *job design* theory

Motivational dimension: **Autonomy**	
Identified characteristic	Strata of articles associated with the characteristic
To judge and solve problems	*I am encouraged to find solutions to resolve problems* (Coelho & Augusto, 2008, p. 171); *chance to use my personal initiative or judgement in carrying out the work* (Hackman & Oldham, 1975, p. 50)
For choice of procedures/activities to be performed	*and deciding on procedures to be followed* (Sims et al., 1976, p. 197); *I am able to choose the way to go about my job (the procedures to utilize)*
For choice of grid/work schedule	*employees have a major say in scheduling their work* (Sims et al., 1976, p. 197); *Control over the timings and sequence of one's work activities* (Sekhar, 2011, p. 31)
To set working time	*In my job I have control over my hours of work* (Lloyd, 2008, p. 34)
To set the pace at which work will be performed	*The control I have over the pace of my work* (Sims et al., 1976, p. 200)
For choice of equipment/tools	*selecting the equipment they will use* (Sims et al., 1976, p. 197)
For choice of working method	*Discretion about procedures and means of doing one's work* (Sekhar, 2011, p. 31); *I am allowed to decide how to go about getting my job done (the method to use)* (Sadler-Smith et al., 2003, p. 718)
For the choice of criteria for evaluating the work	*The ability to choose alternative ends of goals in terms of which one's performance is judged* (Sekhar, 2011, p. 31); *My job allows me to modify the normal way we are evaluated so that I can emphasize some aspects of my job and play down others* (Sadler-Smith et al., 2003, p. 718)
To make the necessary decisions	*My job allows me to make a lot of decisions on my own* (Lloyd, 2008, p. 34); *The extent to which employees were formally given explicit and specific decision-making rights* (Sekhar, 2011, p. 31)
To define when to perform personal activities	*My job is such that I can decide when to do particular work activities* (Sadler-Smith et al., 2003, p. 718)
To define the objectives of the work	*I am able to modify what my job objectives are (what I am supposed to accomplish)* (Sadler-Smith et al., 2003, p. 718)
To define the scope of my work	*I have some control over what I am supposed to accomplish (what my supervisor sees as my job)* (Sadler-Smith et al., 2003, p. 718)

(continued)

Table 6.1 (continued)

Motivational dimension: **Autonomy**	
Identified characteristic	Strata of articles associated with the characteristic
To carry out the work independently of other	*I am able to do my job independently of others* (Lloyd, 2008, p. 34)
To control the physical conditions of the working environment	*How much can you control the physical conditions of your work station (e.g., lighting, temperature)?* (Pierce et al., 2004, p. 519)

Source The Author

Table 6.2 Motivational characteristics, identified in recent literature, associated with the *Feedback* dimension of the *job design* theory

Motivational dimension: *Feedback*	
Identified characteristic	Strata of articles associated with the characteristic
Feedback from superior	*Feedback from my superior on my job performance* (Foss et al., 2009, p. 881); *The feedback from my superior on how well I'm doing* (Sims et al., 1976, p. 200)
Feedback from co-workers (from peers)	*And co-workers on this job almost never give me any feedback* (Hackman & Oldham, 1975, p. 50)
Feedback from others in the organization other than the superior	*The extent of feedback you receive from individuals other than your supervisor* (Sims et al., 1976, p. 200)
Formal or institutional recognition	*Formal acknowledgment* (Foss et al., 2009, p. 881);
Feedback is given in a respectful manner	*The degree of respect and fair treatment I receive from management* (Galup et al., 2008, p. 63)
The return given is fairly designed	*The degree of respect and fair treatment I receive from management* (Galup et al., 2008, p. 63)
The quality of the feedback given by the organization	*The overall quality of the supervision I receive in my work* (Galup et al., 2008, p. 63)

Source The Author

is the service sector, Taylor's principles have also been applied in this type of environment.

The dimensions of variety, identity, and significance are associated with the attribution of meaning to work, having a considerable influence on the motivation, satisfaction, and productivity of workers. These are the dimensions that enable workers to experience the meaning of their work. Morin (2002) points out that even with the significant changes in the world of work, with the disappearance of

Table 6.3 Motivational characteristics, identified in recent literature, associated with the Identity dimension of the *job design* theory

Motivational dimension: **Identity**	
Identified characteristic	Strata of articles associated with the characteristic
Carry out a complete piece of work	*I have the opportunity to do an entire piece of work* (Coelho & Augusto, 2008, p. 171); The opportunity to *complete work that I started* (Foss et al., 2009, p. 881); *The opportunity to do a job from the beginning to end (i.e., the chance to do a whole job)* (Sims et al., 1976, p. 200)
Perform more than one complete piece of work	*I perform a lot of work from beginning to end* (Coelho & Augusto, 2008, p. 171)
View the other parts that make up the work as a whole	*In this job I have a complete view over the stages of the work* (Coelho & Augusto, 2008, p. 171)
Perform the work independently of others	*The opportunity to do my job independently of others* (Foss et al., 2009, p. 881)
Understanding the final result of the work	*and can clearly identify the result of their efforts* (Sims et al., 1976, p. 197)

Source The Author

permanent jobs and the emergence of new technologies and new forms of work organization, work remains an important value and a structuring element in our society. Thus, the perception that the work performed is meaningful remains a fundamental element for worker behavior.

The weakening of permanent work bonds, with the consequent increase in turnover, are essential elements in the new work environment and have a significant impact on the concept of career. Currently, the concept of career tends to be associated with the professional trajectory of each individual, detaching from the organization and the area of training. In this context, professionals live in a constant state of transformation and learning, from an individual perspective of career management. The job design, its complexity and inherent challenges are key pieces in the promotion of workers' development. This is a particularly relevant element in a society based on information, especially for *knowledge workers* and for knowledge-intensive companies.

6.3 Motivational Characteristics Present in the M-B-BP Approach

The work structured, executed, and managed within the concept proposed by the M-B-BP approach provides the fulfillment of the motivational demands according to the five dimensions identified by the research of Hackman and Oldham (1976).

Table 6.4 Motivational characteristics, identified in recent literature, associated with the Significance dimension of the *job design* theory

Motivational dimension: **Significance**	
Identified characteristic	Strata of articles associated with the characteristic
Work that allows you to influence the lives of other people (beneficiaries)	*the degree to which the job has a substantial impact on the lives or work of other people—whether in the immediate organization or in the external* (Hackman & Oldham, 1975, p. 161); *Job impact on beneficiaries is the degree to which a job provides opportunities for employees to affect the lives of beneficiaries* (Grant, 2007, p. 397)
Work that allows contact with the people benefiting from the work	*Contact with beneficiaries is the degree to which a job is relationally structured to provide opportunities for employees to interact and communicate with the people affected by their work* (Grant, 2007, p. 398)
The work should enable the worker to understand the impact of their work on the lives of the beneficiaries	*Perceived impact on beneficiaries is the degree to which employees are aware that their actions affect others* (Grant, 2007, p. 399)
The work should enable informal relationships to be established with other people in the company	*establish informal relationships with other people at work* (Sims et al., 1976, p. 197)
The work should allow for conversation with others during work	*job allows employees to talk with one another on the job* (Sims et al., 1976, p. 197)
The work must demand interaction with people	*job requires employees to deal with other people* (Sims et al., 1976, p. 197)*; the job requires a lot of cooperative work with other people* (Hackman & Oldham, 1975, p. 50)

Source The Author

In this subsection we will discuss the positive impact of the approach in each of the dimensions of the Job Design theory: ability variety, task identity, task meaning, autonomy, and feedback. By this we want to highlight that the M-B-BP approach is very conducive and suitable for modern people management practices. It increases people's satisfaction with work and, consequently, favors the emergence of desired behaviors, according to the attitudes defined as ideal for each job position.

Variety of skills. In the M-B-BP approach, the worker's performance is not restricted to the scope of a functional area. The worker has his or her skills available and used by different business processes of the company. Each business process has its functions, rules, customers, and specific deliverables to be performed. Thus, even though a lawyer, an accountant, a cost analyst, among other professionals, have a specific scope of action, in the M-B-BP approach they will be required to interact in different business processes, with different corporate demands. Instead of working on batches of similar transactions in a

Table 6.5 Motivational characteristics, identified in recent literature, associated with the Variety dimension of the *job design* theory

Motivational dimension: **Variety**	
Identified characteristic	Strata of articles associated with the characteristic
Activities	*I perform different tasks frequently* (Coelho & Augusto, 2008, p. 171); *job requires employees to perform a wide range of operations* (Sims et al., 1976, p. 197)
Skills	*I use different skills and talents in this job* (Coelho & Augusto, 2008, p. 171); *I use the relevant skills to perform my job effectively* (Lloyd, 2008, p. 34)
Knowledge	*I have very good knowledge of all facets of my job* (Lloyd, 2008, p. 34)
Of equipment/tools	*the degree to which employees must use a variety of equipment* (Sims et al., 1976, p. 197)
Of challenges/complexity of work	*The job requires me to use a number of complex or high-level skills* (Hackman & Oldham, 1975, p. 50); *One work characteristic that appears to encourage proactive behaviors is job complexity, which can stimulate creativity, intellectual flexibility, and feelings of responsibility* (Grant & Parker, 2009, p. 345)

Source The Author

functional area, without much customization and obeying a single leadership that is far from the real end customers, B-B-BP workers integrate and work in several teams, focused on different business processes. Each business process presents very diverse challenges that require different knowledge, skills, and attitudes. Thus, there is a greater challenge for professionals, removing them from the routine and boring work of traditional functional areas.

Task identity. In the M-B-BP approach all professionals involved in the business process have a common and integrated vision of the goal to be achieved. The key performance indicator (KPI) is the same for all workers who work along the business process, because as the name indicates, it should focus on the central or key aspects of the process. The fact that this indicator is comprehensive, portraying the perception of value delivered to the end customer, gives meaning and identity to the work of all involved, because it is not merely an intermediate indicator or with partial meaning. The KPI is configured as a broad instrument that points and measures something of value beyond the company, associated with the interests of end customers. Thus, every worker in the M-B-BP approach sees his or her tasks in a broad and well-defined way, including as to the end customers and the results to be provided to them.

Significance of the task. The need of the business process to deliver something of value to the end customer forces managers to discuss and explain what should be effectively delivered by the business process. There is a continuous and open channel with the stakeholders of each business process. This implies a continuous discussion about what should be delivered, when, where, how, and why. This last

Table 6.6 *Template* for suggestion and discussion of possible motivating aspects of jobs being created or redesigned

Workstation sizes				
Autonomy	*Feedback*	Identity	Significance	Variety
To judge and solve problems	*Feedback* from superior	It should cover a complete part of the work	Work that allows you to influence the lives of others (beneficiaries)	Activities
For choice of procedures/activities to be performed	*Feedback from co-workers* (from peers)	It should cover more than one complete piece of work	Work that allows contact with the beneficiaries	Skills
For choice of grid/work schedule	*Feedback* from others in the organization other than the superior	Allow you to view the other parts that make up the work as a whole	It allows to understand the impact on the lives of the beneficiaries	Knowledge
To set working time	Formal or institutional recognition	Perform the work independently of others	Enable informal relationships to be established with other people in the company	Of equipment/tools
To set the pace at which work will be performed	Feedback is given in a respectful manner	Understanding the final result of the work	Allow conversation with others during work	Of challenges/complexity of work
For choice of equipment/tools	The return given is fairly designed		Requires interaction with people	
For choice of working method	The quality of the feedback given by the organization			
For the choice of criteria for evaluating the work	***Direct feedback from the beneficiary***			
To make the necessary decisions				
To define when to perform personal activities				
To define the objectives of the work				

(continued)

Table 6.6 (continued)

Workstation sizes				
Autonomy	*Feedback*	Identity	Significance	Variety
To define the scope of my work				
To carry out the work independently of other				
To control the physical conditions of the working environment				
For the choice of workplace (home office, virtual office, company, …)				
To choose the type of service (virtual or face-to-face)				

Source The Author

one, the "why", brings light to the aspects of relevance and interest for the final customer, that is, what is being delivered by the business process. Meeting the needs of the end customer makes the business process worthy, as well as gives sense and meaning to the work of all professionals involved along the business process. Thus, in the M-B-BP approach everyone has a greater meaning to their work, which is linked to the end customer and to what is expected from the service or product being delivered.

Autonomy. In the M-B-BP approach, the employee works in one or more of the company's business processes. They have the autonomy to discuss with the managers of each business process their action agenda, as well as the best way to collaborate in specific activities. There is no boss figure typical of companies structured in functional areas, but collaborative teams that focus on delivering something of value to the final customer. It is not a mechanistic work imposed according to workloads by processing batches of similar activities, but team collaboration for the treatment and overcoming of unheard of issues and exceptions that may arise over time. Every worker along the business process has the competence and permission to interfere in the business process, either to change the processing flow of a specific instance or even to stop the operation of the entire business process.

Feedback. With the end customer of each business process well defined, as well as the value to be delivered to them, the M-B-BP approach points very clearly who should provide feedback to workers, as well as the relevant content to be provided. It reduces the risk of feedback to the worker coming from intermediate customers or even people not relevant to the work performed. Besides the dialogue with

the right person, the process of collecting feedback has a good direction on what should be asked, i.e. what really adds value. The same KPI that helps give identity to the work, helps to give accurate and effective feedback to workers.

6.4 Multifunctionality as an Instrument for Flexibility

So that the worker can demonstrate his autonomy in the most efficient way, realizing what is most important to be done at each moment, changing the work in execution if necessary, the employee must be satisfied with the work, so that there is no inhibitor of attitudes. This new work context oriented to business processes, according to the precepts of the M-B-BP approach, implies in multifunctional employees, with the ability to make the reading of the process and have the attitude to select and execute the most appropriate functions at each moment (on demand), considering the multiple instances running in the business process.

The administrative demand for multifunctionality became more intensely evident with the restructuring of organizations promoted in the last decade of the twentieth century, from functional structures to structures oriented to business processes. In companies this movement was called organizational reengineering, with the aim of generating less vertical or hierarchical organizations, that is, enabling the flat organizations, also called flexible organizations (Hammer & Champy, 1997; Ostroff, 1999). The functional areas of hierarchical organizations bring together people according to the similarity of their skills, providing a high level of functional flexibility due to the high level of redundancy of skills. This, for example, reduces the impacts of absenteeism in the workplace. The new flexible organizations or oriented by process, without the presence of functional groupings or some of these groupings, start to demand the multifunctionality of their employees, in order to preserve the levels of redundancy of labor to perform the functions of work and, consequently, to have the level of organizational flexibility required (Molleman & Slomp, 1999). Thus, we have the multifunctionality as one of the important resources to the competitiveness of organizations.

In some countries, employee multifunctionality is not allowed due to labor laws. In Brazil, only in 2017 there was a reform of labor laws that regulated the multifunctional activity exercised by numerous employees and categories. Until then, companies that practiced multifunctionality were exposed to the sanctions of the Brazilian labor courts, in particular to penalties associated with the "deviation of function" and "accumulation of function" of their employees. Before that, only a few business segments and professional organizations had managed to mitigate such risks, developing a long and costly process of discussions with society, in order to create laws specific to their demands regarding multifunctionality. Examples are the laws specifically aimed at radio broadcasters and port workers. The law regulating the profession of radio broadcaster (Brazil, 1978) describes not only the technical but also the administrative and commercial functions generally performed by these professionals within the broadcasting companies. Multifunctional

work in ports was regulated by the Port Modernization Law (Brazil, 2013), developed with the aim of making labor compatible with new technologies and cargo handling processes in modern port environments.

Thus, for the full implementation of the M-B-BP approach, with multifunctionality as a lever for autonomy and variety of skills for employees, it cannot always be applied in a broad and generalized way for all points of operation of the company. It is necessary to verify, for example, the framework of the labor laws of each country. In many countries, multifunctionality is considered synonymous with multipurpose or versatility. The adjective multifunctionality when applied to a worker indicates that this person is able, able to perform multiple functions, i.e., that require specific skills. The adjective multipurpose is associated with different uses, something less qualified and more focused on economy and use of human resources. In short, the multifunctionality develops and enriches the worker with the development of specific skills, while the multipurpose exhausts and stunts the employee only with more diversified work.

The overlap between the terms multifunctional and multipurpose occurs even among academics, resulting in questions about the adoption and importance of

Table 6.7 Contrasts between multifunctional and multipurpose/purpose work

	Polivalence	Multifunctionality
Carrying out the activities	Structured, predefined, and predominantly serial/linear (not concurrent)	In series or in parallel (concurrent), according to the executor's perception in the context of the moment (on demand)
Quantity and diversity of activities	Many, but close in sequencing: all horizontal/operational or all vertical/administrative	Many, predominantly mixed: both horizontal/operational and vertical/administrative
Skills required of the worker	Knowledge and skills to carry out the various actions of the predefined script	Valuing behavioral competencies, in addition to knowledge and skills, also the attitude to switch to another action according to the perception of demand
Objective of the approach	Additive: in the set of activities to be performed by the professional	Integrative: in the roles to be assumed by the worker within the process
Aspects most perceptible to the worker	Intensification of the pace of work due to the performance of multiple activities	Autonomy to decide what is most important to be done
More perceptible organizational results	Fewer employees resulting in optimization and more profit for the company	Reduction of hierarchical levels, greater flexibility for decisions and actions on demand, resulting in greater quality and employee satisfaction

Source The Author

multifunctionality for modern organizations. Below is an excerpt from a text that highlights such questioning (Beukel & Molleman, 2002, p. 483):

> In this paper, however, we take a closer look at this relationship between multifunctionality and quality of working life, and suggest that multifunctionality does not necessarily entail a positive experience for all employees.

In order to better understand the term multifunctionality, we conducted a content analysis of different articles on the subject in the context of People Management in organizations. Table 6.7 shows a comparison between the terms multifunctionality and multipurpose/polivalence.

Questions for Reflection

a. How do you define the three components of the Competence construct: knowledge, skill, and attitude? Which of them is more difficult to be worked on and developed by companies or even educational institutions?
b. What is the relationship between satisfaction, behavior, and attitude when discussing worker motivation?
c. Consider a group of professionals working within a business process of a specific segment. For this group, explore the five motivational dimensions of Job Design, comparing the traditional approach to work (organized by functions) with the M-B-BP approach.

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7 Technologies in Support of Management by Business Processes

Objective of This Chapter
By the end of this chapter the reader will understand some of the various aspects that make Information and Communication Technologies resources as a key enabler of core features of the Management by Business Process (M-B-BP) approach.

The dynamism of the business environment generates constant changes in market conditions and forces executives to react as quickly as possible, implying changes in the company's business processes. The information systems environment intrinsic to the operation and management of the company's business processes has always been one of the resources most affected by these constant changes. The logic implemented by the software, the structure implemented by the database and the means of communication of a software to the other systems are some examples of components of an information system that present high complexity, demand a long time to be changed and, when changed, significantly increase the exposure to failures and errors in the process, i.e., increase the risk.

Business processes are increasingly collaborative, that is, they involve several partner companies in the process operation. These processes go beyond organizational boundaries and involve a diversity of information systems. Besides the problems related to the difficulty of changing software, there is now the problem of the diversity of systems, of technological platforms on which they operate, of databases and all the other components necessary for the execution of an information system. Thus, the difficulties imposed by the software in the activities of management by business processes have increased. The traditional information systems, such as those directed to business transactions of an area, the online transaction processing (OLTP), carried out all the transactions of a business process within its scope. Thus, it was possible to follow its performance indicators and trigger actions based on the status of its attributes, because the entire universe

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of data and logic was under the control of a central software, whose incumbency was of an IT team.

For the current collaborative business processes, which involve several entities and several information systems, there is no longer technical feasibility of embedding managerial controls of the process in the various software related to its execution as it worked, until then, with OLTP systems. OLTP systems had analytical modules, the online analytical processing (OLAP), which besides generating analytical reports, triggered actions based on rules activated by system parameters (embedded workflow). Currently, the business process is no longer implemented under the direction of only one software; there are several softwares that execute it, but not all of them have facilities such as OLAP resources, workflow embedded. Another aspect to be highlighted is that it does not make sense to have these treatments for isolated activities or parts of the business process. Thus, the process management functions have to be implemented by a software layer above the operational ones, which covers the control and operation of all the other software involved in the process operation.

The problem is not only restricted to the fragmentation of software and technological components involved in the treatment of a business process, but also in the issue of the shortage of time for the identification of business events. Current competitiveness limits make companies operate at the limit of their resources, making each process abnormality a critical event that must be treated immediately. The identification of events throughout the process, in real time, is an important business factor that corroborates the demand for a management layer connected directly to the software that is executing the process. This demand makes traditional information system solutions unfeasible, such as algorithms for the treatment of performance indicators, balanced scorecard solutions, software for cost calculation, software for process simulation, among others. These solutions were designed to work offline, using databases and consolidated files referring to a specific period of dates.

The visualization or abstraction of the business process flow in real time, regardless of the number and location of the software that compose it, the monitoring of the process indicators or its parts, the triggering of actions based on events, among other features required to the management of modern collaborative business processes, require a software proposal and architecture different from the traditional ones. There are entities focused on the development and promotion of specific solutions for collaborative process management, such as the Object Management Group (OMG), which works on the development of open standards for the various stages of process management: design, distribution, execution, maintenance, and optimization. The software layer that helps the implementation of these steps is called by many authors and entities Business Process Management System (BPMS).

Business processes form an independent system with a life of its own, with increasing dynamism. They grow, shrink, join, or split, directly reflecting all changes in the business environment. Thus, business processes also have a life

cycle of changes not only in state (data), but also in structure (capability) and design (intentions expressed by rules). For these reasons, companies need flexible and adaptable solutions, such as BPMS solutions, oriented to the management of the life cycle of business processes.

7.1 Main Components of the Business Process Management System (BPMS) Solution

Figure 7.1 shows a schematic depicting of the main components of the BPMS software layer. There are several important aspects to be observed in this structure. We will expose the themes starting with the most common elements for organizations, which is their portfolio of information systems, going through the integration layer between systems and, finally, the management layer. As a visual guideline, we will analyze the concepts in the order going from the bottom to the top of Fig. 7.1. They are:

- the BPM solution preserves the investments already made in software by the various companies involved in the operation and management of the business process. These are large investments that have been made over the past decades and any proposal for broad replacement of information systems is unfeasible, not only for the financial issue, but also for the technical unfeasibility to meet

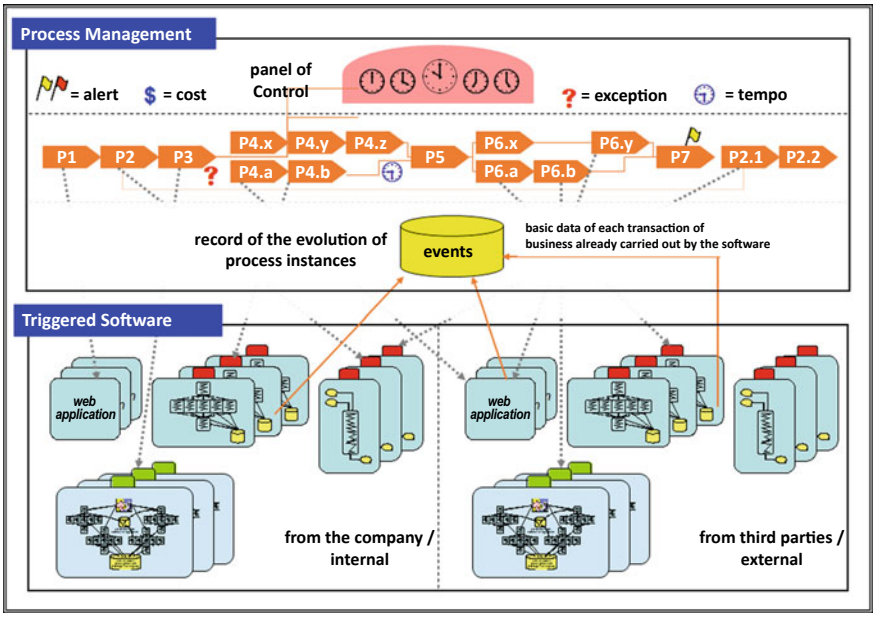

Fig. 7.1 Technology solution model for the M-B-BP approach (*Source* The Author)

the temporal issues. The BPMS proposal is to integrate and connect the already existing information systems to the management layer by business processes, either to capture data from the business, to check its operation status, to obtain data of its performance, such as time and throughput, or even to trigger it or send it a workload. This reality is portrayed in Fig. 7.1, in the area indicated as "driven software", where you can see icons that represent different technological generations of information systems, such as batch systems, OLTP, integrated and configurable and web applications;

- Note that, with the exception of web applications, which use newer technologies, all other groups of systems have a tab at the top, indicated in darker tone in the figure, which represents the component technology required for communication. Identifying and handling events along each procedure that composes the business process requires efficient interaction mechanisms. Furthermore, communicating by exchanging files, closing a communication cycle, for example, every 24-hour period, may be too time-consuming and does not meet the demands of today's business processes. Thus, the incorporation of modern system integration technologies is highly required for BPMS projects. For this reason, many authors label the BPMS solution as the junction and evolution of enterprise application integration (EAI) solutions with process automation or workflow solutions;
- another important aspect to be highlighted in the BPMS solution is the ability to manage an instance or occurrence of the business process throughout its entire process chain. Without the BPMS, this would demand a high volume of time and work, which usually involves accessing and searching different people and information systems. In the central part of Fig. 7.1, we can observe that there is the representation of a database for storing the events related to each instance of the business process. For each action performed, whether human or automated through software, this database of events is updated. It is not a copy of the executed business transaction, but only the register of some of its data that are relevant for the management by business processes. First, the transaction is performed in one of the several information systems and then this event is registered in the software layer responsible for the M-B-BP;
- the business process management environment is depicted in the upper part of Fig. 7.1, where there is the abstraction of the process flow. It is through this abstraction, which we call the business process management layer, that one can analyze the role played by the business process and track its macro-performance or some specific occurrence. The facility of working with abstract models of the business process is useful for several purposes of management by processes: to analyze the macro-rules of the business process, identify bottlenecks, simulate the impact of potential changes, analyze cost, time and other resources involved, among other purposes that will be discussed throughout this chapter.

7.2 Functionalities Required for the Business Process Management (BPM) Solution

In the following paragraphs the main functionalities required for a BPM solution are analyzed. These topics were obtained through surveys conducted with companies that are evaluating and selecting BPMS solutions and also with consulting and software companies that offer BPMS solutions. The set of functionalities is distributed along three subsections: resources for the optimization and the flexibility of the process operation, resources for the management of the process operation, and resources for the planning and the project of the process.

7.2.1 Resources for Optimizing Process Operation and Making It More Flexible

Flexibility to change the software connected to the execution of activities Having facilities to change or replace one or more software used in the execution of a particular activity of the business process flow. Processes are created or changed in runtime, "on the fly", immediately starting to run within the new context. This is the dynamism required for many business environments. For example, the customer service area needs to be informed about the geographic location of the product to be delivered to the customer; for this, the order tracking system needs access to the cargo positioning system of the partner company responsible for product transportation. The customer service process manager may decide to replace the service provider responsible for product transportation. At this point, the software layer for process management has to be agile and flexible to provide facilities for disconnecting a positioning software and replacing it with an analog of the new contracted service provider.

Monitoring of occurrences of problems in computing environments For the execution of a business process, several software can be activated; these can operate in different computing environments, inside or outside the company. The interruption or slowness of one of these softwares can compromise the execution of the whole process. Monitoring the status of the execution of the activated software is an important role for the system that manages the operation of business processes; the critical situations must be foreseen, as well as the procedures for the recovery and continuity of the process. In practice, the process management layer should allow the configuration of rules that describe possible events that may occur with the technological platforms involved and the actions to be taken that aim at the continuity of the process operation.

Human interaction in the operation of the process To have technical facilities for the definition of points of human interaction, such as activities that require analysis and approval of a professional or for the registration and routing of the way to handle a particular occurrence of exception identified by the system. It is quite common that business processes require some kind of human interaction; this way, the process

management environment must have facilities for creating, changing, and excluding means of interaction of the process with people. These facilities contemplate environment of editing, tests, prototyping, publication, and operational presentation of screens for the user's interaction with the environment of process management.

Flexibility to change the flow of activities according to the context During the execution of an instance of the process, more specifically in a step that requires human interaction, the professional who is performing the interaction may realize some inadequacy of the sequence of following steps for that specific instance. The environment of management by processes should be flexible enough to accommodate and document the change, for example by removing the obligation of the specific instance to go through one of the pre-established steps. This type of feature is one of the great differentiators of the management environment for process automation tools. This environment is called an orchestration-centric context-driven environment.

Manuals and online instructions that employ the operational diagrams of the process The diagrams and other logical abstractions used for the execution and management of processes are structured in objects, properties, and relationships stored in digital databases. These diagrams can be "assembled" in real time from the users' request, always portraying the current and operational version of the process, and are useful to clarify doubts, discussion, and analysis of the process, training accomplishment, among other applications. These online documents can replace with many advantages the traditional user operation manuals, training materials, and help menus to help clarify doubts.

Operational process version management Business processes are in constant change and evolution. Changing their rules, activity flows, executors, and software involved in their execution is one of the situations that require different versions of the process in a short period of time. Managing version history is a demand for process management solutions. Many times there is the need to have different versions of the process in operation, allowing, for example, an operational version of the process only for new instances and prevailing the previous rule for instances with previous date. In short, it is common to find a same process with two or more versions in operation, portraying different rules for different moments of the process.

Flagging real cases (instances of the process) for further analysis To have facilities that allow those involved in the execution of the process to indicate potential improvements, pointing operational instances of the process as examples of situations that illustrate problems or opportunities. All variables of the business process for that specific instance, pointed out by the process analyst as exemplary for the situation to be discussed, are registered in a database for analysis at any time. This facilitates the exposure and spontaneous collaboration of the people involved in the operation and management of processes.

7.2.2 Resources for Process Operation Management

Identification of bottlenecks Identify activities that are reducing the productive capacity of the process, allowing to establish rules that have the throughput and the execution time of the activities as parameters for the triggering of corrective actions.

Suggestion of potential improvement points. From the identification of the standard-path and average time traveled by most instances of the process, analyze those that presented greater deviation in relation to the average standard, verifying similarities between their attributes, so that potential causes of delay or acceleration of the process can be suggested.

Pointing of the critical path and other data of the operation in real time Pointing in real time the indicators of the process operation: performance of the moment, established goals, numbers obtained by analogical benchmarking. Allowing the comparison of these numbers between different versions of a process, as well as its use in the simulation environment, graphically verifying the result of changes in the process.

Analysis of the resources allocated to the process (designed, installed, in use, and idle) Mark, for each activity of the process, the resources needed, whether human or material, such as computer and printer. For each resource, indicate the projected quantity, the ones that are actually installed, the ones that are in operation and, consequently, the idle ones. Allow these quantities to be used as input to the process simulation algorithms.

Identification of necessary resources Allow classifying families of resources that can be allocated to processes, registering not only their definition, but also their attributes such as cost and unit of measure. Among the examples of families of resources there are human, computational, and operational resources.

Cost calculation Have available different algorithms for cost calculation, working both with the values assigned in the design phase and with those obtained in the process operation. Cost calculations are applied in several versions of the process: planned, current or in execution and in simulation versions, once its values are visualized in different forms, including in diagrams and other logical abstractions used by the process manager.

Assignment of goals Allow the assignment of values to be achieved by the operation of a particular process, such as the operating results of processes considered benchmarking.

Control panel (management cockpit) Having the facilities of a virtual environment that allows process managers to interact, monitor, and analyze the current performance or simulations, selecting different angles of analysis: goals, costs, resources, activities, throughput, times, and other attributes and performance indicators of the process. This environment is the central point for process management and control. In the upper part of Fig. 7.1, there is the representation of a control panel presenting some of the indicators required for management by processes.

7.2.3 Resources for Process Planning and Design

Simulations Allow the realization of dynamic simulations of processes making adjustments until the desired result is obtained. At each new simulation, generate values for each one of the performance indicators selected for the process. Allow comparisons between the results obtained in the different simulations and of these with the data of the process in force.

Evolutionary history of the process Storing the different operational versions of the process, as well as the values obtained for its various performance indicators.

7.3 Culture and Organizational Climate for the Development of the Business Process Management System (BPMS) Solution

We present below two motivators that have driven BPMS solutions, both originated from the business environment, the first is related to the corporate merger and acquisition process, and the second to the tension generated by financial scandals in large corporations:

- companies have acquired during the last two decades a wide variety of solutions in the form of information systems, many highly specialized and focused on specific functions, labeled as "killer applications", and of broad and generic applications, focused on the company's support activities. The portfolio of corporate information systems, which was already undergoing a growth process, was further boosted by the worldwide phenomenon of mergers and acquisitions. These two movements elevated not only the total capital invested in IT but also the difficulty in managing IT resources and the demand for greater use of these resources and greater aggregation of value to the business;
- Financial scandals at apparently safe companies, such as those at Enron and WorldCom, have prompted regulators and investors to demand greater transparency and control of corporate management. Corporate governance committees were set up to ensure proper risk management in corporations that

involves monitoring all the main resources and processes linked to them. As an example, we have the governance practices of IT resources, which are an integral part of corporate governance, whose goal is greater control of the structure, processes and leadership of the company's IT, ensuring that this area is able to sustain and expand the organization's strategies and objectives. The enterprise governance movement further elevates the rigor and requirements for the BPMS environment.

These two organizational factors increase the possibility of the IT area adding greater value to the business. There is a broad information system structure that already operates at large companies, with many integration problems that, when adequately treated, might add several benefits to the business. One of these benefits, already expected and demanded by organizations, is the availability of more information, automation, and control over business processes.

From the point of view of organizational culture, we can state that the architecture of the BPMS solution, which is being developed by several organizations, such as OMG, is extremely simple and easy to be understood by business professionals involved with process management. An example of this is the graphical notation that is being used to represent the semantics of business processes, called business process modeling notation (BPMN). The purpose of this notation is to support process management both from the point of view of technical users and business users, providing an intuitive notation to these users, even in cases where the semantics of complex processes must be represented. BPMI.org, the organ of the current OMG, released the first version of BPMN on August 25, 2003.

For business processes that relate to a wide range of activities, organizations, areas, and professionals, the notation for business process management, BPMN, is very pertinent and appropriate. It is based on a process-centric work methodology that is more natural and intuitive for business analysts to use. The specification work starts by the analysis of the process control and message flows. This information is part of the daily operation and management of business processes and their users, a situation opposed to other notations used, such as the unified modeling language (UML), which is object-oriented. The UML approach starts by the discovery of objects through diagrams of the static structure to later employ diagrams for the discovery of behaviors of these objects. Objects are not part of the usual repertoire, vocabulary, and working method of business people, which restricts the application of UML to the audience of IT specialists.

The aspects related to the way of structuring the reasoning and of idea units possible to be specified compose the study objects of ontology, a very important science when the main subject is notation.

7.4 Business Ontology

Ontology is the science that studies beings and their properties; the application of this science in the administrative universe is called business ontology. The use of

this science in the business environment promotes the standardization of vocabularies among the companies participating in the collaborative environment, the reuse of components, the identification of similarities between objects, among other benefits. For the management of current business processes that require constant adjustments to meet the alternations of the business environment, the enterprise ontology is very beneficial. It improves communication and integration between companies and facilitates the search for digital services (web services) to meet a certain context, working with a larger scope of services as an alternative for a situation, since it enables the analysis of similar services. A practical example of benefit in the communication process is to imagine a professional who says "select product", while the other says "choose product". It would be very difficult to know if it is the same process if there is no notation generated within the principles of the business ontology.

In terms of business process specification and support of information technology resources, there seems to be a consensus among current researchers regarding the need to use enterprise ontology for the development of business models structured by means of processes—meaning hierarchy of activities. What does not prevent that, within the same company or chain, object-oriented models are used to specify the software components that assist in the implementation of business processes. Terai and Sawai (2002) present in their studies a very clear division between models for business environment and models for software components repository. The first is oriented by activities and processes and the second, object-oriented.

The business processes of the digital economy of the current information society present an inseparability between technical and social resources (Orlikowski & Scott, 2008). This strongly imbricated nature between technologies, people, and matter in the business environment configures a work practice defined as sociomaterial. This environment demands ontologies that can encompass and harmonically integrate both the technological artifacts (applications, databases and their derivatives) and the social aspects (actors, their locations, and adequacy of artifacts to these actors) of the business process. Researchers in the areas of Computing, Administration, and Information Sciences point out the need to develop natural languages (lexicons) consistent with the demands for sociomaterialist ontology. These lexicons should allow the "rational reconstruction" of the business environment context, through formal logic, which should make use of a set of analytical categories (Habermas, 1979).

Gaskin et al. (2014) proposed a sociomaterialist lexicon framework to be applied in the design of business processes. This lexical framework consists of seven analytical categories: (1) the type of activity being performed; (2) the configuration of the actors; (3) the location of the activity; (4) the modality of the tool; (5) the ease of recognition (affordance) as a tool of the artifact being introduced to perform the activity (constitutive sociomaterial relation); (6) the type of artifact used and/or produced by the activity; and (7) the data flow being used or produced during the activity (constitutive relation).

Table 7.1 Sociomaterialist lexicon proposed by Gaskin et al. (2014)

Name and definition of lexical category	Possible values for category
Type of activity: refers to the purpose of the of the activity	Generate, transfer, choose, negotiate, execute, validate or train
Actor configuration: refers to the number and grouping of actors involved in the activity	Individual, group, many individuals, many groups, or individuals & groups
Location of the activity: where the activity takes place in relation to the actors	Close: actors are in close proximity to each other at the activity site On site: actors are distributed in the location where the activity takes place Remote: actors are distant from the location where the activity is carried out Mixed: a combination of the previous types
Tool modality: refers to the underlying materiality of the functionalities offered by the tool to perform the task	Physical or digital
Tool Service perceived by the actor: refers to the specific way of appropriating the tool during task execution	Represent, analyse, transform, control, cooperate or store
Type of artifact: refers to the purpose of the artifact being used for input, for update, or as output, resulting from an activity	Specification, prototype/draft, implementation, process planning or knowledge
Data flow: refers to how a tool affects or relates to an artifact during task execution	*Output*: the artifact does not exist before the task and is generated by a tool during the task *Input*: the artifact exists before the task and is used as input by a tool *Update*: the artifact exists before the task and is updated when the task is finished

Source The Author

Table 7.1 presents the definition of each of the seven analytical categories that make up the sociomaterialist lexicon framework of Gaskin et al. (2014). It is observed that these are categories that allow abstractions of the highest levels of a business process, covering all its extent and complexity, including the various activities of social nature. We consider important the recognition of this information by business process managers, for example, when specifying requirements for acquisition of BPMS systems, as it presents an enterprise ontology adequate to the challenges of the current business environment.

Questions for Reflection

a. What is the relevance of the BPMS solution in preserving the already existing software in the organization, bringing them closer through the integration layer between information systems?

b. Analyze the importance of the Events database, one of the constituent components of the BPMS according to Fig. 7.1, for the feasibility of the functionality "identification of bottlenecks" and "critical path identification".
c. If in Fig. 7.1 the database shown stores data from the transactions referring to the processing of each instance of process, where would be the data referring to the description of the process' operation logic, that is, the objects, the properties, and the relations between them?

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8 Analysis of the Components of Business Process Management System (BPMS) Technology from the Perspective of a Practical Case

Objective of This Chapter
By the end of this chapter the reader will understand the components of Business Process Management System technology, as well as their role in implementing some of the key features of the Management by Business Process (M-B-BP) approach.

In this chapter we will discuss the main components of BPMS technology, through two stages: in the first we will present the theoretical foundation of BPMS technology and, in the second, a practical experience exploring BPMS in the context of the analysis of a practical case. To keep the focus on the components, we chose to analyze not a broad and complex business process, but something more specific, a business transaction in the context of a process.

8.1 The Business Process Management System (BPMS) Architecture

Before presenting and discussing in depth the components of the BPMS, central object of this chapter, it is important to understand the architecture of the BPMS solution. The presentation of this architecture begins with the importance of the availability of an effective environment for integration between information systems. The BPMS conceptual model values the investments already made in software by the organizations involved with the business process, differently from the reengineering strategy of the 1990s. At that time, with the wide adoption and expansion of database management systems in organizations, it was imagined that it would be possible to integrate the various systems of the organization by means of a database recording the various business transactions. This was one of

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the intentions of many of the initial purchases behind the purchase and implementation of the Enterprise Resource Planning (ERP) system. There was an idea of discarding and replacing legacy information systems with the ERP system, a fallacious marketing that quickly proved to be mistaken.

In the BPMS conceptual model, the legacy information systems, hosted in different computing environments, continue to execute the operations required for the business process, as can be seen in the "computing environments" layer of Fig. 8.1. These legacy systems are coordinated, "orchestrated", by the BPMS process management environment (BPM). The conceptual model of the BPMS is not based on the construction of software or modules of information systems, but on the junction and orchestration of parts of already available software (AALST, 2004).

The activation or cancellation of a legacy information system via BPMS occurs according to the rules of the business process embedded in the BPM layer, using connectors and adapters for communication with the information systems. The connectors and adapters are available in the technology integration environment (AIT), as shown in Fig. 8.1.

The concepts presented so far allow a general understanding of the fundamentals, the proposition, and the architecture of BPMS. For understanding and discussion of some of its critical aspects, it is necessary to understand the internal

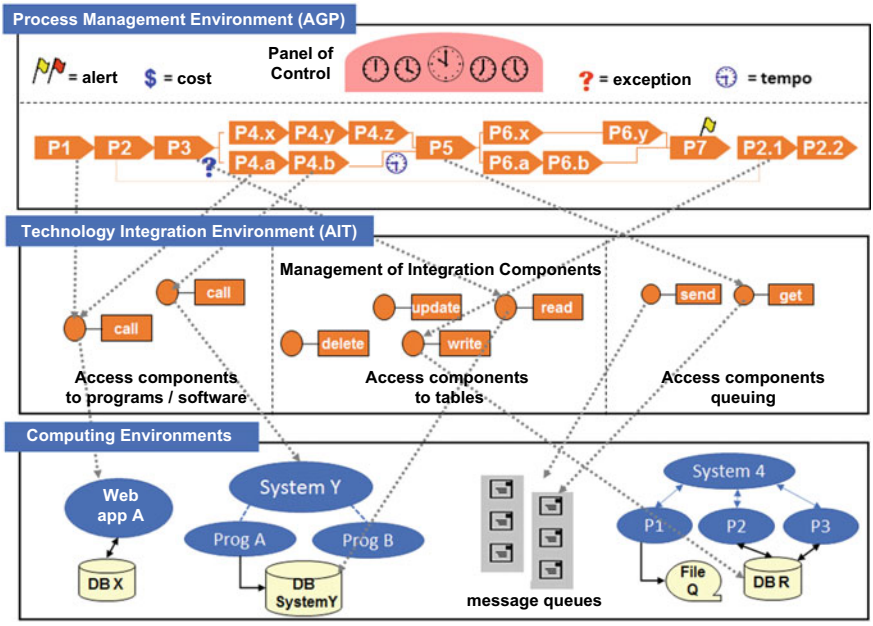

Fig. 8.1 Main components of the BPMS conceptual model (*Source* The Author)

operation of the BPMS tool. For this, it is requested a greater detailing of each of its internal components of the BPMS, which will be analyzed in the next subsection through the description of a practical case.

8.2 Analysis of the BPMS System Implementation Case

The company associated with the case analyzed Insurance Company X, one of the largest insurance companies, is present in 33 countries, with operations distributed in more than 132 offices. Founded at the end of the eighteenth century, it initially offered marine insurance, but soon began to offer commercial and personal insurance as well. In Brazil, operations began in 1973 with the acquisition of shareholder control of the oldest insurance company in Latin America. Currently, Insurance Company X still operates in Brazil with its headquarters in São Paulo, the location of the data collection associated with the case analyzed. In the personal insurance line, Seguradora X's main focuses are high-value automobiles, boats, executive jets, and personal assets, such as works of art, antiques, and collections. The commercial insurance portfolio covers maritime operations, transportation (all modes), group life insurance, several corporate risks, and mass-market insurance, among others. Seguradora X do Brasil has a team of approximately 250 employees.

Origins of the initiative to improve processes through BPMS at Seguradora X do Brasil In 2003, to increase its competitiveness, Seguradora X do Brasil started the Six Sigma project, which generated several initiatives aimed at improving its processes. In the same period, Seguradora X in the United States concluded a study on the possibilities offered by the business process management system (BPMS) technology in the operation, support, and improvement of processes. From this study, a corporate recommendation for the use of BPMS software was derived, which culminated with the approval of a corporate BPMS solution developed by an English software house.

The main focus of the Six Sigma project was the Operations area of Seguradora X. In the company's organizational structure, this area was part of the Operations and Technology Board, also responsible for the adoption of new technologies. This facilitated the visualization of opportunities to use BPMS technology, as well as its implementation and evolution, since the area responsible for implementing the solution was also the main user area. Understanding that BPMS technology had great potential to drive the process improvement initiatives targeted by the Six Sigma project, the Operations and Technology Board of Seguradora X do Brasil initiated, in 2003, a pilot project for process improvement through BPMS technology, which had as its main purpose the "insurance quotation" process.

The experience was very successful and motivated the creation of a program to implement BPMS technology in other processes. The BPMS system began to be understood as the main enabler for process improvement, often being confused with the Six Sigma project initiative itself. In August 2005, ten processes had already

been improved with the aid of BPMS technology and eight other processes were in progress.

Approach for selection of processes to be improved via BPMS There was the need to define criteria for the selection of processes that would be worked on by the Six Sigma project team, considering that the good results achieved by the pilot project aroused the interest of several internal groups of the organization. The criteria adopted by Seguradora X were:

a. the process improvement initiative should ensure a high financial return or significant changes in the business environment (qualitative gains);
b. process should be short and of low complexity or, if it was an extensive and complex process, that could be implemented in stages, gradually expanding its scope as positive results were achieved. Therefore, the adopted strategy for process improvement was to implement gradual improvements, instead of promoting radical and broad scope changes.

Below, we describe the process "Handling of Claims with Reinsurance", which has already been improved with the help of BPMS technology. In addition to describing the purpose, the operation of the process and the points where BPMS technology was applied, the main gains, both qualitative and quantitative, resulting in the business of Seguradora X do Brasil are also explained.

The process "Treat Occurrence of Claim with Reinsurance" The Brazilian legislation that regulates the activity of insurance companies requires that high-value insurance be carried out in conjunction with a federal entity called the Instituto de Resseguros do Brasil (IRB). Due to this requirement, the insurers pass on to the IRB a percentage of the premium paid by the insured, which varies according to the value and type of the insured item. In the event of a loss, however, the IRB is jointly and severally liable with the insurer, assuming responsibility for a percentage of the compensation established by the insurance. Thus, when a loss with reinsurance occurs, the insurer must inform the IRB of the occurrence, so that the institute is financially prepared to make the payments due to the insurer. After the IRB notification, the insurer obtains more complete data on the loss, gathers documents, and makes the payments of compensation to the insured, which may occur in one or more installments. At each payment made, the IRB must be informed in order to make the payments of the percentages due to the insurer. Figure 8.2 presents a process diagram that describes the activities performed for the execution of this process.

The main objective of the implementation of BPMS technology in the process was to reduce the time to send notifications to the IRB, both of the occurrence of the claim and of making a payment to the insured. As a consequence, two benefits would be provided: first, Seguradora X do Brasil would no longer be subject to the fines applied by the IRB when the notification of loss occurred outside the stipulated regulatory timeframe; second, the timeframe to receive the amount due by the IRB would be reduced, resulting in financial gains to Seguradora X. For the company,

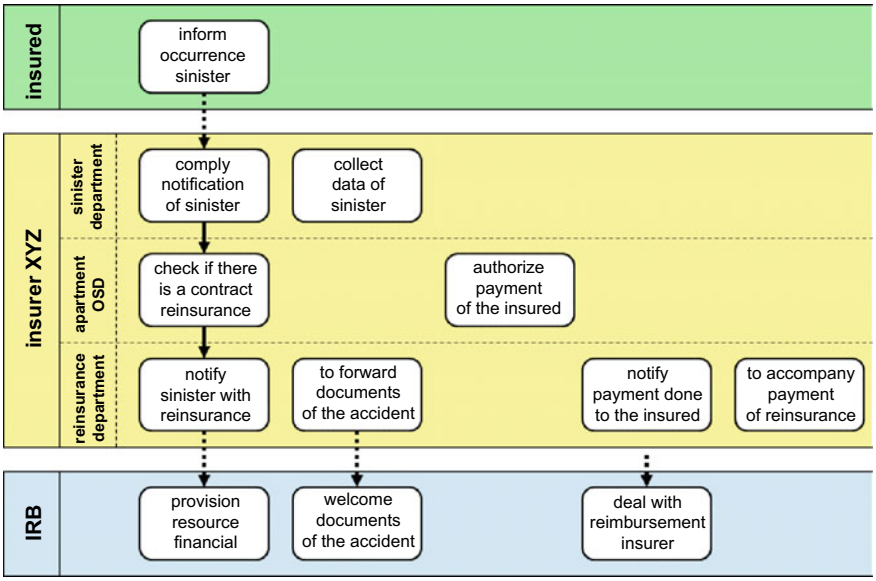

Fig. 8.2 Diagram of the "Handling of Claims with Reinsurance" process (*Source* The Author)

the importance of this process is perceived by the total number of occurrences in a month: an average of 80–100 notices of loss per day, 10% of which are reinsured by the IRB, that is, approximately 180 claims per month require reinsurance from the IRB.

The following is a detailed description of the activities performed by the process "Handling of Claims with Reinsurance". To facilitate understanding of the process, its activities were subdivided into two subprocesses: "Notify Occurrence of Claim to IRB" and "Redeem Reinsurance Amount". The activities described resulted from the work of process improvement through the BPMS technology.

8.2.1 Activities of the Subprocess "Notify the Occurrence of a Claim to the IRB"

The actors of the subprocess "Notify Occurrence of Claim to IRB", their perceived events, the sequence of occurrence of these, as well as the time between them are described in the interaction diagram presented in Fig. 8.3.

The following texts are identified by letters, establishing a relationship between the events of the subprocess described in Fig. 8.3, also described by letters, and the texts that describe it. Let's look at the description of the ten events in Fig. 8.3:

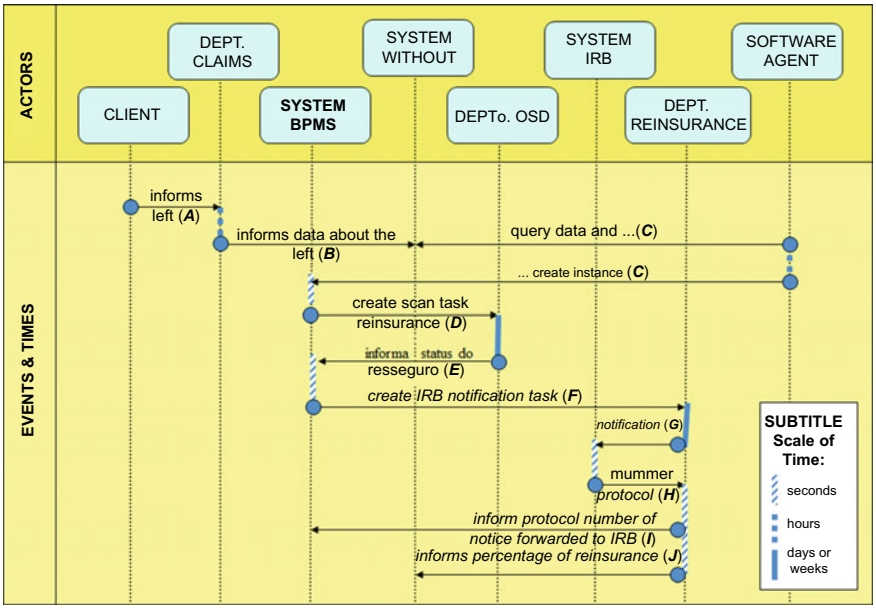

Fig. 8.3 Interaction diagram for "Notify Occurrence of Claim to IRB" (*Source* The Author)

a. the process starts when a notification of occurrence of a claim is received by the responsible department (claims department); this can occur in different ways: by phone, fax, or email. Such an event is characterized by activity "A" of Fig. 8.3;
b. After preliminary analysis by the Claims Department, the data relating to the insurance and the claim are entered into the Claims Control System (SIN system), processed in a large-scale computer environment (mainframe platform);
c. daily, at the end of the day (time event), an agent software copies to the database of the BPMS system the claims data recorded in the SIN system, creating a process instance for each of the claims;
d. Once a claim instance is registered in the BPMS system, a task is automatically created in the to-do list of the professional in the area responsible for insurance, a department known internally by the acronym OSD (Operational Services Department), which consists of checking the status of the reinsurance, i.e., whether or not there is a reinsurance contract for that claim;
e. if there is reinsurance, the value of the percentage to be reimbursed by the IRB is informed to the BPMS system by means of a human–machine graphic interface ("system screen"), developed in the BPMS system's own interaction tools environment. If there is no reinsurance, the instance of the process created in the BPMS system, as described in activity "C", is marked as closed;

f. by the fact that the reinsurance contract exists, the BPMS system automatically creates a task in the worklist of the Reinsurance Department so that the notification to the IRB can be made;
g. the Reinsurance Department notifies the IRB by entering the claim data into the IRB's own information system—IRB system—available on the internet (web application);
h. the IRB system returns to the reinsurance department of Insurer X a protocol number that proves the date and time of the claim notification;
i. the reinsurance department enters into the BPMS system the number of the protocol received by the IRB;
j. finalizing the subprocess, the reinsurance department enters the reinsurance percentage into the SIN system.

8.2.2 Activities of the Subprocess "Claiming Reinsurance Value"

The actors of the subprocess "Redeem Value of Reinsurance", their perceived events, the sequence of occurrence of these events, as well as the time between events, are described in the interaction diagram presented in Fig. 8.4. The following texts are identified by letters, thus establishing a relationship between the events of the subprocess described in Fig. 8.4, also identified by letters, and the texts that describe it. Let's go to the description of the seven events of Fig. 8.4:

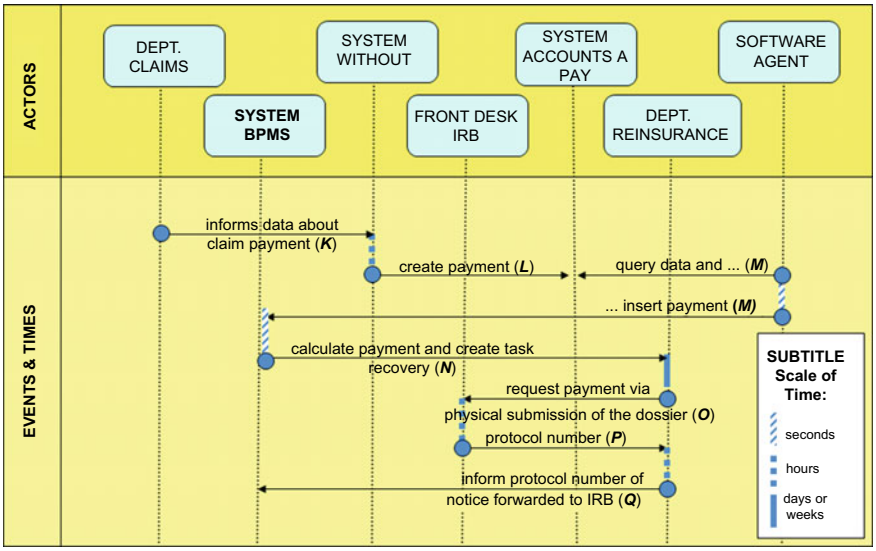

Fig. 8.4 Reinsurance value redemption subprocess interaction diagram (*Source* The Author)

k. The process begins when the claims department enters the amount of the indemnity to be paid to the insured into the SIN system, which may be paid in one or more installments;
l. daily, the SIN system generates a file containing data on payments of claims to be made, used as input by the accounts payable system for the creation of instances of payments to be made;
m. an agent software extracts from the database of the accounts payable system the payments being made on the day and enters them into the BPMS system;
n. the BPMS system calculates the amount to be recovered for reinsurance and creates a task in the to-do list of the reinsurance department so that it notifies the IRB;
o. the reinsurance department notifies the IRB of the need for the financial counterpart of this entity for the payment of the claim by means of forwarding a dossier on it, via courier (physical remittance of documents);
p. the IRB reception provides a protocol number that formally registers the notification made by delivering the documents;
q. the reinsurance department enters into the BPMS system the number of the delivery protocol informed by the IRB, and the file is delivered.

8.3 Gains Provided by the "Handling of Claims with Reinsurance" Process

Seguradora X do Brasil found several benefits in the process "Handling occurrence of claims with reinsurance" as a result of the adoption of BPMS technology to support its operation. The most significant gain was the reduction in the time taken to notify the IRB of the occurrence of a reinsurance claim, from 107 to 27 days. In the situation before the introduction of BPMS technology, there was a risk of loss of files in which the data on the claim was recorded and there was no precise control over the situation of each one. The process was very bureaucratic, documents circulated with stamps and signatures, and the various areas involved maintained private control spreadsheets.

Another benefit perceived was related to the reduction in the fines applied by the IRB due to the issuance of the notification of occurrence of loss after the regulatory deadline. The reduction of these expenses with fines, plus the financial gains due to having the refund from the IRB earlier, provided a gain of approximately US$200 thousand per year. The continuous improvement of the process is another factor perceived as a result of the BPMS technology. The greater operational visibility of the process is obtained through the to-do lists, as well as the managerial visibility of operational activities that happens through watch lists. This last list produces instantaneous information about the total of pending instances in each activity, total instances already processed, and critical path, among others. Such

information is used to define events that can trigger rules that result, for example, in the triggering of alert messages to executors and managers (Ross, 2003). This information makes everyone more committed to the process; as a result, it is observed a significant improvement in the process.

8.4 Exemplifying the Components of the BPMS System from the Case Analyzed

To discuss the components of the BPMS system, we adopted the framework proposed by Krafzig et al. (2004), composed of 11 components: design tool, deploy & configure, monitor & management, process manager, process engine, process definition repository, process instance repository, transaction manager, connector framework, middleware, and backend applications.

As a management tool and not of process execution, the BPMS system plays the role of organizer and controller. Such a characteristic makes many call it as business process "orchestrator", making a direct analogy to the important work performed by the conductor in an orchestra. Corroborating with this perspective, we have that, in the case study, all the outputs of the BPMS system, stated in Figs. 8.3 and 8.4, are related to the organization and management of work: information "D", described in Fig. 8.3, notifies the OSD staff about the need to check if there is reinsurance for a particular claim; information "F", described in Fig. 8.3, notifies the reinsurance department staff that they need to communicate to the IRB about the occurrence of a claim with reinsurance; information "N", described in Fig. 8.4, notifies the reinsurance department that Insurer X has already paid the insurance amount to the customer, and therefore it is the time to collect the counterpart from the IRB.

The rules that command the BPMS system to trigger each of the information are stored in the BPMS component called by Krafzig et al. (2004) as "process definition repository". In this component, are described the activities, the possible sequences of work, the rules for identification of start and end of each activity, among other important information to the "orchestration" of the process. All this information is introduced into the BPMS system by the business analyst, who should focus on the aspects of the process and business environment, even if he is not a profound connoisseur of programming languages and other information technology resources. The business analyst inserts into the BPMS system the information related to process control by means of diagrammers, also known as "design tools", as called by Krafzig et al. (2004) when describing the several components of the BPMS system.

The "design tool" is fundamental to develop the specification of the business process logic. Process diagrams, such as the one depicted in Fig. 8.2, and interaction diagrams, exemplified in Figs. 8.3 and 8.4, are some examples of diagrams available in BPMS tools. Business rule descriptions, events, and actions can be specified for various diagram objects; for example, one can define for each arrow in Fig. 8.2—input from one process and output from another—the event required

for its "trigger". Design tools store and manipulate data located in the BPMS component called "process definition repository" (Krafzig et al., 2004).

From the process control instructions inserted by the business analyst via diagrammers and other graphic facilities offered by the BPMS system, the executable code (software) to be used by the BPMS system in the process monitoring is generated. The source code generated follows the standards of BPMS technology and is called business process modeling language (BPML). The BPML software routines are constantly interpreted and executed by the "process engine", one of the components of the BPMS system according to Krafzig et al. (2004).

The BPMS system also allows facilities for people interaction. Several information from the system to the people/departments have already been described, remaining to describe the reverse flow, from people/departments to the BPMS system. For this, note that Figs. 8.3 and 8.4, show the following flows: information "E", described in Fig. 8.3, the OSD department informs the percentage value of the total insurance to be refunded by the IRB; information "I", described in Fig. 8.3, the reinsurance department informs the protocol number provided by the IRB when sending the notification of occurrence of a claim with reinsurance; information "Q", described in Fig. 8.4, the reinsurance department informs the protocol number provided by the IRB when delivering the claim file. All this information is stored in the BPMS component called "process instance repository", according to the structure of components proposed by Krafzig et al. (2004).

The software that plays the role of the "process engine" is processed directly over the two data repositories of the BMPS solution: "process instance repository" and "process definition repository", as described in the BPMS framework proposed by Krafzig et al. (2004). This is due to the strong dependency of the process engine in having access to data from these two repositories to effectively control the process. We will exemplify such dependency, analyzing below a practical example of the case studied. Initially, we describe the operations necessary for the routing and control of the process and, subsequently, we present the contents manipulated in the two repositories.

The description of some operations required for the routing and control of the process is as follows: once a claim instance is created in the BPMS system, an event perceived by the arrival of information "C" (described in Fig. 8.3), one of the professionals of the OSD department must be notified to verify the existence or not of a reinsurance contract for that claim. The rule for selecting the OSD professional to perform the query is rotating, that is, it will always be the employee who has been without receiving a request for the longest time. The request forwarded to the OSD professional is characterized by sending the information "D" in Fig. 8.3. If the OSD employee, who received the verification request, does not respond within 24 hours, an email alert will be issued to the employee's electronic mailbox. After that, another 24 hours are counted and if there is no return, a notification will be issued to the employee's superior and the claim to be researched will be transferred to another analyst in the OSD department. If the OSD department informs that there is a reinsurance contract, that claim is marked as eligible for reinsurance and the Reinsurance department will be contacted to recover the amount from the IRB.

In the Process Definition Repository the values of several parameters necessary to control the process are stored. The BPMS system presents to the business analyst, in a graphic and intuitive way, a list of variables to be filled in for the definition of a business rule, from the event that initiates it until its conclusion. In the example described, the arrival of information "C" to the BPMS system is monitored by the business rule "Handle New Claim Occurrence". As soon as a new occurrence is identified, the rule should "immediately" send an email to the OSD professional—instead of "immediately" it could be "after 24 hours" or "every 15th of the month" or any other time mention that is defined through a variable stored in the Process Definition Repository.

In terms of data structure, there is a great detailing and specialization so that the software can handle all possible complexity to be required. In the example, the definition of sending an email to the employee after 24 hours without reply, the specification of the time period is made by marking the numeric value "24" for the variable "waiting time" and the content "H" for variable "unit of measure", representing that it is hours the amount of time informed.

The routing of the process flow, for example, instead of doing after 24 hours without response from an employee, also involves variables that are with their values stored in the "Process Definition Repository". The definition of settings (or parameterizations) of the BPMS system occurs through the Deploy & Configure component as described in the BPMS framework proposed by Krafzig et al. (2004). It is from these components that data are inserted, changed, or deleted from the "Process Definition Repository".

In the Process Instance Repository the path already traveled is registered (activities performed) for each one of the instances of the business process. In the example above, an instance of occurrence of a claim can be perceived by the BPMS system and be in one of the following stages, that is, processing position within the process flow:

- awaiting opinion of the OSD professional;
- awaiting opinion from the OSD professional for more than 24 hours;
- awaiting opinion from the OSD professional for more than 48 hours;
- closed due to no reinsurance;
- awaiting notification to the IRB;
- awaiting payment from the IRB;
- closed because there was a payment from the IRB.

Each information that arrives or leaves the BPMS has its basic facts pointed (recorded) in the Process Instance Repository. When you have the identifier number of a particular instance, you quickly know its situation within the business process, just by accessing the last occurrence recorded in the Process Instance Repository. It can be said that the Process Instance Repository deals with the necessary data for the operation and management of the process (runtime).

Returning to the description of the BPMS components according to the framework proposed by Krafzig et al. (2004), there is the component "Monitor &

Manage". This component allows the monitoring and management of the process in several ways. One of the most interesting and used is the process dashboard, in which the status of each of the activities that compose it is observed, with the display of throughput, lead time, critical path, among other important indicators for the process manager. It is not a mere static drawing, but a dynamic and real representation of the productive environment. A very simplistic but illustrative example would be the creation of an indicator in the BPMS to track the average time elapsed between events "D" (creates the task of reinsurance verification) and "E" (informs reinsurance status), described in Fig. 8.3, in order to monitor the agility of the OSD department. The dashboard can present this indicator per instance, for all instances handled in the month, or in other groupings that are of interest to the manager.

The dynamic monitoring of the process allows treating the interaction software–software, software–person, and person–person. For the set of software–software interaction, there is a great complexity from the technological point of view regarding the treatment of technological diversities, either between computational platforms, languages, storage media, or between communication protocols. The "Connector framework" and the "Middleware" components, described by Krafzig et al. (2004) as two of the eleven components of the BPMS technology, are fundamental to the integration and transparency necessary to the BPMS about the evolution of an instance within the business process. They are the ones that allow the BPMS to visualize a given activity implemented and executed by means of different software, operating in different computing environments.

These two resources are very important to the BPMS, when considering that companies are increasingly organized in a collaborative way and that the processes are more structured and organized in an intensive way. Thus, it is to be expected for a business process the involvement of several information systems, software and applications, which are processed ("hosted") in different computational platforms, that is, several and different from the platform used to process the BPMS system.

In the case study analyzed, a lot of interaction between software–person and a few software–software can be observed. Since the Middleware component is not available in Insurer X's computing infrastructure, the software–software integration, and communication, when necessary, occurs in a traditional way, for example, by means of agent software. This is the case for information flow "C" in Fig. 8.3, which connected the BPMS system to the SIN system. Another example is the information flow "M" in Fig. 8.4, which connected the BPMS system to the accounts payable system. Two connections between information systems developed in a traditional way, i.e., difficult to be developed and changed in the future.

The greater the flexibility to access existing software in the organization or even outside it, the greater the ability to manage business processes, i.e., the implementation of a comprehensive BPMS solution. This situation is perceived by the intensive use of the components "connector framework" and "middleware"; a situation that was not found in the case studied. In situations where such resources

are available, the BPMS system must have a rigorous control of the execution status of the instance of interest to the business process, in the context of each one of the software activated via "middleware". For this, the BPMS system uses the component "transaction manager". The status of an instance in processing can be: in processing, suspended processing and its justification, cancelled processing, and its justification, completed processing, among other statuses.

According to the processing status of an instance in certain software, followed by the "Transaction Manager", the BPMS system can, from the rules of the business process stored in the "Process Definition Repository", make the appropriate decisions for the good progress of the instance of the business process: activate another software, advance to another activity of the business process, and leave part of the work on hold waiting for the system to return, notify the process manager, notify the person responsible for the system on hold or suspended, among other options.

The BPMS components framework developed by Krafzig et al. (2004) is very important for presenting and discussing the data handled by the BPMS, both those related to the configuration and parameterization of the business process and those related to the management of the instances of the business process whose operation is being monitored by the BPMS. These are stored, respectively, in the Repository of Process Definition and in the Repository of Process Instances.

8.5 Critical Aspects to Be Considered When Implementing BPMS Technology

The importance of knowing each of the components of the BPMS system architecture can be justified in different ways. First, for being useful for understanding the fundamentals and purposes of the BPMS system, still little disseminated even among computer experts; second, to have grounds to evaluate the adoption of a BPMS system, either in the form of a package provided by only one software house (pure-play BPMS) or composing the BPMS system, through the purchase of several software that implement its various functionalities (composite BPMS): simulation, automation, monitoring, version controller, among others. In the latter option, the various software interact through middleware, that is, the business process itself is built, operated, and managed from the same software architecture and components to be used for the other business processes of the organization.

The understanding of the data structure component of the Process Definition Repository and the data structure of the Process Instances Repository is a critical factor for the success of the agglutination of several tools or modules that will form the compound BPMS. Meeting this need is very critical for the implementation of a comprehensive BPMS, considering that the few tools that propose to support the whole life cycle of the business process are still immature, which characterizes the inexistence of tools that can be classified as pure-play BPMS (Lachal, 2004). The feasibility study of joint work between different BPMS tools bring to discussion

the broad and complex subject of the ontology of BPMS systems directly linked to the two components of the BPMS that characterize the data repositories.

Another important aspect to be observed, when introducing BPMS technology at organizations, are the characteristics of connectors made available by BPMS to connect with legacy systems that will perform operational activities. One should observe the ease of developing connectors between the BPMS and the information systems developed by the organization itself as well as analyze the quality of connectors made available by BPMS for market information systems, those widely spread and purchased by the organization. Building new connectors or having to refine the supplied connectors reduces productivity and gains of the BPMS technology.

The middleware and connector framework components, although not mandatory in the introduction of the BPMS system, provide gains to the development and maintenance of business processes. Thus, the case study company is favored by several facilities provided by the BPMS system to the process management; however, without the use of these two important components, it will continue without answers to part of the problems of the software crisis that lasts until today (Pressman, 2004), here characterized by two questions:

1. How to give flexibility to the IT areas, making them gain agility in meeting the huge demand for new software in organizations?
2. How to change and evolve the growing set of software already existing in organizations, quickly and securely?

The gains provided by the integration components (middleware and connector framework) are noticeable in the medium and long term, when it becomes evident the practicality of reusing and changing the integration connectors. Connectors allow, for example, that data from a table, a message from a queue of a messaging system or the code (logic) of an information system be used by several business processes from a single connector, significantly accelerating the process of construction and operation of new business processes via BPMS system. Another facility perceived over time is the gain in the maintenance and evolution of business processes managed by the BPMS system, especially in the ease of replacement or modification of information technology resources triggered throughout the business processes, such as tables, queues, and information systems (software).

It is important to highlight that the BPMS system can provide significant results even when not implemented in its entirety. In the case of the company analyzed, Seguradora X do Brasil, good administrative results were achieved with a single BPMS tool, even if not using all components, such as those that allow the integration of legacy software, the middleware components, and the connector framework. The BPMS technology is available to organizations in different spectrums; it is up

to the process management professional to seek the understanding of the organizational demand and, based on the knowledge of the architecture and the BPMS technology components, define the most adequate BPMS technology project for each organization.

Questions for Reflection

a. Differentiate the two large sets of data managed by BPMS: (a) those related to the several instances that are being managed by the business process; and (b) those related to the business process definitions.
b. What is the significance of labeling BMPS as a business process "orchestrator"?
c. In terms of operating time of a process, we can think of different perspectives, the actually occurred or execution time, the planned and desired by the institution, the time that stimulates and that is presented as a future goal (benchmarking), among others. What is the role of the "process definition repository" and the "process instance repository" to obtain and manage these different types of process time?

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Office Focused on Business Process Management

9

Objective of This Chapter
By the end of this chapter the reader will understand how companies organize themselves internally in terms of the structure supporting the operationalization and continuous development of the Management by Business Process (M-B-BP) approach.

An organization that prioritizes and values its business processes needs to have professionals and an area within the organizational structure directed to the management of these resources. By analogy, it is the same managerial logic applied to other resources or themes considered as relevant for the organizations, as occurs with project offices and quality areas directed to project and quality resources. Thus, the M-B-BP approach, in a broader perspective, of an effectively process-centric company, needs to have a structure dedicated to business processes. This structure is usually called Business Process Office (BPO) or Business Process Management Centre of Excellence (BPM CoE); for this book we have opted for the first term because it is shorter and more intuitive.

The creation of the BPO area avoids that the M-B-BP actions are something sporadic and ad hoc responsibility of a few managers, as well as facilitates the technological and conceptual appropriation of the M-B-BP approach by the organization as a whole (vom Brocke et al., 2014). The BPO becomes a support area for the organization and its managers, it does not replace or diminish the role of managers or owners of business processes, it collaborates with them by providing a portfolio of services in support of the operationalization, management, and evolution of business processes (Hernaus et al., 2016).

In this chapter we will address BPO within three aspects: (a) the main roles performed by BPO professionals; (b) the dynamics of interaction of BPO professionals with other professional groups in the organization; and (c) the current stage and trends for BPO.

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9.1 Functions Performed by BPO Professionals

Not caring much about the job denominations, but rather about the functions to be performed by BPO professionals, I describe in this subsection the functional demands to be performed by the BPO.

9.1.1 Ensure Business Processes Aligned to the Organizational Strategy

It is the responsibility of the BPM to ensure that business processes are aligned and support the mission, vision, and objective of the company. The BPO should be represented and work closely with the organization's top management, effectively participating in discussions on the (re)formulation of the business strategy. In the organizational structure, the BPO manager should have the same level and status as the business process owners, allowing good interaction with them. In the process-centric company, normally the achievement of its objective is clearly characterized by the success of its business processes. The texts that label the core business processes are very close semantically to the texts of the organization's mission and vision, similarities perceptible even to a reader outside the organization.

9.1.2 Ensure Integrated and Cooperative Work Fronts (Projects)

A business process for being complex, extensive, and involving several activities, among other characteristics, continuously demands actions of adequacy to legal and market demands, among others. Just to stay updated and competitive, without necessarily seeking innovation, there is a set of actions to be taken in terms of changes, either of human resources (necessary skills), business rules, infrastructure, and facilities, as well as software and other technologies. For this, the BPO must develop and ensure that the business process managers have a good command of project management practices. Usually there is more than one initiative or project in progress for each business process, which are interdependent not only among themselves, but also with the ongoing projects of other business processes. For an effective business process management, the company must also have competence in project management and it is up to the BPO to ensure this. If the organization also has a project office (PO), part of these duties are shared with the professionals of the PO.

9.1.3 Ensure Sharing of Human Resources (Skills)

The BPO area should encourage the best allocation and sharing of human skills among the various business processes. The idea is to keep the group of business process managers comfortable and secure with the self-allocation of time by the

employees themselves. The professionals should be well informed of the value added to end customers, as well as the demands of the moment of each business process, giving them more information and insight to negotiate and allocate their time in different work fronts. Here it is up to the BPO to work together with the area of people management for the development of skills in negotiation techniques and conflict management. These skills should be developed and possessed not only by managers, but by all employees in the organizational environment that adopts the M-B-BP approach.

9.1.4 Develop Dynamic Specification of the Contents of Business Processes

The BPO area should define which techniques will be used to document the different levels of information required for business processes. The idea is to develop a good organizational understanding of the different designs and techniques required, the justifications for these, as well as the required integrations between these techniques. Here there should be a good sense between what is desired and what is available in the tools, very hardly all intentions will be supported by the tools (BPMS software). The main aspect of this functional demand is to assure that what is actually happening in the operation of the process is equally portrayed in the specification, in the different business process documentation. No business process specification should be something watertight, static, and out of date with the operational reality of the business process. For this, the changes have to be made using the techniques (graphical or not) available in BPMS software that are integrated in the business process operation codes. By changing the designs of the requirements engineering of the process, automatically the operation, the training material, the support material to the users operation (manuals) are being changed, i.e., integrated change of design content of the process in the different documents or points of delivery of content about the business process.

9.1.5 Develop and Maintain the BPMS Platform

The BPO area is responsible for defining the functions and actions required for the BPMS platform. Ontological standards for BPMS tools are also responsibility of the BPO, relevant information for selection of each software, in order to compose and integrate an effective BPMS platform. We are considering the premise that a BPMS vendor will hardly be able to meet all the demands of the M-B-BP approach. All the choice and homologation of the BPMS platform software is the responsibility of the BPO. Within this context are the facilities for plug-and-play of software and operational applications of the company or third parties. The BPMS tools must have connectors and other technological facilities to interact with the technological integration environment (AIT) studied in the previous chapter (Fig. 8.1). The AIT is useful to integrate the management tools (BPM)

with the various software that perform the operational activities, as well as to integrate the tools themselves that make up the BPMS platform. It is important to emphasize that AIT is the responsibility of the Information Technology (IT) area of the company, and the BPO should have a good dialogue with this area.

9.1.6 To Define and Provide Indicators to Support the Development of Business Processes

Besides allowing the graphic and textual register for the business process specification (discussed in 9.1.4), the specification integrated to the business process operation through the AIT provides a series of managerial facilities. Because of this, the BPO professionals must define with the owners and managers of the business processes the necessary functions and managerial information. At this point, real-time processing indicators can be defined, such as throughput, lead time and number of exceptions waiting for resolution. It is discussed at this point, which of the several indicators defined in Sect. 3.12 should be configured for automatic generation and availability to the business process owners and managers.

9.1.7 Define Method (Activities and Techniques) in Support of the M-B-BP Approach

The BPO area should define the method and techniques employed for each of the phases of the business process life cycle. This includes activities and techniques used, for example, for the design of the business process, for testing and simulation, tools for automation and implementation of business rules, tools for monitoring performance indicators of the instances served by the business process. This environment should meet both the initial specification of the business process and its evolution in terms of maintenance and continuous improvement.

9.1.8 Transfer Knowledge About the M-B-BP Approach and BPMS Tools

The BPO is responsible for training and keeping professionals who interact with business processes up to date on the activities and techniques used in each phase of the M-B-BP approach. The training also covers the BPMS platform software that assists in the operation and management of each of the phases of the M-B-BP approach.

9.2 Dynamics of BPO Interaction with Other Professional Groups in the Organization

The BPO needs to interact with different groups of professionals in the organization to better define relevant aspects for better effectiveness of the M-B-BP approach. Figure 5.2 showed several groups of professionals who interact with the BPO, pointing to some metadata and metadata for the BPMS platform defined or discussed with these groups. Next, we explore the interactions of some of these different groups with the BPO area.

9.2.1 IT Area

Assist in implementing, configuring, updating, and maintaining the performance of the various software associated with the BPMS platform based on the actors, expected uses, and demand for each tool. Definition of the controls of creation, reading, update, and deletion of contents of the repository of Process Definition and the repository of Process Instances. Discussion of facilities and technologies needed for the technological integration environment (AIT) for software connectivity, storage media, message queues, and other resources needed for the management and operation of business processes.

9.2.2 Human Resources Area

Provide a current and complete map of organizational roles, as well as the necessary competencies, breaking them down into knowledge, skills, and attitudes. This metadata helps to define the type of preferred actor and their profile for each of the tasks of the business process.

9.2.3 Strategy Area

Provide strategic direction, informing mission, objective, and vision defined for the business. This helps the BPO area to give its opinion, for example, regarding possible overlaps between business processes, such as configurations of aspects pertinent to two or more business processes.

9.2.4 Legal Area

Provide support in determining regulatory and legal issues, for example, regarding the necessary care with client data and information. These are aspects that can help define the best way to configure the software and repositories associated with the BPMS platform.

9.2.5 Quality Area

Assist in defining indicators for better monitoring of business processes, helping BPO professionals to better customize the metadata and metadata for the BPMS platform. Here, for example, it can be defined for indicators that relate the desired value (benchmarking) with the current value of the process. Another relevant aspect is the definition of service levels required for the various business transactions performed in the context of the business process.

9.2.6 Intellectual Capital Area

Define issues of data registration and business process information, both of the rules ("Process Definition Repository") and the instances being processed ("Process Instance Repository"), exploring issues of retrieval, use, learning, and transformation of these. Together with this area it is discussed how to do data mining about the business processes, stored in the two repositories, generating information and indicators to the process owners that go beyond the conventional ones that apply to any process (such as throughput and lead time). Another relevant aspect is the discussion about the generation and maintenance of versions of business process rules (versioning).

9.2.7 Project Office

Support the BPO in terms of the best use of the method and software for project management, especially in the analysis of simultaneous work fronts of several business processes that may require the same resources in order to exhaust the availability of the same.

9.3 Current Stage and Trends for BPO

Structures similar to the BPO described in this chapter are only present in companies that already have a good level of maturity with respect to the domain and practice of the M-B-BP approach. Companies that are implementing their first processes, making the gradual transition from a non-process-centric structure, usually do not have the availability of a dedicated structure like BPO. The literature regarding BPO is quite scarce, as well as case studies about concrete experiences. This is consistent with the still limited availability of BPO-type structures in organizations.

For companies that have the concepts of M-B-BP from their inception, most likely a large part of the functions described in Sect. 9.1 are not required to be performed or managed by a group of specific professionals from a specific area such as BPO. The predominance of the business process culture as an organizational mindset, distributes and shares part of the BPO functions to all employees

collectively. This reduces the BPO functions to something very specific, but very relevant. In organizations with excellence in the practice of the M-B-BP approach, truly process-centric companies, one can imagine a very small structure in terms of professionals working in BPO. If we imagine the relationship between the maturity of the company with the M-B-BP approach and the size of the structure needed for BPO, we can expect something like an inverted U-shaped graph.

In the more mature stages of insertion of the M-B-BP approach as an organizational culture, BPO comes to be seen as a center of innovation and knowledge generation about business processes.

Questions for Reflection

a. Search the Internet for the names of different professionals associated with BPO, linking them to the roles described in subsection 9.1.
b. Consider the concepts of the M-B-BP approach and the groups of professionals described in Sect. 9.2, who relate to and support the BPO work. Should these professionals be allocated and assigned to an organizational area or to a business process?
c. Establish an analogy between the specific professionals of quality management of a company that has a broad domain and practice, of the principles of quality, with the specific professionals of process management (BPO) of a company with a broad domain and practice of the M-B-BP approach.

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Organization as a Business Process

10

Objective of This Chapter
By the end of this chapter the reader will understand how practitioners and scholars consider an organization designed, operated, and managed as a business process, i.e., with business processes as the primary resource of the enterprise.

The understanding and description of anything, whether a physical or abstract entity, is characterized as an ontological challenge. Ontology is the science that studies the description of beings in terms of their properties, i.e., it covers not only the form of understanding, but mainly the description of the entity. Thus, in this chapter we have as a central focus the ontological discussion of how researchers in the Administration field understand and describe the organization guided by processes, as required for the effectiveness of the M-B-BP approach. In other words, we will discuss the predominant thinking of process-oriented ("process-centric") organizations, with the purpose of describing the process-centric administrative logic ("process thinking") required for the full implementation of the M-B-BP approach.

The current literature does not describe practitioners' perspectives on what an organization as a process should be, but presents articles and books that explore researchers' ontological perspectives. Tor Hernes (2008, 2014) is one of the scholars who has most engaged with the topic of "organization as process". Seidl (2009) in analyzing and commenting on Hernes' (2008) first book exalted the paradox between scientists' ontological understanding of what an organization is and the context in which it actually operates. We will describe separately these two aspects to facilitate the explicitness of the incongruity pointed out by Siedl (2009).

As for the ontological understanding of the entity organization by researchers, it is that they consider it as a set of "things", e.g., positions, rules, strategies, culture, identity, and performance (Seidl, 2009). Consequently, [organizational]

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process is understood as movement, the transition from one set of "things" to another; however, based on this assumption, movement as such cannot be properly understood. Movement is usually treated simply as a succession of distinct stages.

Regarding the operational environment of the organizations, the second aspect, it is observed that organizations increasingly operate in uncertain environments and in full change, continuously facing new challenges and problems. Thus, Organizations must be ready for change, i.e., flexibility and adaptability, as intrinsic and necessary characteristics for contemporary companies (Jones, 2013).

According to Seidl (2009) the paradox lies in the conceptual structure of what is the Organization, a set of things that simply succeed over time, that is, conceiving it as a series of immobilities. In this way the concept of Organization contradicts the necessary characterization of continuous transformation of the contemporary company, that is, flexibility and readiness for change. The incoherence is summarized in the definition of Organization that is not characterized by change, that denies it (although essential characteristic), presenting it as a mere transition of state over time.

Chia et al. (2004) label the traditional and predominant perspective of process in organizations as the "weak view", in which processes are considered as important, but ultimately are subordinated and reducible to the actions of the "things" that are the priorities of managers. They highlight the importance of the insertion of the "strong view" of process, of the "Organization as Process". In this vision, the process is the starting point and the "things" are secondary conceptual abstractions, insofar as they are products of the processes instead of existing before them. In this conception, the process gives the perspective of movement and change, being understood as an essential condition of the organization itself, and the other "things" are secondary. This establishes the dominant *process thinking* which "involves considering phenomena dynamically - in terms of movement, activity, events, change and temporal evolution" (Langley, 2007, p. 271).

The following subsections discuss issues relevant to *process thinking* as a constituent element of what may be considered as the predominant thinking (*mindset*) among individuals in a process-centric organization that fully adopts and practices the M-B-BP approach.

10.1 Techniques for Structuring Organizations

For the design of new businesses, many of the approaches used to discuss and design the nascent company already propose the use of techniques that address the discussion of processes as an important but secondary entity. In this subsection we will explore how this occurs in two approaches well recognized by academia and practitioners, one quite traditional and widespread, while the other is newer and more recent. The more traditional is the approach known as Competitive Strategy (Porter, 1985), whose principles are still present today in many contemporary approaches. The most recent, already within the concept of ontological models

for business modeling or *Business Model Ontology* (Osterwalder, 2004), is the *Business Model Canvas (*BMC) approach.

Porter's (1985) Competitive Strategy asks those who conceive and plan a company to insert it within the context of the environment, to this effect, projecting it according to the map named value chain (VC). This map indicates suppliers to the left and clients to the right, with primary activities being declared in the middle of these. Therefore, the basic concept of General Systems Theory is applied, consisting of input, processing, and output. Although Porter has generalized the business process, breaking it down into five fairly generic activities of the industrial segment (inbound logistics, operations, outbound logistics, marketing & sales, and services), the reader clearly perceives a central and structuring business process of the company.

Elaborations of VC designs can be conceived both in the functional view (management of the process, BPM) and in the perspective of business processes (management by process, M-B-BP), everything will depend on the intentions and *mindset* of those who define and structure the organization. As an example of VC designed for a business process-oriented organization, Dumas et al. (2018) presented the VC of the company that operates public transportation in Vienna, broken down into four business processes and indicating its main processes: (a) Customer relationship management (contacting customers, managing sales, and promoting relationships); (b) Operating vehicles (planning and purchasing vehicles, maintaining vehicles, checking vehicles); (c) Transporting customers (planning customer transportation, transporting customers, evaluating transportation performed); and (d) Providing infrastructure (planning infrastructure, building infrastructure, maintaining infrastructure, evaluating infrastructure).

The BMC approach, on the other hand, addresses nine topics that are distributed into four themes. The four themes are: Infrastructure (or "How?"), Supply (or "What?"), Customers (or "For whom?"), and Finance (or "How much?"). The infrastructure theme is broken down into (Osterwalder, 2004):

- Key Activities: The most important activities to execute the company's value proposition;
- Key Resources: The resources that are required to create value for the customer. They are considered assets of the company and are necessary to maintain and support the business. These resources can be human, financial, physical, or intellectual;
- Partner network: The business alliances that complement the other aspects of the business model.

Key activities are the business processes, i.e., those that deliver value to the customer, value that is thought and stated with the discussion of the Offering theme. BMC key resources are herein analogous to the "things" described by Hernes (2008). These two themes are treated concurrently and equally within the BMC approach, although this equality alone, as with the Competitive Strategy technique,

does not ensure an organization's orientation toward processes in the sense of constituting a *mindset* that might be termed *process thinking*.

Although the application of techniques such as VC and BMC, among others, are very useful for discussing and structuring new businesses, including from the process perspective, helping to understand the organization's business processes, they are only part of the necessary context. They alone do not ensure that the organization will be designed within a *process-centric* perspective, as required by M-B-BP. These techniques or tools only implement, assist in the operationalization of the intentions of those who are defining and/or adjusting the way business is conducted. The techniques alone are not enough, they require other actions or competences prior to the moment of their application.

This perception of techniques as part of the M-B-BP approach is important to observe so as to avoid simplistic actions, strongly guided by investments in technologies (methodologies and techniques automated by software). Davenport (2002) denominated this kind of corporate policy as technological utopia and its major problem is the deviation of managerial attention from priority aspects. In the case of the properly planned M-B-BP environment, we have the mastery of concepts and premises required to adopt this approach, comprising among other things, the understanding of the required organizational culture and policies to this effect, as preceding the application of these techniques.

10.2 Key Resources as Stable Substantives (Entities)

Hernes' (2008) criticism of the way we think about and conceive organizations, including in the two aforementioned approaches, is that we give priority and focus to "things", that is, to nouns. Taking Porter's (1985) value chain technique as an example, much of the discussion as of the initial chain design is through the names of functional areas or departments. Each area turns into a resource or important thing and all processes revolve around it. The management cycle is inspired and defined by the things seen as central and important to the organization. Thus, the area of people management will develop a series of processes thinking about the acquisition, use, control, improvement, and disposal of people. In the BMC approach, the very definitions presented by Osterwalder (2004) for key activities and key resources state the most important aspect: key resources "are considered company assets", while key activities are "important to execute the company's value proposition". In sum, key activities are not assets, but means to deliver core value, processing key resources, these are considered as the organization's main assets.

The criticism of the conception of the company and of what the organization is from the thought centered on "things" is that they promote a static thought, as already said, opposed to the current dynamic business environment that demands constant changes. Without wanting to get into the philosophical discussion that Hernes (2008, 2014) elaborated, when comparing the conception of organization according to the organizational theorist Karl Weick with the conception of the

philosopher Alfred North Whitehead, the main questioning revolves around the manager prioritizing and giving greater emphasis to things (nouns), more stable and less subject to change, than the actions (verbs) of the company, more dynamic and changeable.

Similar discussion in terms of polar status, from static to agile change of state, occurs in other contexts in a very similar way. In the more technical context, of software engineering, it is recognized that *data-centric* systems demand less evolutionary changes than *process-centric* systems, structured from the dynamic business rules (Dias et al., 2015). Thus, we have here a line of thought that corroborates and justifies the conception of Hernes, of having the business process as the most important component or at least in equal importance in relation to the other "things" that configure and constitute an organization.

10.3 Entification and the Balancing Between Verbs (Processes) and Nouns ("Things" or Entities)

The process theory developed by Hernes (2008, 2014) brings as a main gain to researchers and practitioners the importance of balancing between nouns and verbs. Nouns are linguistic representations of physical or abstract entities, while verbs are linguistic representations of temporal summaries of what happens to entities over time (Bakken & Hernes, 2006). For this, he proposes to treat things that involve the organization as entities manipulated by processes, an action he calls entification.

Entification should not be confused with the concept of entity that we know from data modeling techniques: "an entity is a 'thing' which can be distinctly identified. A specific person, company, or event is an example of an entity" (Chen, 1976, p. 10); "something that exists physically or virtually, identifiable only through its characteristics (its attributes)" (De Sordi, 2019, p. 23). The term entification overcomes the division between process and entity, between verb and name. Instead of asking whether something is a process or an entity, one should ask how it takes on certain properties and, in turn, how these properties feed into processes.

Hernes (2008, p. 30) defined entification as follows:

> By 'entification' I mean the extent to which something is seen to disentangle itself so as to be seen to re-enter process. An entity is not to be taken as analogous to a physical object, although it may also be a physical object. An entity is something that is delimited and recognized as something that can be talked about, such as a concept, a company, a technology, a person or a group of people. An entity may be considered to be a label. (Weick, 1995)

Thus, the way the organization itself is understood, whether as an entity marked by its stability (nouns) or by actions (verbs) that are continuously changing, influences the understanding of how managers maintain rules, routines, and practices, as well as how they produce new rules while performing their activities (Hussenot & Missonier, 2015). It is not only a matter of understanding, but of perception and attitudes that result in organizational behaviors.

10.4 Techniques That Balance and Integrate Processes and Data

In this book we present only some of the many techniques used to implement the M-B-BP approach, with the aim of demonstrating to managers the importance of the framework of techniques for implementing and operating the process management approach. Remembering that the purpose of this book is the strategic and managerial conception of the use of the M-B-BP approach, it is not intended to be a guide for technicians and experts regarding its implementation. That said, the set of techniques presented is not exhaustive and complete. The techniques presented serve as a means to discuss the transition between the design and implementation of M-B-BP, and to make managers aware of the need to invest in a framework of techniques, in the form of methods and software. Despite this reduced spectrum in terms of description of techniques, we have enough concepts and examples to show how the idea of entification of the organization materializes in terms of integration of different techniques commonly employed in the M-B-BP approach.

Hussenot and Missonier (2015) when discussing the importance of understanding the company as an integrated set of processes and entities, without being something data-centric or process-centric, but having both as one thing, highlighted the event or scenarios as a logical connector for this conjunction. In this sense, subsection "3.7 Business event and states that characterize it", brings important elements to the M-B-BP approach. The central idea is the events that trigger processes and that change the states of entities. An important technique in this context is the state transition diagram (as an example, see Fig. 3.4), whose events are also linked to processes.

In Information Engineering (IE) there are many procedures that integrate the abstractions present in the process modeling techniques with the abstractions present in the data modeling techniques (Martin, 1990). We will mention here two such integrations:

- For data flows, it is recommended to have views of the data sets associated with them. Thus, each data flow has a name (identifier) and for each of these there is an entity-relationship model (M-E-R) associated. This view of the M-E-R presents only the entities and those attributes of that entity strictly necessary to be delivered to the next activity (the one to which the arrowhead of the data stream points);
- For each elementary activity it is recommended to associate a CRUD matrix (acronym of the verbs *create*, *read*, *update*, *delete*) that indicates which associations are established between that activity with the data entities.

Having this perspective of integrating company processes with the manipulated entities has the appeal of valuing the business process, the "wisdom" as the company's main resource, the organization as the main actor and agent of change. Obviously this approach has not only gains, but it is the most appropriate for those who are managing their organizations within the M-B-BP approach. This

conception of the junction between verb and noun is important not only from the strategic and managerial point of view, of understanding what an organization is, but also from the perspective of the techniques used to design, operate, and evolve the company's processes. The central idea here is to have a dynamic structure, flexible and designed for constant changes, so that it can follow the dynamics of adaptations necessary to maintain its competitiveness in the current business environment.

10.5 M-B-BP Training

Thennakoon et al. (2018, p. 478) conducted an extensive literature review on training focused on the M-B-BP approach and highlighted that "There is wide acknowledgment that training people from all levels of an organization in process management activities and 'process thinking' is a major contributor to the success or failure, and sustainability of BPM". Thus the use of BPM training for the M-B-BP approach, although important for the development of the corporate *mindset* toward *process thinking* should be considered with great care.

The failures, or rather, the non-generation of high return on investment, were pointed out in the research of Thennakoon et al. (2018) for the training actions focused on tools and techniques for process improvement. Here the authors report third-party researches that report more focus and actions on operational aspects (centered on tools and techniques) than strategic ones or focused on the formation of an organizational culture centered on processes. When addressing the topic of culture in the discussion of Maturity Models for Business Processes (MMPN), Rosemann and vom Brocke (2015) highlighted that culture is often overlooked by organizations as a "soft factor", although research shows strong impact of culture on the results of BPM actions.

As for the positive outcomes of BPM training, Thennakoon et al. (2018) identified gains for establishing *process thinking* culture in the following contexts:

a. have the organization's people engaged in knowledge creation;
b. reduction of resistance to change;
c. increased levels of people readiness for business process reengineering;
d. improvement in people's attitude to change;
e. incorporation of BPM cultural values in the organization.

10.6 Organizational Culture

Reviews of the scientific literatures indicate that the theme culture for management by processes is little researched (vom Brocke & Sinnl, 2011). Among the few researches, Schmiedel et al. (2013) used the Delphi method to obtain consensus among experts to identify the themes considered as relevant to the organizational

culture in support of the M-B-BP approach. The four themes identified by the group of 13 managers and 14 researchers were:

- Customer orientation—refers to the proactive and responsive attitude toward the needs of the recipients of the process output, i.e., customers;
- Excellence—refers to the orientation toward continuous improvement and innovation to achieve superior performance for the process;
- Accountability—refers to a commitment to the objectives of the process and responsibility for decisions related to the process;
- Teamwork—refers to the positive attitude toward cross-functional collaboration.

More recently, Raczyńska and krukowski (2019) when discussing the characteristics of BPM culture for public organizations, pointed out four aspects of the M-B-BP culture highlighted by Schmiedel et al. (2013), but also highlighted the notes of Zairi (1997) developed in the late twentieth century. Although older, the topics addressed by Zairi (1997) remain valid and characterize well the shy advance occurred in this theme. It is noteworthy that the seven topics pointed out by Zairi (1997) cover three of the four topics identified more recently by Schmiedel et al. (2013). The seven points identified by Zairi (1997) are:

- orientation toward functional interrelationships, i.e., focus on processes rather than functional departments;
- orientation toward the customer as the recipient of the results of the completion of the process;
- quality as excellence and optimal process performance;
- focus on the effectiveness of the process;
- permanent improvement as a form of pressure to constantly review conditions and processes to eliminate any potential deficiencies;
- innovation as the introduction of creative changes, which have a fundamental effect on the renewal of processes and/or their effects;
- the responsibility to focus on commitment.

It is important to note that the organization's business processes are defined by the people who configure automatic business transactions and who decide on the routing of unusual transactions (exceptions). With this, we have that the culture rooted in the team is a decisive and critical factor for a business process-oriented organization. The vision of the organization as a process is above all an understanding, an understanding of its commanders and their culture. Thus, the culture regarding the assumptions of the M-B-BP approach is fundamental for the success of its implementation.

Questions for Reflection

a. What is the relationship of nouns and verbs to the elements of a business process specification and understanding?
b. Explore how understanding and proposing a business from its data entities can lead to structuring the organization centered by functional areas rather than business processes.
c. Considering the evolutionary life cycle of entities (nouns) and actions (verbs), which one seems to be more appropriate for structuring and designing the company considering the readiness for change and continuous evolution?

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Maturity Models for Business Process Analysis

11

Objective of This Chapter
At the end of this chapter the reader will be able to understand the main topics used for organizational maturity level analyses in the appropriation and exercise of the Management by Business Process (M-B-BP) approach.

Maturity models are developed for important "things" (entities), those for which there are expectations of evolution and that involve complex issues to be implemented, i.e., they demand escalation of actions. As an example of maturity models, we have the reference model for the information system development process, called Capability Maturity Model Integration (CMMI). Developed by the Software Engineering Institute, from Carnegie Mellon University, CMMI is a reference model regarding maturity in software engineering disciplines. The five levels of maturity that can be attributed to the process of software development and maintenance, according to CMMI, are (Chrissis et al., 2003):

- Level 1—Initial: unpredictable and uncontrolled process;
- Level 2—Repeatable: disciplined process;
- Level 3—Defined: consistent and standardized process;
- Level 4—Managed: predictable and controlled process; and
- Level 5—Optimizing: continuously improved process.

Similar to the CMMI for the software development process, we have recently seen the emergence of several maturity models directed to the implementation of management by business processes in organizations. The same institute that developed the CMMI, the *Software Engineering Institute* at Carnegie Mellon University, proposed a model for business process maturity analysis, called *Business Process Maturity Models* (BPMM) (Rosemann & vom Brocke, 2015). Currently we have many proposals of Business Process Maturity Models (BPMM), making it difficult

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even the selection of which is the most appropriate to be adopted for application in organizations (Van Looy et al., 2017). Another criticism of the NPMMs is about their little applicability, being characterized more by their descriptive characteristics than by their prescriptive properties (Tarhan et al., 2016).

An important aspect of the most recent analyses on MMPNs covers the stage of maturity of MMPN proposals as an applied tool in support of the M-B-BP approach. The most recent works, such as those by Van Looy (2020), Ongena and Ravesteyn (2020), and Rosemann and vom Brocke (2015), are not concerned with defining classification strata and the rules for framing the process in each one of them. They focus on the discussion of important issues for raising the quality of business processes, that is, they are descriptive and not prescriptive. The title of the text by Rosemann and vom Brocke (2015) evidences well this descriptive proposition: The Six Core Elements of Business Process Management. Of the five texts that discuss MMPN that we will analyze in this chapter, described in Table 11.1, only two of them make mention of classification strata. The texts by Szelagowski and Berniak-Woźny (2020) and OMG (2008) cite the same business process stratification model, the model proposed by OMG (2008) that works with five stages: initial, managed, standardized, predictable, and the innovative.

Although the desire of the practitioners, of the managers who need to manage their business processes, is the use of an artifact for analysis of their processes, the reality of the MMPN points to another path. The more functionalist vision, focused on the ready management use, is something utopian today (Tarhan et al., 2016). When we compare the MMPN with the scale for software maturity, the CMMI, we have the MMPN as a much broader and more complex challenge. The MMPN involves a very wide range of dimensions and contexts as we will observe in this chapter. Although it does not readily meet the functionalist urgency of many, having the knowledge of the relevant and useful aspects for structuring, for decision making, and for managing the current processes, shows itself as a relevant knowledge for those who wish to manage and improve their business processes. In this perspective of understanding the main dimensions for analysis of business processes, we will discuss in this chapter the main topics addressed in five important MMPN.

In Table 11.1 we present the central topics of MMPN analysis according to the perspectives of five groups of researchers. The models proposed by Szelagowski and Berniak-Woźny (2020) and Rosemann and vom Brocke (2015) are interesting because they result from the review of other models, i.e., it already brings an effort of review and consolidation of several MMPN. Another important model is that of Van Looy (2020), not only for being recent, but for being an author with many researches and papers published on this theme during the last years (Van Looy et al., 2013, 2014, 2017). Finally, we also analyzed with the model proposed by Ongena and Ravesteyn (2020), for being quite current; and the model of the Object Management Group (OMG), for being the most cited and referenced in the literature (Tarhan et al., 2016).

In the following subsections, we present the results of our analysis for the five MMPNs described in Table 11.1. We consolidate the topics that were present in

Table 11.1 Business process characteristics considered in the analyzed MMPNs

Authors	Ongena and Ravesteyn (2020)	Szelagowski and Berniak-Woźny (2020)	Van Looy (2020)	Rosemann and vom Brocke (2015)	OMG (2008)
Topics considered relevant to the MMPN	Resources and knowledge	Strategy	Lifecycle aspects per business process	Strategic alignment	Organizational
	Processes awareness	Standards and measurements	Managerial aspects per business process	Governance	Project and work unit management
	Process control	Process management	Process-oriented culture	Methods	Product and service management
	Process description	Management of implementation and rationalization projects	Process-oriented structure	Information technology	Improvements
	Process improvement	People		People	
	Process measurement	Process architecture		Culture	
	Information technology	Information and communications technology architecture			

Source The Author

two or more of the five MMPNs analyzed. It is important to highlight that often the terminology employed is not exactly the same among the various MMPNs, as well as the levels within the topic structure of each MMPN are not necessarily the same, i.e., a topic may be at the first level of the taxonomic structure of one author's MMPN and be at the second level, as a subtopic, in the taxonomic structure of another author's MMPN. Thus, as a result of our analyses, we identified seven central themes for MMPN, all described in the following subsections: (a) culture, (b) people, (c) strategy, (d) project management, (e) information and communication technologies (ICT), (f) measurements, and (g) method.

11.1 Culture

Culture is the set of values and beliefs of a group that directly impacts on the behaviors of its members. Companies monitor and develop the competencies of their employees considering the entities: knowledge, skills, and attitudes (Baartman & Bruijn, 2011). Attitudes are predictors of expected behaviors, that is, what

it is intended that people do. The behaviors are the actions that predominate in the group that, in the ideal situation, should be very close to the planned attitudes. Thus companies define attitudes, design, and work several actions so that their employees manifest behaviors appropriate to their values and principles.

In organizations that adopt the M-B-BP approach it is expected that there is a Culture centered on processes. In a very pragmatic way, Van Looy (2020, p. 291) defined the Culture centered on processes as: "Values that favor business processes and their translation in attitudes and behaviors. It requires appraisals and rewards that consider process results and top management commitment". For this author, the Culture centered in processes is one of the four major topics of a MMPN, being broken down into three subtopics: (a) values, attitudes, and behaviors oriented to processes; (b) appraisals and rewards oriented to the process; and (c) commitment of top management with the orientation to processes.

According to Table 11.1, the authors Rosemann and vom Brocke (2015) also included Culture as one of the important topics to the MMPN. They emphasize that Culture, although it is often overlooked by the organization as a "soft factor", research shows a strong impact of Culture on the results of M-B-BP actions. As occurs on other organizational fronts, such as quality management or knowledge management, Culture is recognized as a much more lasting factor, i.e., difficult to be changed. Technocratic approaches, with less emphasis on people and much emphasis on technology (BPMS projects, instead of M-B-BP), tend to give less importance to this topic and, obviously, to obtain inferior results.

The breakdown of the Culture dimension in the MMPN, according to Rosemann and vom Brocke (2015), comprises five subtopics: (a) responsiveness to process changes, (b) incorporation of values and beliefs in processes, (c) attitudes and behaviors toward processes, (d) leadership attention to the M-B-BP approach, and (e) social networks in support of management by processes. Dumas et al. (2018, p. 488) summarized the analysis and discussion of these five subtopics in the following questions:

- Responsiveness to process change: To what extent does the organization embrace and respond to continuous process change?
- Embedding of process values and beliefs: How deep is process thinking ingrained in the corporate values and beliefs?
- Adherence to process design: To what degree do process participants adhere to process designs?
- Leadership attention to M-B-BP: How much support do leaders exhibit for M-B-BP?
- M-B-BP social networks: Are social networks in place to shape and disseminate M-B-BP in the organization?

11.2 Persons

While the topic Culture in the MMPNs is focused on one of the dimensions of the professionals' competence, the Attitude, the other two dimensions of the management by competencies, the Knowledge and the Skill, are analyzed through the People topic. Szelagowski and Berniak-Woźny (2020) highlight the People as one of the most important elements of the M-B-BP. Considering the continuous need for a change of business processes, which are driven by people, there is the dependence and the natural justification of the importance of the People topic for the M-B-BP approach. They highlight three subtopics associated with the People resource within the MMPN: people management and training, people motivation, and management of people skills and responsibilities. Similarly, but with a different name, under the topic "Managerial aspects per business process", Van Looy (2020) points out the importance of MMPN to stick to two subtopics: (a) "skills and training", so that people perform their functions along with the business process; and (b) "roles and responsibilities", covering the description of the jobs of all those involved with the business process.

Rosemann and vom Brocke (2015, p. 113) also included the topic People among the key elements for M-B-BP, defining it as: "individuals and groups who continually enhance and apply their process and process management skills and knowledge in order to improve business performance". The subtopics to be considered in the MMPN for People, according to Rosemann and vom Brocke (2015) are: (a) skills and knowledge, those required according to the perspective of the owner and stakeholders of the business process; (b) knowledge in management by processes, covering principles and practices of the M-B-BP approach; (c) education and learning in processes, covering an education program in M-B-BP that takes care of the certification of educators in the approach, as well as the availability of specific educational programs for such; (d) collaboration and communication process, addressing the patterns of how knowledge is discovered, exploited, and disseminated; and (e) leadership management, ascertaining the degree to which process leadership skills and desired management styles are actually practiced.

Ongena and Ravesteyn (2020, p. 134) used another denomination, using the term "Resources and knowledge", defining it as the availability of organizational resources (such as people with process knowledge) to create a "culture of process orientation". For analysis of the topic People in the MMPN, Ongena and Ravesteyn pointed out four subtopics that can be expressed according to the following questions:

- To execute a process, according to its objectives, are the right people (numbers, knowledge, experience) as well as resources (money, facilities, systems) available?
- Are the people who participate in the process sufficiently trained and have the necessary competencies to act in the process?

- Are employees aware of the process they are participating in, do they know its objectives, their role with the process, and are they actively cooperating to achieve the process objectives?
- Within the organization, are there formal and informal communities in which employees (e.g., process owners, analysts) actively share their knowledge and experiences?

In short, the MMPN should analyze the knowledge and skills of the organization's people involved in the practice of M-B-BP, ascertaining the means and resources available for the continuous evolution of people and business processes. The key words in this topic are: knowledge, ability, training, function, role, and responsibility. It is noteworthy that there is a big difference between the topics Culture and Person, although together they constitute the triad that defines the term Competence. While the attitudes are more difficult to be worked and changed by the organization, the knowledge and skills are likely to be transferred and absorbed by people in the organization.

11.3 Strategy

Szelagowski and Berniak-Woźny (2020) presented the topic Strategy as one of the seven core topics for MMPN according to the revisionist study of different MMPN analyzed by them. Although in their text there is no description for the topic strategy, they decomposed it into three subtopics: (a) strategic alignment, (b) consistent top management support, and (c) governance. Szelagowski and Berniak-Woźny (2020) also do not describe the three subtopics in their scientific article, due to the limited size of texts in this type of document (scientific article) and because they are concepts widely used and disseminated in explaining the links between strategy and different entities. Below we describe the essence of these three subtopics.

Strategic alignment involves keeping business processes coherently aligned with the strategic intent of the organization. The organizational purpose, vision, and mission should be the inspiration and guide for the few business processes of the organization and for the whole structure of processes that support them. Thus, whenever there is a change in the organization's strategy there should be an analysis of the impact on business processes. In maintaining this alignment, M-B-BP and business processes will always be perceived as positive and fundamental to the organization's success. This subtopic, strategic alignment, identified by Szelagowski and Berniak-Woźny (2020) is treated in Rosemann and vom Brocke's (2015) model with one of the six major topics of MMPN (see Table 11.1). One of the main deliverables resulting from strategic alignment, according to Rosemann and vom Brocke (2015, p. 115), is the Enterprise Process Architecture that

> clearly depicts which major business processes exist, describes the industry-/company-specific value chain, and captures the enabling processes that support this value chain, […]

process architecture provides a high level visualization from a process view and complements, and not replicates, organizational structures. In addition, it serves as the main process landscape and provides a starting point for more detailed process analyses and models.

For the second subtopic of Strategy, "consistent top management support", it should be noted that it is not enough for the organization's top management to identify the points to be changed in business processes to maintain strategic alignment. Once the work fronts have been identified, the projects to be executed must be defined. If the team responsible for the business process does not have the direct support of top management, demands of the areas or even personal demands may override corporate interests. The role of the company's top management is important in combating defensive routines that preserve the status quo and hinder improvements and advances in the organization (Senge, 1990). Thus it is fundamental that top management not only define strategic guidelines, but that they are available and close to the business process team that will execute the different open projects.

Regarding the subtopic "governance", it is mentioned here the need to ensure that the established work fronts are fully carried out as planned, i.e., that projects open for continuous improvement or business process adaptations are fully executed. Senior management should not only be available to help the business process team to overcome possible obstacles, but also be monitoring the execution of these projects. Another governance demand is the availability of top management to decide and guide the team on unforeseen issues that may arise during the implementation of business process improvement and/or adaptation projects. Thus, it is essential that top management is represented and active in the Process Councils or in the Process Management Committees constituted by the organization for the improvement of business processes. Rosemann and vom Brocke (2015) gave a higher importance to the topic Governance, highlighting it as a first level topic of the taxonomic structure proposed by them for the MMPN, as we can see in Table 11.1.

Van Looy (2020) included in her analysis of the MMPN the dimension "process strategy" which is a subtopic of the dimension "managerial aspects per business process", one of the four major dimensions of first level defined by her, as described in Table 11.1. She emphasizes for this subtopic the need for performance indicators associated with business processes, so as to ensure their alignment to the company's strategy. She indicates three central points to be considered by the MMPNs regarding the necessary strategic alignment (Van Looy, 2020, p. 308):

- process management is fully part of my organization's strategy, namely, to help realize the organization's strategy (e.g., to achieve operational excellence, customization, or product/market leadership);
- the organization's strategy is translated into goals that are used to manage business processes;
- all business processes in my organization have performance targets (KPIs, key performance indicators) derived from the organization's objectives.

11.4 Project Management

The management by processes implies the execution of several continuous work fronts, which brings with it the idea of continuous improvement of the business process. In the M-B-BP approach there is a continuously processed phase, the identification of opportunities, which triggers the next phase of making the necessary adjustments, as already discussed in the fifth chapter, in subsection 5.6. Obviously the phase of identifying opportunities is supplied by the subsidies of the previous phase, the monitoring phase, according to the iterative cycle between the various phases of the process. Having said that, it is to be expected a rather large set of actions of alteration, creation, and exclusion in terms of the constituent elements of an extensive business process. This set of work has a very high level of sophistication and risk, which demands the attention and the care of the project management practices, as pointed out in the analyzed MMPN.

The OMG (2008), which presents the topics of interest of the management by process by maturity levels, including them as the maturity degree in the scale of levels rises, presents the domain of the theme project management at the very first change of scale, to progress from the first level (initial) to the second level (managed). In the OMG perspective the project management within MMPN should cover: (a) the change management of the work units, comprising the management and control of contents (versioning) and of the changes in the releases of products deployed for internal and external use to the organization; (b) the suppliers management, which deals with the management of the acquisition of products and services from suppliers external to the organization; and (c) accreditation in terms of ensuring that the activities and the products of the efforts meet the applicable laws, regulations, standards, organizational policies, business rules, process descriptions, and work procedures. Szelagowski and Berniak-Woźny (2020) described very succinctly this topic, breaking it down into: project planning, project execution, and project control.

In short, the organization to obtain good levels of maturity in the M-B-BP approach must have the domain of project management practices, considering that the approach demands the continuous opening of projects for actions aimed at the evolution and maintenance of the organization's business processes. Considering the comprehensive size of business processes, the dynamics of processes in terms of continuous demand for changes, and the imbrication between the various things involved, it is not an exaggeration to think of a support environment dedicated to project management. A full approach to M-B-BP usually demands practices usually found in project offices, with professionals, tools (software), techniques, and methods specific to project management. Because of this, we point to the project office as one of the support areas to the management by process, as described in the ninth chapter, in subchapter 9.2.

11.5 Information and Communications Technology (ICT)

Ongena and Ravesteyn (2020, p. 134) described the Information Technology (IT) dimension as very important to the business process performance, regardless of the company size, including for small companies. In the initial description of the IT dimension they define it as "The organization uses IT to design, simulate and execute processes, and to provide real-time measurement information (key performance indicators)". When breaking down the IT dimension into enablers for M-B-BP, they presented six subtopics:

a. software tools for process description and modeling;
b. tools for process simulation;
c. processes coordinated by information systems (e.g., workflow management or case management);
d. processes should be fully automated (straight-through processing) wherever possible;
e. software should identify bottlenecks in processes; and
f. the information technology department actively involved in improving the organization's processes.

Szelagowski and Berniak-Woźny (2020) described very succinctly the ICT topic, simply as composed of data architecture, application architecture, and technical architecture. Searching for the text they cite to substantiate their understanding of MMPN, the article by Dabaghkashani et al. (2012, p. 727), one finds: "The IT architecture is an organized set of consensus decisions on policies & principles, services & common solutions, standards & guidelines as well as specific vendor products used by IT providers".

The text by Ongena and Ravesteyn (2020) demonstrates a concern in having at the disposal of the business processes team the tools (software) that implement the functions available in the business process management system (BPMS), extensively discussed in Chapters 7 and 8. The text by Szelagowski and Berniak-Woźny (2020), on the other hand, explores more questions of technological standards. In short, the M-B-BP approach demands technological maturity, especially of the ICTs associated with the BPMS environment.

11.6 Measurements

Every maturity model needs measurements, of objective parameters for the monitoring of the entity to which one wishes to follow its evolutionary trajectory. For the MMPN there is, equally, this demand for business processes. Authors such as Szelagowski and Berniak-Woźny (2020) and Ongena and Ravesteyn (2020) have valued these parameters, pointing them as one of the topics of first level in their interpretations of the MMPN, calling them, respectively, as "standards and measurements" and "process measurement".

The usefulness of these business process indicators are several, such as: compare the current results of the process with the defined objectives, compare with the parameters of external processes taken as benchmarks, choose the appropriate process for change, besides the evaluation of the results of improvement projects performed. To meet these demands, Szelagowski and Berniak-Woźny (2020) decomposed the topic "standards and measurements" in: (a) process performance measurements, (b) measurement techniques, and (c) compliance with business standards. Ongena and Ravesteyn (2020, p. 134) defined the dimension "process measurement" as "system to measure and control processes is in place in order to be able to improve processes". The main analyses of this topic, according to them, can be summarized by the following topics (ibid., p. 148):

- For each process, the output and deliverables are defined
- Key Performance Indicators (KPIs) are defined for each process and process performance is actively being measured
- Specific quantitative goals are defined that are related to both customer needs and the organization's strategy
- It is clear who is responsible for measuring, collecting, and reporting the process KPIs
- Process performance is regularly evaluated. When performance deviates from predefined norms measures are taken to adjust this

11.7 Methods

For Rosemann and vom Brocke (2015, p. 113) the Method dimension, within the context of MMPN, is defined as "the set of tools and techniques that support and enable activities along the process lifecycle and within enterprise-wide BPM initiatives". They decompose the Method dimension into five subtopics or phases: (a) process design and modeling; (b) process implementation and execution; (c) process control and measurement; (d) process improvement and innovation, and (e) process project management and program management. A simpler way to discuss the Method dimension, was the one adopted by Van Looy (2020). Among the four main topics of the MMPN, according to the author, she included the topic "lifecycle aspects per business process", which was broken down into the subtopics: plan, do, check, and act, i.e., in the four phases of the PDCA cycle of Deming (1994).

A more discrete way of treating the Method dimension was adopted by Szelagowski and Berniak-Woźny (2020). In their understanding of MMPN, the Method is presented as a subtopic of the dimension "process management", more specifically in the subtopic "process improvement methodology". Szelagowski and Berniak-Woźny's (2020) understanding of MMPN was based on the model of Dabaghkashani et al. (2012, p. 727), who defined the topic "process management" as comprising the phases: "continues monitoring, evaluation, measurement

(e.g., cost, quality, time) and process innovation". In opposition to Szelagowski and Berniak-Woźny (2020), who worked on the Method in a very discrete way, we have the perception of Ongena and Ravesteyn (2020) who included several phases relevant to the Method dimension as first level topics of the MMPN proposed by them. Of the seven dimensions of the proposed MMPN, four of them are strongly associated with the phases of the business process life cycle: process control, process description, process improvement, and process measurement.

In this chapter, the Method was discussed as an analysis parameter within the context of MMPNs, i.e., focusing on the main characteristics that must be considered for business process classification. In the fifth chapter, the discussion of the method for the M-B-BP approach takes place in a holistic way, in its phases and sub-phases, the interaction between them in terms of internal and external products, actors involved, points for quality control, and other important aspects for operationalization of the M-B-BP approach.

Questions for Reflection

a. What are the interdependencies among the different topics of the MMPN? This analysis is important to determine the difficulties for the effective advancement of the M-B-BP approach when working on the partial management of only a few topics that are relevant for the effectiveness of the M-B-BP approach. In short, it highlights and values more comprehensive and complete MMPNs.
b. How can we implement an MMPN in terms of methods and tools? Brings to discussion the issue of analysis criteria, as well as the strata for classification of business processes. In this sense, Van Looy et al. (2013) present a data model with the description of entities, attributes, and relationships, which can assist in the reflection on methods and tools for maturity analysis of processes, in other words, tools for implementing the MMPN.
c. For reasons of operating area, market positioning, or even strategy, the MMPN can be contextualized to the specific demands of each company. Look for success stories (commercial dissemination) or case studies (scientific dissemination) that address the MMPN of a company, compare them with the models analyzed in this chapter in order to identify the particularities and possible justifications.

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New Technologies and New Business Demands in the M-B-BP Context

12

Objective of This Chapter
By the end of this chapter the reader will be up to date on the potential of some recent technologies in terms of integrating and transforming the technology platform of the Management by Business Process (M-B-BP) approach.

In this chapter we address five current and relevant themes for the evolution of the M-B-BP approach. There are many issues associated with new technologies with the potential for significant impacts on M-B-BP, and the five technologies discussed in this chapter exemplify this potential. As this, we want to emphasize that the M-B-BP approach is both influenced by new technologies and also influences and helps define new technological developments.

12.1 Process Mining

In Chapter three we pointed out that the smallest unit of work documented in the BPMN specifications is the activity. This situation is consistent with the management practice, where we have the activity as the smallest unit of work that receives management attention. Resources are defined for it, as well as data is collected and information is generated to support its operation, control, and management. The operational execution of the activity within the BPMS environment is accompanied by the perspective of two platforms: the content/service, contemplating its rules and contents; and the technological/structural, covering the ICT infrastructure required for processing (Meyer & Zack, 1996).

The content platform has its demand and processing time estimated, considering the complexity of the algorithm and the nature of the manipulated inputs

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(image, photo, text, data). On the other hand, the technological/structural platform is estimated by calculating the volume of instances to be processed in a given period. Although the technological/structural platform can be estimated and structured from demand calculations, its performance depends on the moment conditions of the available ICT infrastructure. It covers issues such as quantity and workload of the processors available for the calculation at that moment, speed of the available data transmission lines, and other factors that may influence the operating time of the structure available for the performance of activities. When analyzing the predictive capacity of process mining tools in determining the "time-to-completion of running business process instances", Polato and colleagues (2018, p. 1005) observed: "making such accurate forecasts is not easy, many factors may influence the predicted features".

To generate knowledge from the analysis of the business processes operation history, there is the need for records (logs) of all executed activities, of all the instances handled by the business process within the period of interest. This way, process mining implies having the log in the process perspective, which will depend on the performance of the two platforms, the content/service and the technological/structural. For the purpose of time estimation of highly critical processes, which require real-time monitoring, the technological/structural platform should have a distinct monitoring. They are even objects of monitoring and analysis of Service Leverage Agreement (SLA) contracts. Here there is the measurement of technological resources available for purposes of payment for the use of technological resources, payments that may be reduced due to fines for service levels below those contracted. From the perspective of the records of the content/service platform, the elementary data of all events of interest shall be recorded: the arrival time of each instance to the service processing queue; the processing start time of the specific instance; the instance processing finish time; the instance processing stop time (if any); the instance processing restart time; among others.

Schönig and his colleagues (2016) demonstrated the use of process mining for knowledge extraction from process logs, more specifically the conditions of human resources allocation for process activities. For this, information about the resources involved in the execution of the process activities was extracted from the event logs. This information was used to identify the conditions under which human resources were involved in the execution of the activities, which proved valuable for process improvement activities. In this line of business process redesign, Cho et al. (2017) presented assessments of the business environment calculated from process mining techniques making use of process logs. The method proved to be useful for identifying potential parts of the business process that can benefit from localized improvement interventions.

A more daring and innovative aspect of the use of process logs would be their application not only for historical analysis (a-posteriori) aiming at subsequent improvement and redesign, but also for intelligence at runtime. Recent log mining can serve as a parameter for important decisions, for example regarding content/service or technological/structural platforms. Imagine an e-commerce environment, with an incredible volume of demand on the eve of Mother's Day.

The mining of logs associated with the technological/structural platform generates information to the inferences engine (rule engine) of the BPMS that can, based on its rules, trigger and make available for use other computational resources previously agreed upon in SLA. The same dynamic can occur with the content/service platform, situations found in recent moments can be used to adapt conditions (change algorithms) to the context of the moment. In this way, process mining is perceived not only as an after-the-fact analytical resource, but also as a resource for on-demand actions.

In terms of technological challenges process mining comprises the same difficulties and the same initial set of solutions employed by its predecessors, which form data mining (DM) and text mining (TM). The method of these solutions can be summarized in three major phases: data preparation, mining, and analysis. Among the main activities, there are: extract, transform, and load data to the storage system; store and manage the data in a multidimensional database system; provide data access to business process analysts and information technology professionals; analyze the data by application software; present the data in a useful format, such as a graph or table (Zayoud et al., 2018).

As in the DM, process mining data come from different technological solutions, internal and external to the company, ranging from applications that run on the mainframe to the most modern web applications. Pérez-Castillo et al. (2011) highlighted the difficulties and the extra activities required so that the process mining can work with log data of activities performed by legacy information systems (those with code written long ago becoming technologically obsolete and operating on old technological platforms). In addition to the diversity of sources and technologies, there is also the semantic and ontological challenge, characterized by the need to record in an organized and relational way all the diversity of information about the activities performed in the context of the business process, captured from the logs of the activities performed (Jareevongpiboon & Janecek, 2013). Here there is information of social, technological, procedural, and political nature, among others.

Despite the limitations of process mining in its current stage, such as the difficulty of predicting the processing time for an instance of the business process, the lack of a semantic and ontological standard for harmonizing the different tools and technologies, there is research in progress that is quite audacious. Research associated with the analysis of business process behavior (Savickas & Vasilecas, 2018) is one such example, which justifies our attention to the promising topic of process mining.

12.2 Robotic Process Automation

The first automation cycle of human activities by means of software occurred in the 1960s, with the introduction of batch processing systems. Accounting and stock control activities were among the beneficiaries of automation. This first generation was characterized by the dependence on IT professionals, since there was a need

for a programmer to develop a program. They were expensive and time-consuming automation solutions. The current cycle of automation that we are witnessing from the second decade of the twenty-first century, under the label Robotic process automation (RPA), configures itself as a totally different proposal from the first cycle. The robot resulting from the RPA approach, also known as "bot", is developed by the user itself through appropriate tools that do not require computer experts. Thus, RPA is configured as an open, low-cost environment that can be developed by professionals in all areas.

Bots are applied to the automation of simplistic and repetitive activities, activities that in the day-to-day business process consume much time (delay the process) and that are potential sources of defect generation in the process results. RPA is characterized by replacing human activities linked to repetitive work, such as typing, extracting, coping, and moving huge amounts of data from one system to another system, among other manipulations of digital content (Santos et al., 2020). The classic example of bot application is that of moving data from an excel spreadsheet to fill out a web form. Mohamed and his colleagues (2022) presented several examples of the application of bots within the context of Human Resource Management processes, evidencing how employee data are moved between different areas of the organization and by the different information systems of these areas. Thus, the bots contribute to the improvement of productivity indicators, such as lead time, as well as quality indicators that relate the total number of compliant transactions with the total number of transactions performed in the same period.

In situations where several bots start to execute a sequence of jobs, we can have the situation of an entire workflow being executed by a bot. In this situation, in the BPD specification, instead of just presenting icons of automated type activities (gears in the upper left corner of the box), we need to represent the bot with a participant of the process, that is, as one of the rectangles of the BPD. The bot goes from being a mere automator to being responsible for a part of the flow, encompassing a set of activities. Wewerka and Reichert (2021) recorded this type of situation in the BPD of a Payment Generation process. The initial version of the process before the bot was inserted presented two participants: "Front office agent" and "Back office agent". After the insertion of the bot, the documentation now presents the participants: "Front office agent" and "RPA Bot". The increased presence of bots in organizations should be reflected in the documentation of business processes, whether in BPD, interaction diagram and other process specification techniques employed.

The tools for RPA development currently available are many. The review of recent literature on RPA identified a set of several tools used in the analyzed RPA cases. ANTstein, Appian RPA, Automation 360, Automation Edge, Blue Prism, Bluepond, IBM RPA, Kofax, Pega Robotic, Power Automate, Redwood, Roboplatform, SAP Intelligent RPA, TruBot, UiPath, Worfusion, are some examples of RPA tools cited in published case studies on RPA in the context of organizations (Vincent et al., 2020; Wewerka & Reichert, 2021). The research that discusses the opportunities for integration of these RPA tools with the BMPS environment indicates a large favoring of the former, which can count on exception handling,

process mining, and other facilities available in the BPMS platform (König et al., 2020). It is worth noting that the BPMS environment and the M-B-BP approach also benefit from this integration between RPA and BPMS (software–software). The presence of bots reduces the amount of human activities throughout the process (software–person), making these parts of the process more transparent and amenable to real-time monitoring by the BPMS environment.

12.3 Mixed Reality

The term mixed reality (MR) involves the junction of images from the physical world with figures from the virtual world, in equal proportions, configuring a blend between entities of these two worlds (Benbelkacem et al., 2014). Previous solutions were binary, or exclusively virtual, as in the case of solutions called virtual reality (VR), or predominantly composed of real images with superimposition of some virtual figures, as in the case of augmented reality (AR) solutions. Thus, the term MR better characterizes the various opportunities of using virtual figures and real images, composing them in the different moments of the life cycle of the business process. In this subsection we explore the application of MR in some of the activities of the various phases of M-B-BP.

One of the first moments of the business process of using RM is when it is conceived, covering its identification and initial design. In subsection "5.2 Identification of business processes" we commented that for highly innovative processes it is not always simple and evident the suppliers, inputs, process, output, and customers (SIPOC diagram). In this sense, Miron et al., (2019, p. 541) presented a case study covering the combined use of images and figures in a storyboarding tool used in the context of early exploration and validation of design alternatives (design thinking) in relation to an innovative service. The combination of known images with added figures helped those involved to conceive the new business model of a ventilation company that started to offer "air-as-aservice". "This meant that industrial customers no longer paid for the product, i.e. ventilators, but for the service, i.e. the guarantee the firm provides, monitors and sustains an air quality corresponding to the respective standards in industrial settings".

A widespread aspect of MR technologies and for capacity building and training of employees of organizations (Zhao et al., 2019) and students (Ryan et al., 2022). Here this type of MR application extends to different actors at different points in the business process life cycle. Some examples: training and capacitating new employees or old ones that are being relocated; transmitting knowledge to the external customer of the process on how to interact with the business process; serving as support to solve doubts of the internal or external customer of the business process; among other scenarios that demand good insight into activities, rules, flows, expected actions, generated products, and other information of the business process.

An even broader perspective is the use of RM in conjunction with specification diagrams in support of daily process operation. The availability of enhanced

corporate information supported by MR technology reduces employee decision making time and improves the quality of their decisions. This is most pronounced in processes such as logistics, warehousing, on-site service, repair, design, and management. MR can reduce customer order processing time by three times (Dulishkovych et al., 2021). In the field of management, del-Río-Ortega et al. (2019) highlighted the various ways to present to employees the status of key performance indicators of the process assisted by MR technology. Here the possibilities are numerous, all with strong potential of motivation for action in pursuit of achieving the goals of the business process.

12.4 Green Business Process Management

The concerns with climate issues and environmental sustainability have the potential for several improvements linked to the M-B-BP approach. This initiative is within what is conventionally called in the literature as Green BPM. According to Couckuyt and Van Looy (2020, p. 435) the "Green BPM concerns the modelling, deployment, optimisation and management of business processes with dedicated consideration paid to their environmental consequences". As an example of the several interesting propositions, we highlight in this subsection the one by Recker et al. (2012) who suggested the introduction of new icons for BPMN notation aiming at characterizing the electricity consumption and carbon emissions points along the business process.

The proposed extension of BPMN notations for Green BPM, aims to characterize the specification of two essential constructs for sustainability: (a) activities that demand paper consumption, and (b) activities that consume electricity. For these two constructs, Recker et al. (2012) propose four new icons, as described in Fig. 12.1. The consumptions are considered important events to the Green BPM, hence their icons are inserted within circles that characterize events according to the BPMN standard. Paper consumption is depicted by a page inside a circle, while fuel consumption is depicted by a barrel of oil inside a circle. There are two other icons proposed for the calculation of greenhouse gas emissions (GHG): the icon of the rectangle with a leaf, containing a number below it, which indicates the total GHG emitted by the activity; and the arrow with the wavy line, indicating the GHG emitted by each activity, as well as the sequencing and accumulation of gases emitted throughout the process.

The Green BPM consumption actions are always associated with activities, so the two icons that characterize consumption are inserted within the activity icon, in the upper right corner of the icon (of the rectangle). Thus, the activities' fuel and/or paper consumption is characterized, as described in the extract of a BPD presented in Fig. 12.2. It is noteworthy that the calculation of GHG is important even for administrative activities, considering that ICT resources are responsible for at least 2% of total GHG (Webb, 2008).

Obviously the Green BPM solution involves several other aspects beyond the inclusion of icons to BPMN. It covers, for example, specific ontological issues

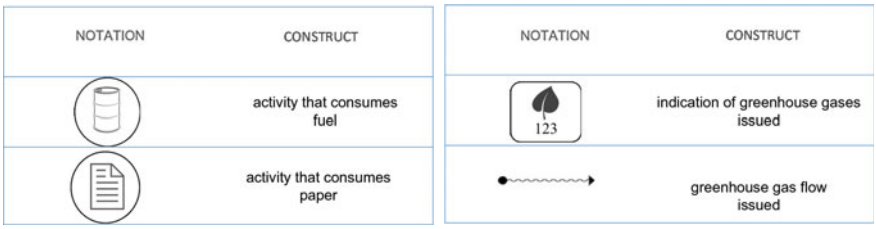

Fig. 12.1 Additional BPMN notation proposed to meet Green BPM requirements (*Source* The Author)

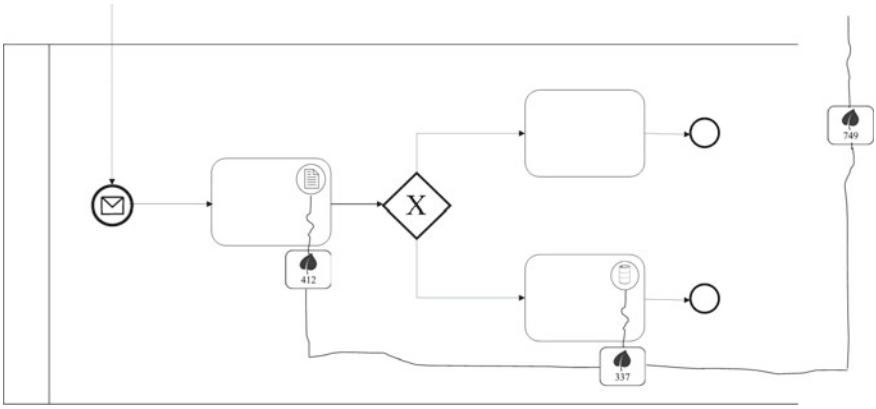

Fig. 12.2 Example BPMN notation for Green BPM (*Source* The Author)

for describing these objects associated with Green BPM, the relationships of these new objects with other objects already existing in BPMN, as well as the descriptive properties for these new objects and for the new relationships. These elements present and represented in the business process definition repository opens perspectives for a series of algorithms capable of generating relevant information to managers and business process owners.

12.5 Customer Journey Map

Modern practices focused on innovation and problem solving, such as Design Thinking (DT), recommend developers to assume the position of the customer (customer-centric), i.e., to practice empathy before changing or creating a product, a service or a process. Another DT recommendation is visualization, i.e., the use of graphical tools that make abstract issues as tangible and explicit as possible (Carlgren et al., 2016). In the area of processes, the Customer Journey Map (CJM)

tool stands out in order to meet these two demands: it directs the attention of the business process developer to the end user, as well as it is graphic.

The CJM is a linear graphical representation, being plotted on the horizontal axis with several little balls, each of them representing a point of interaction between the customer and the process. On the vertical axis, the height of the little balls in relation to the X axis indicates the level of customer satisfaction in each of those moments of interaction. Thus, the CJM shows the customer's journey through the process, portraying his interaction with the process and the different levels of satisfaction at each of the interaction points. Each of these interaction points should be perceived as an opportunity for the company to deliver more value to the customer.

The M-B-BP approach has all the necessary information to generate the CJM, not only it is possible to know which are the interaction points of the customer with the process, but also it is possible to point the sequence and duration of these interactions, as well as the deliveries made to the customer. For a process with enough alternatives of paths, one can present the CJM diagram and the metrics for the most common path traveled by most of the instances; alternatively one can present the other paths ordered by volume of processed instances during the period of interest of the analysis. With the Internet of Things (IoT) it is not difficult to collect quality perceptions at each interaction point or even infer this from subsequent interactions. All of this allows the business process developer to focus more on the customer, allowing them to recognize patterns of customer behavior over time and space. This is a great tool for those seeking quality and excellence in their business processes.

Questions for Reflection

(a) Considering the five topics covered in this chapter, discuss the ontology development required for the repositories (of process definition and process instance) in order to fully exploit the BPMS platform in support of the M-B-BP approach.
(b) Explore different scenarios that illustrate how mixed reality technology can collaborate significantly with the business process operation. Similarly, explore other scenarios that highlight the collaboration of mixed reality in support of managerial decision making.
(c) What technologies are needed for the Green BPM to be an analytical tool and in real time, i.e., to allow comparing the current status of electricity consumption and carbon emissions with the intended figures?

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13 Impact of the Management by Business Processes on the Structural Variables of the Organization

Objective of This Chapter
By the end of this chapter the reader will understand how the organization's strategic variables are configured by managers in order to achieve the best outcome with the adoption of the Management by Business Process (M-B-BP) approach.

The administrators responsible for the organization play the role of organizational designers when defining the elements of the company's organizational structure. The administrator's intention when defining the various elements of the organizational structure "is to enable a diverse set of roles, occupied by people with possibly divergent interests, to nonetheless accomplish organizational objectives" (Sandhu & Kulik, 2019, p. 619). Inconsistencies between the organizational structure and the administrative approach adopted can generate several dysfunctions, such as the occurrence of rework, slowness, little creation, defective products, and services, among other problems. Thus, the poorly designed organizational structure and inadequate in relation to the operational and managerial model of the company may result in a tangle of contradictions.

According to the Contingency Theory, managers should discuss and define the variables of the organizational structure considering the context of their business environment and the performance to be achieved according to the defined corporate objectives. From this premise, the Contingency Theory researchers work with three sets of variables: context, structure, and performance (Drazin & van De Vem, 1985). Among the main aspects of the variable structure that can be defined and shaped by managers are the dimensions: Work scope, Decision making, Representation of rules and procedures, Grouping of jobs for operation and management purposes, Chain of command, and Span of control. In this chapter, we will discuss these six aspects that configure the organizational structure of the company based on the demands of the M-B-BP approach.

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13.1 Work Scope ("Specialization")

The Work Scope dimension, also referred to by some authors as "specialization", is defined as "the degree to which tasks in an organization are subdivided into separate jobs" (Robbins & Judge, 2013, p. 515). A landmark event of successful division of labor occurred in the early twentieth century with Henry Ford's assembly line. Instead of the car standing still and the various professionals walking around the car to assemble it, Ford opted for the car being moved along several workstations. At each station on the assembly line, a different group of parts, tools, and professionals add parts and value to the final product that is the car. In this Ford situation, employees went from being generalists to becoming specialists in a few activities for the assembly of a specific part (a subsystem) of the car.

In the mid-twentieth century it was observed that the excessive specialization of jobs began to give signs contrary to desired. Among the main symptoms observed were boredom, fatigue, stress, low productivity, low quality, increased absenteeism, and high rate of employee turnover. From the observation of these disorders, several studies associated with the work environment arose, among them the one that provided the development of the Job Design theory. This theory turned to the discussion of the characteristics of jobs in order to make them more attractive and, therefore, with greater motivational potential (Job Design is discussed in Chapter 6). According to Hackman and Oldham (1976), the five dimensions of jobs that influence worker motivation are: autonomy, feedback, identity, meaningfulness, and variety. The variety is the dimension directly associated with the aspect of organizational structure called work specialization, more specifically of a wider set of activities, i.e., more variety of activities. In the Job Design theory, variety is defined as the amount of different activities performed by the worker. Too little diversity leads to boredom, demotivation, among other, negative aspects.

Thus, in the M-B-BP approach each role defined in the organization, whether for a single employee or for a group of employees, should include a broad set of relevant activities, i.e., a broad work scope. The aim is to increase the motivation of employees by expanding the scope of possible activities to be performed by them. The employee has autonomy to define what should be done at that moment for a certain instance or group of instances of the process. This allows the worker to perceive and act within the perspective of a complete work, also perceiving the value delivered to the final customer. In this way, in M-B-BP there is the performance of experts and also of non-experts, all with enough autonomy and a wide scope of possible activities to perform, all associated with one or more business processes.

13.2 Decision Making ("Centralization-Decentralization")

The decision making dimension, also called by some authors as "centralization-decentralization", indicates how concentrated or spread out the decision making process is among the several employees of the organization. The concentration

of decisions in a few people characterizes the centralization, while the opposite is the decentralization. The process reengineering movement, which is based on business processes and the M-B-BP approach, has as one of its premises: "putting the decision point where the work is performed" (Hammer, 1990, p. 111). The assumption is that the employee who experiences and identifies the unusual, the exception outside the rule, must be the person with more information and greater agility to make the decision and let the instance move on to the next activity of the process. Thus, in the M-B-BP approach, decision making occurs primarily in a decentralized manner.

As already discussed in other chapters, for decentralized decision making the M-B-BP approach works with employee autonomy, which brings greater employee involvement and motivation with the work. This makes companies more flexible and responsive. The distance from the decisions is pointed out by many as one of the reasons for employees being totally alienated from the work environment, as characterized in the classic phrase of human resources managers: "employee with only the body present in the work environment". Another aspect that favors the decentralization of decision making was the flattening of the organizational pyramid, the reduction of organizational levels, especially the middle management. Thus, the bottom-up decision making is less present in organizations, considering that organizations are increasingly flat (*flat organization*).

13.3 Representation of Rules and Procedures ("Formalization")

The dimension representation of rules and procedures is also called by some authors as "formalization", this is the case of Chatzoglou and his colleagues (2011, p. 668) who defined it as: "formalization refers to the degree to which decisions and working relationships are governed by formal rules and standard policies and procedures". It is observed that as the company grows, the complexity increases as well as the need for formalization of processes. This growth of formalization generates a conflict that hinders the very continuity of growth, as Sandhu and Kulik (2019, p. 621) rightly pointed out: "It provides organizations with structure and stability (Organ & Greene, 1981; Juillerat, 2010), but it is criticized for stifling creativity and individual initiative (Mintzberg, 1979; Briscoe, 2007)".

The M-B-BP approach is based on the detailed specification of the business process, covering the decomposition down to the level of the required activities. In this way the procedures, the rules, and the standard policies that govern the business process are formally explained in the specification and in the operation of the business process. A resource present in the M-B-BP approach to meet the normative set of the business process without tolerating the creativity and individual initiative is the mechanism for exception handling. This resource allows the worker that is interacting with the process to change the expected flow for a certain instance of the process or for several instances with such characteristics or during a specific period of time. The implementation of the change demands that

the worker justifies it, identifying the validity period, and/or the instances covered. The technologies in support of the M-B-BP approach, the BPMS software, record the justification for the change, as well as the moment status of the instance or instances that receive the exception treatment.

In this way, the exception handling mechanism allows the M-B-BP approach to deliver a high level of formalization of business processes, while allowing for employee intervention and creative action. This theme of extreme relevance to M-B-BP involves many aspects, all addressed throughout several chapters:

I. In Chapter 3 we have the description of the technical vocabularies relevant for understanding the M-B-BP approach, in it there is the subsection "3.9 Business rule and its exceptions";
II. In Chapter 5 we discuss the phases and activities of the M-B-BP approach, more specifically in sub-item "5.6.3 Functionalities to support the internalization of knowledge", there is a set of text for discussion of the topic "Identification of unplanned events (exceptions)";
III. In Chapter 7 we deal with technologies supporting the operation and management aspects of the M-B-BP approach, more specifically in the subchapter "7.2.1 Resources for optimizing and making process operation more flexible", there is a set of text on "Human interaction in process operation".

13.4 Grouping of Jobs for Operation and Management Purposes ("Departmentalization")

Another important dimension of the dimensions directly associated with the organizational structure of the company is the way to group the activities of the different jobs performed for operationalization and management purposes. Some authors call this dimension "departmentalization" as is the case of Robbins and Judge (2013, p. 517), who defined it as "the basis by which jobs in an organization are grouped together". There are many ways of grouping jobs: by the family of product or service, by geographic region served, by time zone, by project, by geographic location, by functional pertinence, among other criteria. In the case of the M-B-BP approach, the primary logic for grouping jobs and their executors is the business process. The actors, whether human or robot, are allocated in terms of dedication time and costs based on the business processes in which they operate.

As discussed in subtopic "13.1 Work scope", the specialization of work in highly specific activities for each professional (low work scope), as occurred on the Ford assembly line, leads to the concentration of mastery of a specific technicality around a few professionals, and the allocation of these professionals to functional areas or departments within companies. As a result, one of the most popular forms of work grouping is by pertinence and proximity of the functions performed by workers, hence the term company structured in the hierarchical-functional form. In contrast to the functional structure, the M-B-BP approach encourages a broad set

of relevant activities for the worker along the workflows of the business process, that is, a broad work scope for workers. Thus, it strengthens the creativity and autonomy of the worker while weakening the idea of functional division of labor.

In short, the M-B-BP approach uses process-centric logic to group jobs for operation and management purposes, while at traditional companies with a hierarchical-functional structure, grouping is conducted based on functional-centric logic. When analyzing the competitiveness of companies Ambastha and Momaya (2004, p. 51) emphasized these differences: "Process-centric perspectives have become popular. They can help bridge the critical gaps created by the silo mentality that emerges in functional-centric organizations".

In conclusion, it is important to emphasize that of the six structural dimensions of the organization, the "Grouping of jobs for operation and management purposes" is the easiest to be explained by using a simple and well-known visual tool: the organizational chart. Because of this, this dimension is often considered to be synonymous with organizational structure. As an example, this was the case in Chapter 2 of this book, when we contrasted the twelve characteristics of functional management practiced by companies structured in the hierarchical-functional form with the same twelve characteristics of companies that practice the M-BP approach. For one of these twelve characteristics, we use the term "organizational structure" to refer to the way in which jobs are grouped together for the purposes of operation and management.

13.5 Chain of Command

In a company with traditional management, structured in the hierarchical-functional form, every employee is inserted in a clear and defined chain of command: each employee reports to one and only one boss. In this traditional company, the professionals are specialists, as they deal with activities with a very limited work scope. Thus, they are under the management of the person responsible for the functional area, i.e., they work within the principle of unity of command. In the process-centric company, the employee has a much broader work scope, acting in several points of the long and complex business process, and may even act in several business processes. Thus, the M-B-BP approach implies a more complex chain of command, where the employee may be reporting to two or more superiors at the same time.

The situation of the professional having to report to multiple bosses is one of the typical challenges of the M-B-BP approach and was well portrayed in the title of an article published by The Wall Street Journal: "Office Democracies: How Many Bosses Can One Person Have"? The article comments on the situation of an employee of a software company who needed to respond simultaneously to the demands of four different managers. Situations like these demand a lot of skills from employees and managers in terms of business tactics and conflict management. Thus, in M-B-BP the chain of command is not unique, but diversified.

13.6 Span of Control

The span of control dimension refers to the "number of subordinates a manager can efficiently and effectively direct" (Robbins & Judge, 2013, p. 519). With the M-B-BP approach delegating greater autonomy to employees, including with respect to decision making, there is less demand for managers. Fewer managers imply more employees per manager, that is, an increase in the span of control dimension. Despite the greater number of employees tied to each manager, the demand does not grow proportionally according to the parameters of the conventional company. This lower dependence is due to the greater autonomy and empowerment of employees, reducing the dependence and consequently the amount of interactions of employees with their managers.

Questions for Reflection

(a) Develop a table that points out the differences between the hierarchical-functional administrative approach and the M-B-BP approach in terms of the six dimensions of organizational structure analyzed in this chapter.
(b) Just as Sandberg (2005) drafted the question "How many bosses can one person have?" alluding to the chain of command dimension, Robbins and Judge (2013) drafted the question "How many individuals can a manager span of control efficiently and effectively direct"? They mention an aspect of the M-B-BP that directly contributes for these two questions to be consistent and makes sense.
(c) Explore the reasons why the first four subsections have been given longer names than the abbreviated names customarily used, respectively, specialization, centralization-decentralization, formalization, and departmentalization.

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