Human factor in business process management: modeling competencies of BPM roles

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Abstract

Purpose – The study proposes competence models for the roles of process owners, process analysts and industrial engineers based on qualitative research.
Design/methodology/approach – The research methodology is a combination of a questionnaire survey and interviewing in Czech companies, which develop the process approach. The proposed competence models can be utilized during business process management (BPM) implementation while appointing process owners, analysts and industrial engineers and their further development.
Findings – This paper emphasizes the role of human factor and presents research results concerning most important BPM roles and their competencies.
Research limitations/implications – There is lack of research (a research gap) in the field of BPM roles, what they do and what they should do.
Practical implications – A system of competence models is thus a tool for human resource management and should increase the success rate of BPM projects. Another possible utilization is in higher education in business administration.
Social implications – Another possible utilization is in higher education in business administration.
Originality/value – It proposes competence models for the roles of process owners, process analysts and industrial engineers based on qualitative research.

Keywords Business process management, Competency, Process owner, Process analyst, Industrial engineer, Centre of excellence

Paper type Research paper

1. Introduction

Business process management (BPM) is a popular approach in business practice which is also promoted by the international quality standard ISO 9001, especially in its 2015 revision. Thus, many companies which aspire for this certification describe their processes and implement BPM aspects to their management systems. However, BPM is more than just a set of process maps. Franco-Santos *et al.* (2007) studied various definitions of BPM. On the basis of a systematic research, they proposed a set of necessary and sufficient conditions of BPM that support a higher level of understanding in the research field of performance

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measurement. According to Lehmann (2012), it is the art and science of how to do work and to do it better. More specifically, BPM means achieving goals of an organization through improvement, management and control of business processes—it is not mere technology but management of business processes (Jeston and Nelis, 2014; Szelagowski, 2019a, 2019b, 2019c).

Thus, an emerged horizontal organization is characterized by organizing around core processes instead of tasks and functions. Other BPM characteristics are process ownership, teamwork, decreased hierarchy, non-value work, empowerment of employees, information technologies utilization, integration with customers and suppliers, competencies enhancement, redesign of functional departments to service centers, process performance measurement and continuous improvement culture (Ostroff, 1999). Chountalas and Lagodimos (2019) defined the key attributes of the BPM model independent of predominant paradigms of management. Sometimes, BPM is interchanged with technologies for process execution. Nevertheless, BPM is not mere automation. Processes are the main intellectual property and differentiation element; they represent business *per se* (Smith and Fingar, 2007). It must be noted that processes must be defined and improved before automated (Jeston and Nelis, 2014). For these reasons, we refer to BPM as business process management and BPMS as business process management suits or systems. Fischer *et al.* (2019) focused in their research on the integration of BPM into service-oriented architectures (SOA) and business rules management (BRM). Bach *et al.* (2019) studied the relationship between business intelligence (BI) and BPM on a sample of various organizations. Based on our introduction, there are about eight basic pillars of BPM. The focus of the article was on one of the pillars, the role of human factor in BPM projects. The main goal of the paper is to define especially the modeling competencies of BPM roles.

2. Human factor in BPM

Job position is an organizational unit responsible for given tasks and activities. It can be composed of several process roles identified within the process mapping. These job positions are then assigned to workers according to their competencies (Armstrong and Taylor, 2014). In the following text, the term role is, therefore, understood as a part which a person has in a process. Also, other authors (Froger *et al.*, 2019) defined that the job positions definitions and responsibilities allocation are one of the critical factors for BPM implementation.

Original proponents of business process reengineering (BPR) defined certain roles necessary for a successful reengineering project. The very first one was the characteristic of Hammer and Champy (2003), describing the roles of a reengineering star, steering committee and a process owner. There exists a systematic literature review focused on process owners in BPM in the study of (Danilova, 2019). The author described the significance of appointing process owners, their roles and responsibilities, as well as obstacles to and enablers of effective process ownership. In the course of time, there was established especially a process owner responsible for design and results of a process across functional departments. Other roles are, e.g. BPM center of excellence (CoE) manager, process architect, process designer, business analyst, etc. (Kirchmer *et al.*, 2013). One of the process-oriented approaches is Six Sigma movement which uses the roles of master black belts, black belts and green belts. Similarly, Lean management introduces industrial engineers or kaizen managers. Pereira *et al.* (2019) concentrated on research of the attitudes of individuals to organizational changes, taking into account all the phases and implementation of BPM.

2.1 BPM center of excellence

Process management can be particularly in more complex organizations with higher BPM maturity represented by BPM CoE. This unit is responsible for BPM program, individual projects and continuous development. The members of this center can coordinate all process work in the organization, monitor process efficiency, or other sub-projects (KAIZEN, etc.). Moreover, it provides important support for process change management (Harmon and Wolf, 2012).

In narrower concept, it is composed of its manager and the roles presented below, in broader sense, it includes process owners. Team members may differ according to company strategy. The goal is to ensure uniformity of governance, methodology, tools and competencies. An individual member may be assigned to different projects and units within the organization (Jeston and Nelis, 2014). Further, BPM CoE administers process models repository (Panagacos, 2012), enterprise architecture, support to process owners, reporting and training BPM users (Harmon, 2014). The efficiency of BPM CoE was researched by Nqampoyi *et al.* (2017). They worked on a model of efficiency, which is a theoretical benefit in this field of study. Bitkowska (2018) also focused on research of this issue.

2.2 Process owner

The role of a process owner was described at the beginning of BPR movement by Hammer 1990 and Davenport and Short (1990), and today it is a common term in the academic literature and business practice (Hrabal *et al.*, 2014). Process ownership is one of distinguishing factors of process organizations from functional organizations. Process owners are responsible for the whole cross-functional process and thus their scope exceeds traditional functional departments (Robson and Ullah, 1996). Their task is to "fill the white spaces on the map" between departments in the organization structure (Rummler and Brache, 2013). According to Trkman (2010), the process owners are one of the key success factors, especially when top managers are assigned to the role. The other research results (Hernaus *et al.*, 2016) clearly showed that the best results of BPM initiatives were achieved by organizations that had introduced a strategic approach to BPM. In the context of process ownership, on one hand, they defined a centralized BPM responsibility, and on the other hand, they preferred decentralized process ownership roles. Main tasks of the process owners are documenting the process, standardization within individual branches, authorizing of process variants, approving process improvements and ensuring that changes do not negatively affect other processes and workers (Siemieniuch and Sinclair, 2002). Despite the vast body of the literature, there is actually a low awareness of what the process owners do or what they should do (Reijers and Peeters, 2010). This fact is one of the reasons for this research.

2.3 BPM manager, process analyst and Six Sigma roles

A manager of BPM CoE is responsible for alignment between business needs and processes. He or she leads the process team which delivers process modeling and improvement to internal customers—process owners. Thus, he or she should be a very good motivator and leader rather than a man with the greatest knowledge about given processes (Jeston and Nelis, 2014).

A process analyst may comprise roles such as process designers, process architect, business analysts, etc. It is a role with responsibility for process modeling and writing related documentation, simulation, ensuring alignment between tools, supporting performance measurement system, internal customers and improvement proposals (Panagacos, 2012). Very often, process analysts or business analysts serve as a connection between business and

information technologies and thus "translates" needs of business in the form of a process and systems models for automation (Jeston and Nelis, 2014).

Based on some authors (Cherbakov *et al.*, 2005), the "owners" and "customers" can also be defined from business capabilities' perspective in the generic sense, performing within a certain level of quality.

In this sense, "maps of capabilities" are concerned. These maps can describe the features implemented at a given point in time in more detail and in relation to: the people involved; the operational processes; the data and content manipulated; the technologies and so on (Mendes and Bax, 2018).

Also, within the Six Sigma initiatives, it is necessary to determine specific roles for process improvement, i.e. master black belts, black belts and green belts. Master black belts usually possess professional knowledge of change management, statistical methods and process design and train other black and green belts. Black belts are more experienced than green belts and may be full-time roles. Six Sigma also establishes process owners who sponsor improvement projects and take over results (Harmon, 2014; George *et al.*, 2004).

2.4 Management by competencies

Competencies refer to basic characteristics of a man which lead to effective or superior performance in a specific job or situation. It is behavior and thinking which persist in time, e.g. traits, motives, self-concept, knowledge and skills (Spencer and Spencer, 1993). Among other competencies, there are results orientation, customer orientation, planning and organizing, problem-solving, technical skills, decision making, development of others, creativity and many others (Armstrong and Taylor, 2014). Boyatzis (2008) defines competency as a capability or ability which can be observed via person's behavior and which is resulting from neural circuits, unconscious traits and motivations and values and philosophical foundations of these competencies. Further, competencies can be developed. Most of companies with more than 300 employees use some form of management by competency within its human resource management.

Competencies are a basis for performance management which can be achieved when demands on a job position are in balance with person's talent and vision and organizational environment (Boyatzis, 2011). A competent worker should possess not only professional knowledge but also practical skills and social maturity. Knowledge includes knowledge about objects and its functions and management. Practical skills consist of communication, motivation, teamwork and self-management. Social maturity is comprised of character, creativity, temperament and somatic characteristics (Porvazník *et al.*, 2017).

In the context of adoption of information technologies in the manufacturing industry, the manufacturing companies should strive to manage their data and manufacturing processes in a way to enhance their manufacturing competency (Ahn and Chang, 2019).

As the future is in smart factories, these factories acquire processing data from connected machines and the BPM approach can enrich the capability of manufacturing operations management. Also, the manufacturing companies could benefit from the well-defined methodologies and process-centric engineering practices of this BPM approach to optimize their manufacturing processes.

For management by competencies, it is suitable to develop competence models—descriptions of key competencies for a given job position. In a model, there can be included behavioral competencies, i.e. what behavior is expected from workers, and technical competencies found out from the analysis of expectations upon performance and tasks (Armstrong and Taylor, 2014; Eicker *et al.*, 2008). These descriptions should be complemented by scales enabling their assessment such as the rate of task completion, effectiveness rate, complexity, amount of effort or uniqueness (Spencer and Spencer, 1993).

Competencies in BPM were analyzed, for example, by Sonteya and Seymour (2012) who divided competencies of a process analyst into five layers:

(1) Basic – business analysis, process and holistic thinking and customer orientation

(2) Inter-personal – facilitation and leadership, communication and trustworthiness

(3) Organizational – understanding strategy and linkages between functional departments

(4) Process approach – BPM support, modeling risk assessment and process improvement

(5) Technical – service-oriented architecture, ERP system and user interface design

A similar framework is presented by Panagacos (2012) who defines competencies for a process analyst, process architect and a process professional. Among these, there are BPMN, process modeling and redesign, performance measurement, workflows, governance and compliance management, BPM maturity, writing manuals and procedures, surveying, stakeholders relationship management, project management, enterprise architecture and certification in Lean or Six Sigma.

However, these models lack description of competencies and their individual levels, which would indicate how to manage them.

Other competence analysis is offered by Smith and Fingar (2007) who define 7 levels of expertise:

(1) Without any knowledge – needs to be informed and educated

(2) Aware – should be trained in the basics of BPM

(3) Beginner – should be trained in details and tools

(4) Practitioner – ready to use BPM and make decisions, needs to be mentored further

(5) Expert – uses BPM naturally and independently

(6) Professional – knows methodological fundamentals, knows what and how and especially why

(7) Expert – publishes in the field of modeling and methodology, mentoring and training

But this framework is rather general and not connected to a particular role but to BPM awareness among every worker in an organization. The question is what it means to be a competent professional in the process-oriented organization.

3. Methodology

Via literature review, it was found out that there is lack of research in human factor in BPM which focuses more on technical aspects. Although several roles are described and considered as important or even as the key BPM pillar such as process owners, little is actually known about what they do in practice or what they should do. Even from authors' business experience in several companies, BPM implementations end after mapping processes and developing their models without a clear differentiation of functional managers and process owners (Tucek and Hrabal, 2014). The main motivation to do this research was to complement current body of BPM knowledge by description of BPM roles and their competencies so they could support implementation projects in organizations by selecting and training workers for their jobs in the process-oriented companies.

The main goal of the research was to define necessary competencies and create competence models for the most important roles in BPM. Secondary goals were to conduct survey and interviews among organizations in the area of BPM activities and roles, development of methodology for selecting and positioning of these roles within an organization and to design the process of process management and improvement. Research questions are thus formulated as follows:

RQ1. What process roles are related to implementation and development of BPM?

RQ2. What competencies do workers in these roles need for effective performance?

RQ3. What other roles are suitable to implement in relation with BPM program?

RQ4. What form of positioning is appropriate for BPM roles in relation to the organization structure, i.e. functional departments and managers?

The research process was divided into several phases. In the first phase, there were defined the areas of focus and literature review was conducted. Literature review was carried out continuously also in further research phases. The second phase consisted of formulation of goals, research questions and methodology. The third phase rested in determining research sample and gathering empirical data. A questionnaire survey and subsequent personal interviews were chosen as primary methods. Questionnaires should identify the main trends and prepare more focused research through interviewing respondents. In the fourth phase, the gathered data were analyzed and the results synthesized into competence models.

4. Results

The following chapter presents the main results of the third phase of the research, i.e. a questionnaire survey and structured interviews.

4.1 Questionnaire survey

The questionnaire survey among organizations was conducted with the aim to identify principal BPM activities and roles. The questionnaire underwent pilot testing and was distributed electronically to respondents from the ranks of cooperating organizations of Tomas Bata University in Zlín. Small, medium and big organizations which utilize some of BPM aspects were addressed. The criterion was having ISO 9001 certification of quality management system which emphasizes the process approach. Within the survey, 135 organizations were addressed and 30 of them completed the whole questionnaire. Other 13 respondents were excluded because of incomplete answers in the questionnaire. The structure of the sample is listed in Table 1.

The gathered data from the sample therefore describe mainly large organizations and include especially manufacturing enterprises. Because of a limited size of the sample and its structure, we cannot provide generalized inductive reasoning. However, the aim of the survey was to identify possible BPM trends and get ready for more focused interviewing which went into more detail about BPM governance, role and competencies.

Among the most common BPM activities, there were mentioned process performance measurements, followed by automation or workflow eventually. Most organizations also utilize methods of industrial engineering for process improvement, or process modeling. Activity based costing, BPR or Six Sigma are less frequent. Simulations are used mainly in large organizations and only marginally (Table 2).

Processes are most commonly documented in text form e.g. as guidelines and directives. Process maps in their static form, e.g. in MS Visio or tables, are also frequent. Process models are used in 40% of cases using BPMS such as ARIS, Bizagi, Attis, Bonitasoft, IBM BPM, etc.

Characteristics	Frequency (relative frequency)
Respondents addressed (*N*)	135
Total cases collected	43
Cases excluded	13
Cases included to analysis (*n*)	30
Sectorial characteristics	
Manufacturing	20 (66.7%)
Construction industry	1 (3.3%)
Wholesale and retail trade, repairs and maintenance	3 (10%)
Information and communication technologies	3 (10%)
Finance and insurance	3 /10%)
Organizational characteristics	
Small organizations (<50 employees)	2 (6.67%)
Mid-size organizations (51–250 employees)	5 (16.67%)
Big organizations (251–500 employees)	7 (23.33%)
Large organization (>501 employees)	16 (53.33%)

Table 1. Questionnaire survey sample structure

	Organization size (number of employees)							
	<50		51–250		251–500		>500	
BPM activity	N	%	N	%	N	%	N	%
Modeling	2	100	2	40	2	28.6	12	75.0
Simulation	1	50	–	–	–	–	9	56.3
Industrial engineering	–	–	3	60	1	14.3	14	87.5
Six Sigma	–	–	–	–	1	14.3	10	62.5
BPR	1	50	2	40	1	14.3	7	43.8
Automatization/workflow	1	50	4	80	1	14.3	13	81.3
Activity based costing	1	50	2	40	1	14.3	9	56.3
Performance measurement	1	50	5	100	1	14.3	15	93.8
Others	–	–	–	–	–	–	1	6.3

Table 2. BPM activities according to the organization size

The organizational position of BPM is various and is often not centralized. In some cases, functional managers are supported by BPM specialists or industrial engineers. In nine cases, information and communication technology (ICT) department is responsible for BPM. It can be assumed that automation and workflow is the reason. In four cases, quality management department is responsible for BPM, in three cases, it is operations. But mostly, in ten cases, the organization itself chooses own different positioning of BPM.

The survey found out that the most frequent BPM role is a process owner, which supports the importance emphasized in the BPM literature. Because of majority participation of manufacturing enterprises, the role of an industrial engineer follows. The roles of process architects, IT architects, project sponsors and business analysts or process analysts are less frequent. Organizations with BPM CoE have established BPM managers and organizations with Six Sigma programs implemented the roles of black belts and green belts. An overview of BPM roles with their frequencies identified in the survey is in Table 3.

The survey results were analyzed from the organization size perspective. The aim was to find out possible differences between a scope of BPM activities and roles implementation. For the analysis purpose, first three categories of organizations were merged into one category "<500 employees" compared to the second category ">500 employees". Two-sample *t*-test was chosen for testing the hypotheses about the difference of two means. For the calculation

BPM role	*N*	%
Process owner	18	60.0
Industrial engineer	16	53.3
IT architect	8	26.7
Business	6	20.0
Process/project sponsor	6	20.0
Process analyst	5	16.7
Six Sigma roles: master/black belt, green belt	4	13.3
Others	4	13.3
BPM CoE manager	3	10.0
No roles in BPM	3	10.0
Process architect	1	3.3
Chief process officer	0	0.0

Table 3. Implemented BPM roles

of statistics, XL Statistics tool was used. In Table 4, descriptive statistics for organizations "<500 employees" and ">500 employees" are presented.

The null hypothesis about the equity of means was tested against the alternative hypothesis when means differ:

H0. The average number of BPM activities between organizations to 500 and over 500 employees does not differ.

H1. The average number of BPM activities between organizations to 500 and over 500 employees differs.

In Figure 1, there are basic and important characteristics of the *T*-test result for BPM activities and these values can complete the descriptive statistics characteristics for BPM activities in Table 4. The resulting value T is −2.297957333 with 28 degrees of freedom (DF) and p-value is 0.029243656 (Figure 1). On the significance level $\alpha = 0.05$, we can reject the null hypothesis and assume that there is a difference between the scope of BPM activities between smaller and larger organizations.

					Scope				
Category	*N*	Mean	Σ	Skewness	Min	Max	Q_1	Median	Q_2
<500	14	3.07143	2.33582	1.67452	1	9	2	2	3.75
>500	16	4.9375	2.11246	−0.1976	1	8	3.75	5	6.25
Total	30	4.06667	2.37709	0.47645	1	9	2	4	6

Note(s): σ - standard deviation; Q_1 - lower quartile; Q_2 - upper quartile

Table 4. Descriptive statistics for BPM activities

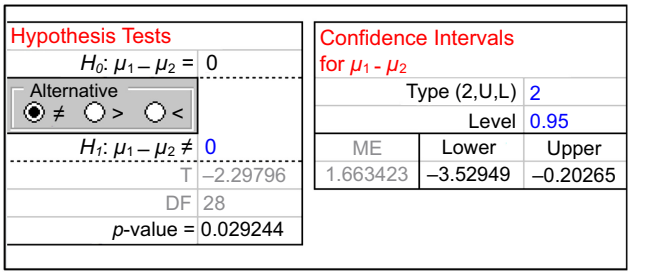

Figure 1. *T*-test results for BPM activities according to the organization size

Analogous procedure was carried out for the analysis of implemented BPM roles of which characteristics are described in Table 5.

Again, the null hypothesis about the equity of means was tested against the alternative hypothesis when means differ:

H0. The average number of BPM roles between organizations to 500 and over 500 employees does not differ.

H1. The average number of BPM roles between organizations to 500 and over 500 employees differs.

In Figure 2, there are basic and important characteristics of the *T*-test results for the implemented BPM roles and these values can complete the descriptive statistics characteristics for the implemented BPM roles in Table 5. The T value resulted in – 2.7 with 28 degrees of freedom, *p*-value is 0.011.

We can, therefore, reject the null hypothesis and on the significance level $\alpha = 0.05$, we suppose that there is a different scope of BPM roles implementation in larger organizations. Statistical testing indicated differences between larger and smaller organizations in the scope of BPM activities and roles. Due to this fact, the size and complexity of an organization when the process models were designed were considered in the following phases of the research.

4.2 Structured interviews

Based on the phase of a questionnaire survey, there were found out the most common BPM roles and activities. Among these roles, there is a process owner, industrial engineer, process architect, IT architect, project or process sponsor and business or process analyst. The following phase was focused on BPM roles in more detail including their competencies. After that, the interview with a process owner, industrial engineer and business analyst and process analyst was organized. IT architects can be interconnected with BPM indirectly as they support process automation. Project or process sponsors may coincide with functional managers or process owners. Interviews were conducted with the aim to gather qualitative in-depth data and enable a deeper understanding of BPM governance and roles. For the BPM

Category	*N*	Mean	Σ	Skewness	Scope		Q_1	Median	Q_2
					Min	Max			
<500	14	1.57143	0.93761	1.71979	1	4	1	1	4
>500	16	3.25	2.14476	0.55603	1	7	1	3	7
Total	30	2.46667	1.87052	1.22443	1	7	1	2	3.75

Note(s): σ - standard deviation; Q_1 - lower quartile; Q_2 - upper quartile
Source(s): own research

Table 5.
Descriptive statistics for implemented BPM roles

Hypothesis Tests	
H_0: $\mu_1 - \mu_2$ =	0
Alternative	≠ > <
H_1: $\mu_1 - \mu_2 \neq$	0
T	–2.70631
DF	28
p-value =	0.011456

Confidence Intervals for μ_1 - μ_2		
Type (2,U,L)	2	
Level	0.95	
ME	Lower	Upper
1.270513	–2.94908	–0.40806

Figure 2.
t-test results for BPM roles according to the organization size

maturity assessment, American Productivity and Quality Center (APQC) maturity model was chosen. However, rather than audit for precise evaluation, we used an organization's management system for general orientation and understanding.

Respondents were chosen particularly based on participation in the survey. A prerequisite for an interview was ISO 9001 certification of quality management system or a similar system and the existence of positions or department responsible for process management or industrial engineering.

The structure of the interview composed of questions about the organization vision and mission, management system overview, process landscape and organization structure. BPM maturity assessment used APQC checklist with questions about the process management scope, process documentation, process awareness, process ownership, performance measurement, process improvement, agility and anomalies resolution, the relationship between risk and quality management, awareness of roles and job descriptions and tools and technologies. The main part of the interview focused on the implemented BPM roles, their duties and requirements regarding competencies. Lastly, the perceived benefits of BPM were discussed.

During individual interviews, mutual patterns and similar characteristics among the analyzed organizations emerged in the context of grounded theory. After completion of eight interviews, the gathered data were evaluated to synthesize them into competence models (see Table 6). Below, we present precise conclusions about the competencies of BPM roles.

4.2.1 Process owner's competencies. The process owner's competencies were analyzed on the basis of data about managers and process owners in companies A, B, C, E, G and H (Table 6). Companies with the implemented BPMS emphasized the knowledge of BPM, most of the companies stressed professional knowledge of assigned process and expertise in subsequent disciplines. Knowledge of project management was mentioned particularly in relation to project sponsorship or project management itself. A process owner should be a leader with a vision and strategy how to achieve it and for which he or she can excite his or her team. He or she should further develop and motivate the team. Thus, the process owner should suitably combine leadership with management skills. Systemic thinking was explained as a need to see the whole process with its attributes and interfaces to other processes and organizational context. Analytic thinking was not considered to be important as a process owner should mainly be decisive according to his or her analysis. As for soft skills, there are important communication and presentation skills, social skills, e.g. empathy, integrity, openness to other opinions and changes.

Table 6.
Process owner's competencies according to interviews

Process owner's competencies	A	B	C	E	G	H
Knowledge of BPM	✓	✓				
Knowledge of a given process	✓		✓	✓	✓	✓
Knowledge of risk management	✓					
Basic economic knowledge	✓					
Knowledge of project management	✓	✓			✓	✓
Leadership – sharing vision and strategy		✓	✓	✓		
Development and motivation of team		✓	✓	✓		
Management skills and teamwork		✓		✓	✓	✓
Systemic thinking	✓	✓	✓	✓		
Communication and negotiating skills	✓	✓	✓	✓		✓
Emotional intelligence – empathy, self-management		✓	✓	✓		
Integrity, trustfulness		✓	✓	✓		
Proactivity, openness to improvement		✓	✓	✓		✓

4.2.2 Process analyst's competencies. Competencies of process analysts were analyzed based on data from organizations A, B and F (Table 7) which contain the roles of a process architect and designer, process analyst and business analyst. The key knowledge for the process analyst is knowledge of BPM, including knowledge of reference process models or best practices such as, for example, APQC process classification framework, supply chain operations reference (SCOR) model, etc. During the process of BPM implementation and further development, the process analyst should consider organizational context—its structure, processes, culture and people. Lean thinking competency rests in basic overview of industrial engineering philosophy and methods and incitement to continuous improvement. Analytic thinking was mentioned indirectly, the emphasis was placed on systematic data processing and systemic thinking in general. Computer literacy differs according to the software applications used. However, for a governance of process repository, modeling and workflow design, it is suitable to have certain "programming thinking". Skills to define and measure performance indicators can also be requested.

Communication skills are crucial, collaboration with co-workers and moderating workshops. It is related to assertiveness and leadership pursuant to directing others, e.g. during workshops and the art of asking suitable questions. While gathering data, process analysts must show patience and sensitivity—know psychology for working with different people. Creativity is then perceived as a design of user-friendly process models and solutions.

4.2.3 Industrial engineer's competencies. An industrial engineer was the most commonly occurring role within the analyzed organizations during interviews (Table 8). The consensus reigns on the need of detailed knowledge of industrial engineering—Lean philosophy and methods including skills of adapting and implementing certain methods to the given organization. The need of analytical thinking in relation to gathering and analyzing data was stressed, most commonly in table processor. In two organizations, there was explicitly requested knowledge of a simulation software application. In general, knowledge of different software applications such as workplace design, layouts or process modeling software is appreciated. Also, technical thinking is required as an industrial engineer may need to read technical and drawing documentation, design assembly procedures, etc.

Industrial engineers often work on projects and in teams, that is why knowledge of project management with the emphasis on moderating workshops is included. While working with teams, an industrial engineer must motivate, excite, communicate and be assertive, e.g. while overcoming disagreement. Nevertheless, he or she must always behave respectfully.

Process analyst's competencies	A	B	F
Knowledge of BPM	✓	✓	✓
Knowledge of BPMS	✓	✓	✓
Knowledge of organizational context	✓	✓	
Lean thinking	✓	✓	
Analytic thinking			✓
Systemic thinking	✓	✓	✓
Computer literacy, programming thinking	✓		✓
Communication skills	✓	✓	✓
Assertiveness, leadership	✓		
Moderating workshops	✓	✓	✓
Processes of the organization and best practices	✓	✓	
Performance measurement	✓		
Creativity – visualization and design	✓	✓	✓
Emotional intelligence – patience, empathy, sensitivity		✓	
Flexibility and speed		✓	
Psychology		✓	

Table 7. Process analyst's competencies according to interviews

Industrial engineer's competencies	A	B	C	D	E	G	H
Knowledge of industrial engineering	✓	✓	✓	✓	✓	✓	✓
Technical thinking	✓	✓				✓	✓
Computer skills – table processor	✓	✓	✓			✓	✓
Computer skills – simulations	✓					✓	
Computer skills – others	✓	✓	✓			✓	✓
Knowledge of project management and teamwork	✓	✓			✓		✓
Knowledge of foreign knowledge						✓	✓
Analytic thinking	✓	✓	✓	✓		✓	✓
Systemic thinking	✓	✓				✓	✓
Moderating workshops	✓	✓	✓	✓	✓	✓	✓
Assertiveness	✓	✓	✓				
Communication skills, inspiring, respect	✓	✓	✓	✓		✓	✓
Creativity	✓						
Flexibility and speed		✓					
Leadership				✓	✓		

Table 8.
Industrial engineer's competencies according to interviews

5. Competence models

The results can be directly synthesized into competence models of a process owner, process analyst and industrial engineer as the most common roles identified by the research. It must be noted that a role is not equal to a job position. Therefore, especially in smaller companies, one industrial engineer can also have the role of a process analyst, of the director of a department or he/she can be a process owner, etc. With more roles within one job position, requirements increase upon competencies, or more precisely, more competent workers can have more roles assigned.

The competence model is composed of three clusters – knowledge, skills and behavioral competencies to include not only technical but also behavioral ones as suggested by Armstrong and Taylor (2014) or Boyatzis (2008). In these groups, there are included individual competencies with their definitions. The competence model is in the form of a tree diagram modeled in SW ARIS and in the form of a matrix. In Figure 3, there is a legend of symbols.

The competence matrix gives an overview of competencies and their levels. Competencies can be measured on four levels:

(1) Basic level – knowledge, skills and behavior enabling cooperation in a team.

(2) Advanced level – knowledge, skills and behavior enabling independent work or leading smaller teams.

(3) Professional level – knowledge, skills and behavior enabling professional work, problem-solving and improvement.

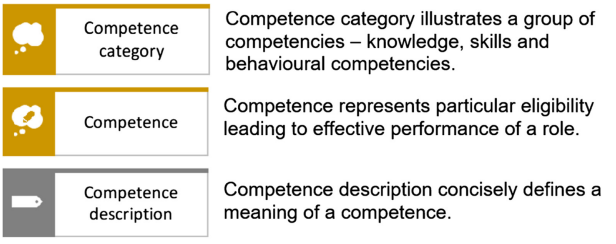

Figure 3.
Meaning of symbols in competence models

(4) Expert level – knowledge, skills and behavior enabling leadership or training colleagues in a given area.

Dark gray cells in competence matrixes indicate the level of a competence (e.g. three dark gray cells mean level 3 of the competence). A detailed description of individual levels for each competence is given in the Appendix.

There is also another competence matrix in another area. But the principle is the same. For example, The University of Magallanes in Chile has been using a computer proficiency test for all students entering the first year of undergraduate studies since 2010. The test aims to validate skills and knowledge related to the ICT of the students (Ojeda *et al.*, 2019).

Some systems are also working with an on-line automated employability profiling tool to identify the user's existing skills, competencies, attitudes and experience against identified digital jobs profiles, and these can be combined with the age, personal goals and formal education to place the user in an employment matrix (Rautkauskiene and Gudoniene, 2019).

5.1 Competence model of a process owner

The competence model of a process owner is determined by the following activities:

(1) Responsibility for the assigned process, leading a process team and functional managers.

(2) Designing the process and configuration and its attributes.

(3) Monitoring and reporting on process performance.

(4) In case of problems, implementing corrective and preventive measures, requesting improvements, sponsoring projects.

Position in an organization:

(1) A process owner is part of top management.

(2) In case of one end-to-end process, there should be just one process owner, e.g. a person with the highest influence (through resources) and with proper competencies.

(3) In case of more end-to-end processes, there can be more process owners with necessary competencies. It is suitable to assign BPM process owner to coordinate the whole system.

Competencies of a process owner and their levels are shown in Table 9.

Competence	Required level
Professional knowledge	
Business Process Management (BPM)	
Project management	
Leadership	
Management skills	
Communication skills	
Systemic thinking	
Emotional intelligence	
Proactivity and creative thinking	

Table 9.
Competence matrix of a process owner

The process owner's knowledge must correspond with his or her expertise in a field, e.g. technologies, production, finance or sales, etc. A process owner must understand BPM to the extent to which it contributes to a company, so he or she can design a process, configuration, attributes, read process models and set up performance indicators.

Knowledge of project management includes knowledge of project types and methodologies used in a company, knowledge of the project management process and roles. Of course, in case that a process owner owns BPM or project management process, he or she should have the highest level in these competencies.

Skills of process owners suitably combine management and leadership. As a process owner does not need to be a formal superior of functional managers in a process, he or she should possess strong leadership skills – sharing vision and strategy – at least on the level 2, or in case of the core process, on the level 3. Level 2 is a minimal requirement and with a higher complexity of processes and number of employees, it should increase. A high level of communication skills is needed in case of problem solving and negotiations with functional managers and workers in a process out of subordination of the process owner, or in case of dealing with interested parties.

Key behavioral characteristics of a process owner are systemic thinking—seeing things in the context of an organization, understanding interactions between the process, systems and structures, anticipation of changes (Figure 4). While dealing with people, a process owner has a high level of emotional intelligence, i.e. understands and manages own emotions and emotions of colleagues. A process owner should apply individual approach; act justly and with regard to interests of a company. He or she is also open to other opinions and actively suggests improvements.

In case that a process owner needs creativity for his or her profession, a higher level of this competence can be required. It may be suitable for processes such as marketing processes or developing new products, etc.

5.2 Competence model of a process analyst

The process analyst's competencies are determined by tasks:

(1) Mapping as-is processes and designing to-be processes with a team.

(2) Measuring, analyzing and reporting process performance.

(3) Modeling processes with given notation and conventions (designer).

(4) Governing the process repository and conventions (architect).

(5) In case of the green or black belt certification, he or she also leads improvement projects.

Position in an organization:

(1) In case of one process owner, a process analyst is in his or her team.

(2) In case of more end-to-end processes, a process analyst is in BPM CoE.

(3) In case of smaller organizations, a process analyst does not need to have a full-time job position but a role assigned, e.g. to an industrial engineer or quality engineer, etc.

(4) Note: in case of green and black belts, a process analyst needs competence in statistics and project management methodology DMAIC.

The focus of process analyst's knowledge rests in BPM on the professional level including knowledge of reference models and best practices. BPMS knowledge means detailed knowledge of software application for modeling, notation and conventions. Architects who

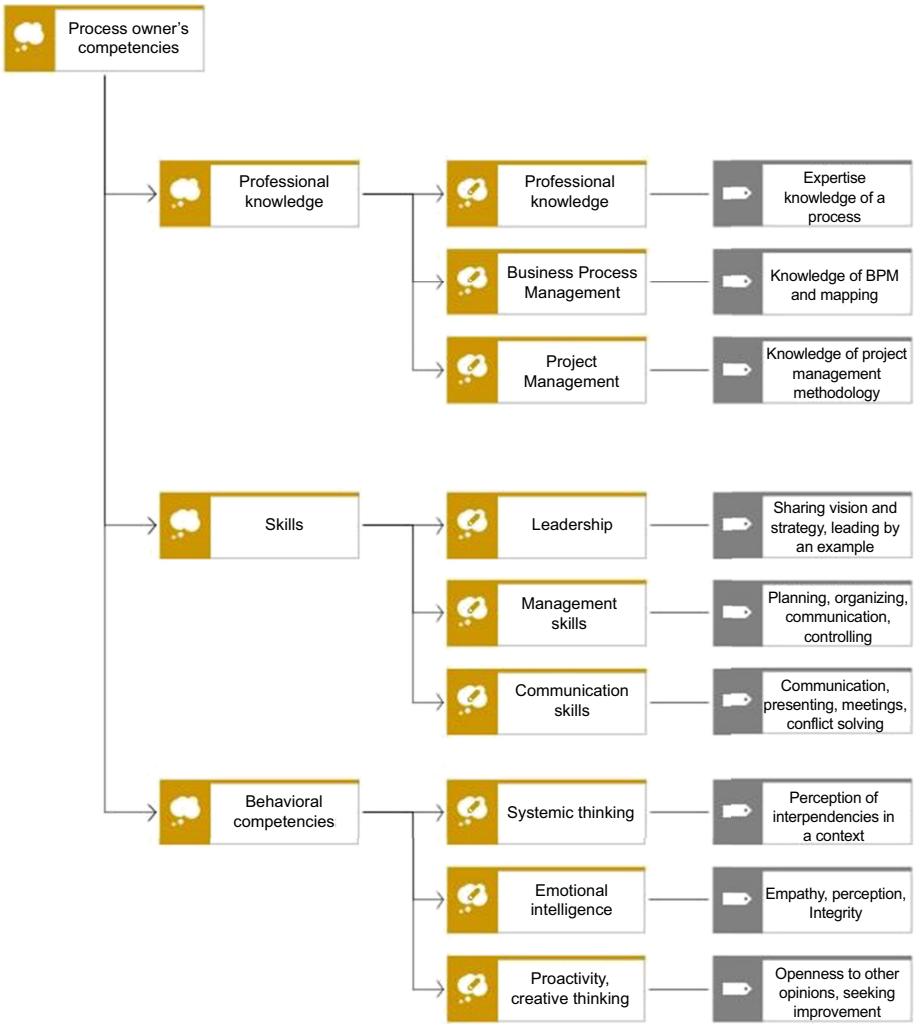

Figure 4.
Competence model of a process owner

govern the whole database need a higher level of the competence. A process analyst must promote Lean thinking, in case of green and black belt, professional competence in industrial engineering is suitable (Table 10 and Figure 5).

While mapping and modeling, the analyst cooperates with various co-workers and thus needs proper communication skills, ask appropriate questions and moderate discussions. In many cases, analysts collect data, analyze performance and set up indicators together with the process owner. Thus, computer literacy, i.e. table processor or modeling and simulation software are required.

An analyst from its definition needs analytic thinking. But while modeling and process designing, he or she must perceive facts in the context. So, he or she is required to have systemic thinking, too. For this reason, creativity is needed to make the process model user-friendly. Emotional intelligence such as empathy, patience, stress resistance, etc. is not less important.

Table 10.
Competence matrix of a process analyst

Competence	Required level
Business Process Management	
Business Process Management System/Suite	
Industrial engineering	
Communication skills	
Performance measurement	
Moderation	
Computer literacy	
Systemic thinking	
Analytic thinking	
Emotion intelligence	
Proactivity and creative thinking	

5.3 Competence model of an industrial engineer

The industrial engineer's main activities are:

(1) Eliminating waste and increasing productivity of production or administrative processes.

(2) Promoting and training Lean thinking.

(3) Analyzing and evaluating performance.

(4) Proposing and implementing improvements, managing own projects.

Position in an organization:

(1) In case of one process owner, an industrial engineer is in his or her team.

(2) In case of more end-to-end processes, an industrial engineer is in BPM CoE.

(3) Note: in case of green and black belts, an industrial engineer needs competence in statistics and project management methodology DMAIC.

Competence matrix of a process analyst is in Table 11.

The main body of industrial engineer's knowledge is industrial engineering—philosophy and methods. The professional level of knowledge requires that an industrial engineer is able to choose a suitable method for a given problem and applies it according to company's needs. He or she should also know methodology for project management so that he or she can manage own smaller improvement projects. On a basic level, technical thinking is expected for orientation in the technologies used and for reading technical documentation.

Skills are similar to the process analyst's ones, but with stronger emphasis on moderations when the engineer needs to coordinate a team of colleagues at workshops. This competence is interlinked with communication skills when the industrial engineer has to adjust communication styles to different people according to their position in the organization.

An industrial engineer needs to be a very good analyst. In case of green or black belts, the role includes the knowledge of statistics. Further, he or she needs to be proactive while promoting changes and improvements and emotionally mature to manage him/her while understanding colleagues.

Competence model of an industrial engineer is in Figure 6.

5.4 Position of BPM roles within an organization

Organizational positioning of a process owner, process analyst and industrial engineer is illustrated in Figure 7.

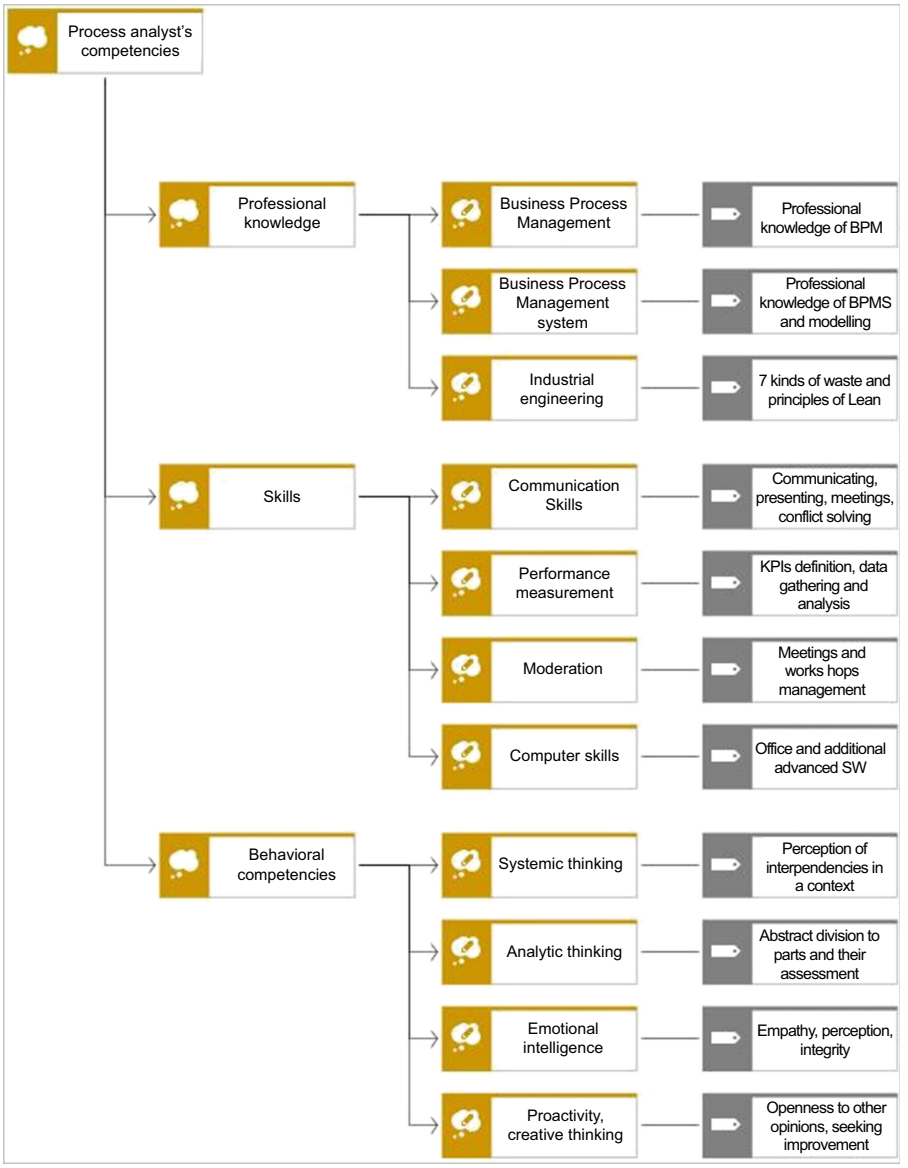

Figure 5.
Competence model of a process analyst

In the first example, there is an organization with one end-to-end core process. There is one process owner with a team consisting of a process analyst and an industrial engineer. Other roles can be included. As a process owner, a competent member of top management can be assigned and other roles can be positioned in his/her department. It needs to be noted that positions can have different names. For example, industrial engineers especially in service organizations can be called Lean specialists, etc.

In the second example, there is a more complex organization with several end-to-end core processes, each with its own process owner. In that case, BPM CoE is set up with BPM process

Competence	Required level
Industrial engineering	
Business Process Management	
Project management	
Technical knowledge	
Communication skills	
Performance measurement	
Moderation	
Computer literacy	
Systemic thinking	
Analytic thinking	
Emotional intelligence	
Proactivity and creative thinking	

Table 11.
Competence matrix of a process analyst

owners, process analysts, industrial engineers and other required roles coordinating the whole BPM across the organization and thus supporting process owners.

It is also appropriate for organizations with several branches, plants or locations, to assign just one process owner who coordinates process managers in branches. A local manager then can propose improvement suggestions which a process owner can authorize as a new standard.

6. Discussion

The competence models presented above are based on the research results—a questionnaire survey and structured interviews in Czech companies and experience from case studies. Nevertheless, the research sample was slightly limited and the results are influenced by rather bigger industrial organizations. Conclusions cannot be generalized to the whole population and in case of implementation of these competence models in sectors such as banking, services, logistics, ICT, etc., they must be modified. There, therefore, lies potential for further research.

The models are thus designed with respect to needs of different organizations and a need to be adjusted when applied. Due to the fact that organizations may have implemented various competence or performance assessments, scales of presented competencies can be modified so as to be compatible with the existing systems.

Utilization of competency models can be seen especially in human resources management, BPM and process improvement. After the initial as-is analysis of company's needs, the vision of future state is defined, initial BPM training performed and the roles of process analysts and owners assigned. At this moment, competency models can be used for selection of process owners, analysts and industrial engineers and planning their further development. After that, BPM implementation project itself can start. An alternative scenario rests in mapping as-is core process and developing to-be process with a project team. During the project, appropriate persons may be selected for the role of a process owner. Once again, competence models may guide the selection and further training.

It is crucial to not only map processes and create their models, but also to set up the process of process management itself. This process consists of developing vision of the process and its design by a process owner, creating the process model by an analyst, process performance management and execution and process continuous improvement. A process owner is the key person for performance management and improvement. Process analysts and industrial engineers provide a required support for this. There are also included process

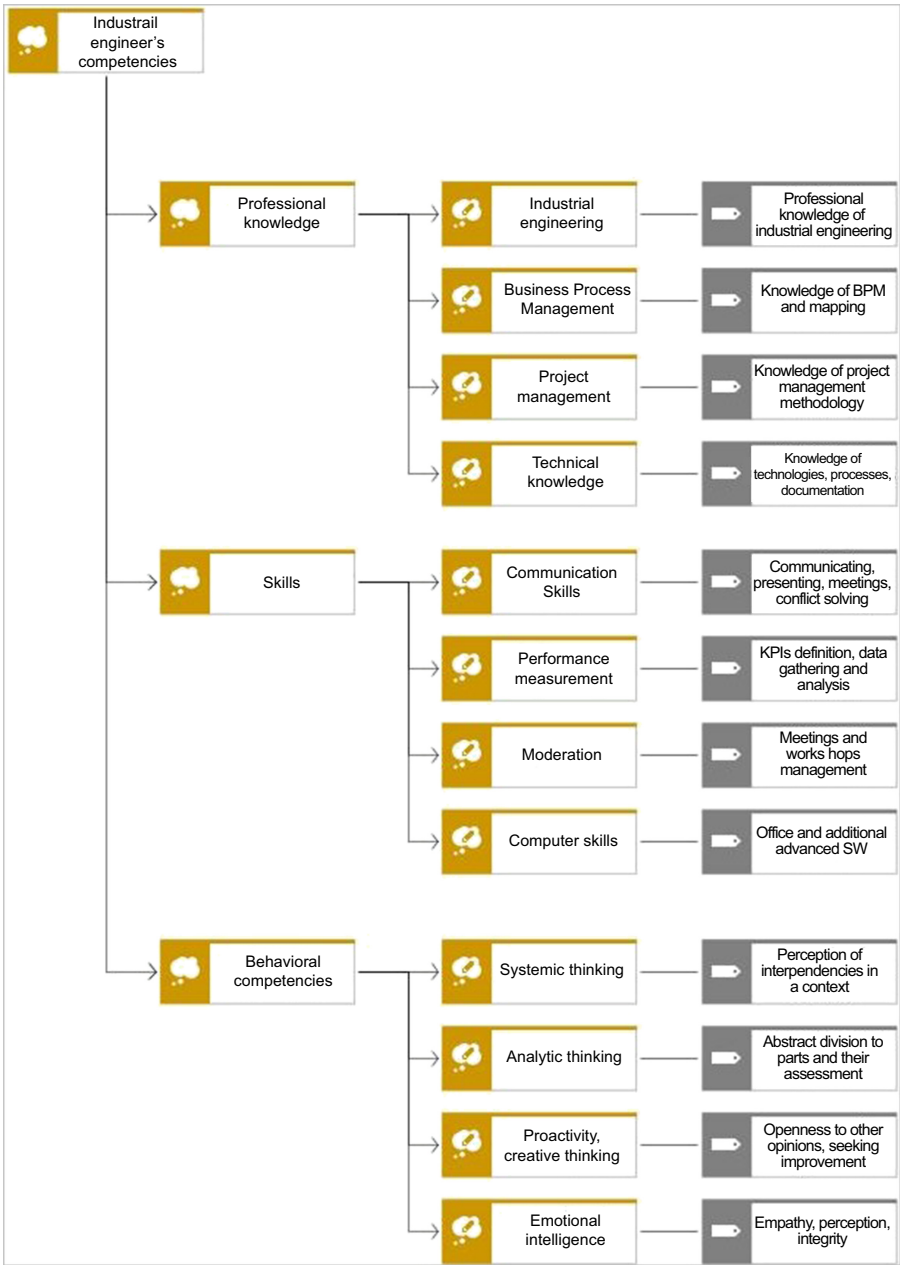

Figure 6.
Competence model of an industrial engineer

models repository governance by a process architect and internal audits by independent auditors. The process management model is illustrated in Figure 8.

The most common roles in the examined companies were the ones of a process owner, process analyst and industrial engineer. Requirements regarding their competencies are

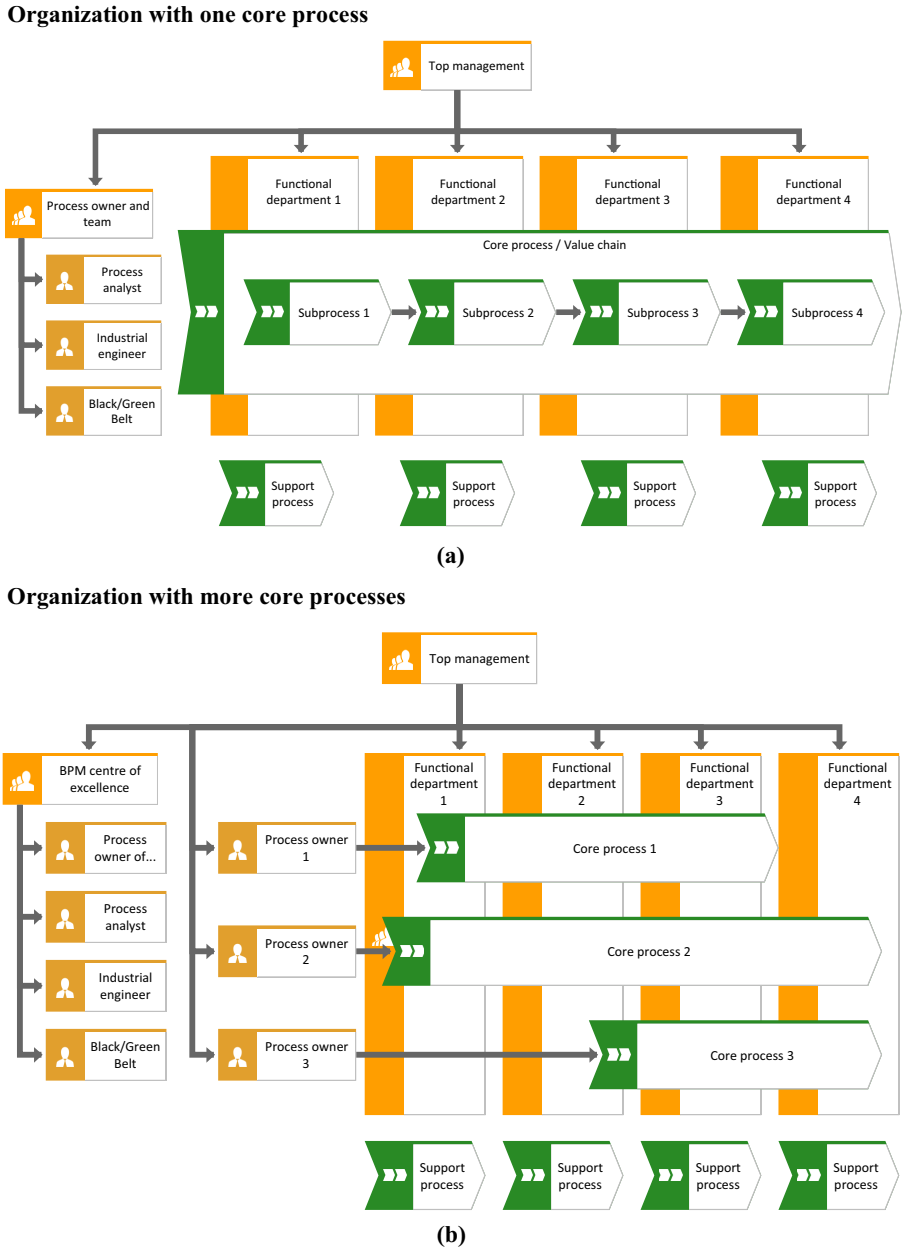

Figure 7.
Position of BPM roles in an organization

rather the same in large corporations, but different roles positioning can be suggested for Small and Medium Enterprises (SMEs). Qualitative research in this article was focused on large corporations only. It means that generalization of the research results is limited by the sample size as well as structure of participating organizations. We can generalize our results

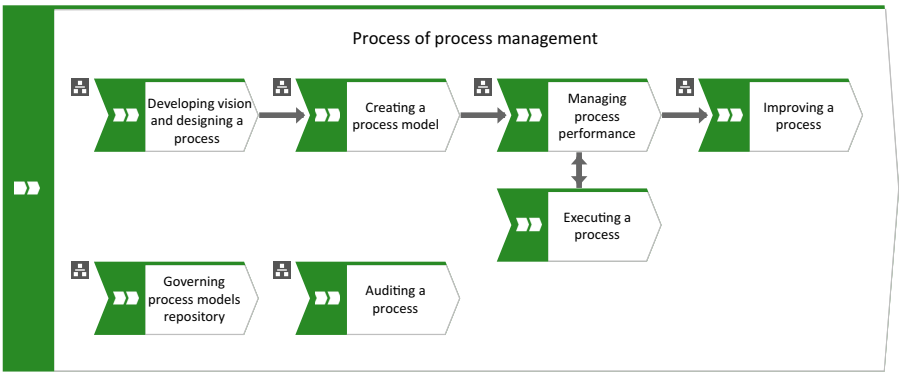

Figure 8.
Process of process management

concerning large industrial companies mainly. Nevertheless, the proposed competence models can be designed in the future with respect to differences between SMEs and large corporations.

Further research should include the following steps:

(1) Definition of the industry areas

(2) Definition of the structure of SMEs as for their size. We can follow, for example, the structure below (see Table 12).

Following the above-mentioned structure of SMEs, the same analysis will be performed within the companies selected. The selected companies must be the ones having experience with the implemented process management, which means those actively using basic pillars of BPM.

7. Conclusions

The reason for starting working on research in large corporations was that in the case of these companies, the application of BPM was successful in most cases and, therefore, it was easier to include them in the first phase of research. The next phase of research among SMEs is expected to take place in the years 2020–2022. The research procedure as well as validity of the results will not differ from the already performed ones.

The research limitations and the structured research follow-up are described in the final chapter conclusion. The added value lies in improving the knowledge of this issue in SMEs, too. Moreover, it is needed to reveal the differences in fulfilling the roles of human factor within the BPM projects and their competencies in SMEs, too.

The added value of such a type of research will lie in a subsequent comparison with large corporations, which means answering the main question if the role of process owners and their competencies differ in the companies of a different size.

Characteristics of a company		Number of evaluated companies	
	Number of employees	Absolute frequency	Relative frequency
Micro companies	1–19		
Small companies	20–49		
Medium-sized companies	50–250		
TOTAL			100%

Table 12.
Distribution of respondents by number of employees

The existence of other roles in SMEs enables to identify and analyze the roles which have not been identified in large corporations yet.

The paper was dedicated to human factor in the context of BPM. Specifically, it stressed the importance of particular competencies of BPM roles. BPM is often in practice interchanged with a mere process of mapping and automation. In academia, research is mostly focused on technical and methodical aspects of BPM.

The main goal of the research was to define necessary competencies and create competence models for the most important roles in BPM. The questionnaire survey and structured interviews were conducted to achieve this goal. Based on the research, the most important roles were identified – a process owner, process analyst and an industrial engineer. In relation with roles identification, their competencies were defined in the form of models with categories of knowledge, skills and behavioral competencies.

It can be recommended for less complex organizations with a single core process to assign just one process owner and put together a team of process analysts, industrial engineers, green or black belts and implement process management. In more complex organizations with more end-to-end core processes with their owners, BPM CoE can be established. Its members are assigned to different projects and support various process owners but are always in compliance with CoE standards and conventions.

The proposed competence models expand the body of knowledge of BPM field and emphasize the human factor of the methodology. They can be used in practice, e.g. in the area of human resources management for selecting and evaluating workers in given roles, planning their training and managing their performance. Also, putting emphasis on BPM competencies can improve the success of BPM projects.

The paper extends previous research by showing the human performance effects of several BPM governance practices. The results clearly suggest that the best outcomes of BPM initiatives were achieved by organizations that had introduced all pillars to BPM, along with having defined a centralized BPM responsibility and assigned decentralized process ownership roles.

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Appendices

Appendix 1. Survey questionnaire

(1) What is the main scope of your business?

- Agriculture, forestry and fishing
- Mining and quarrying
- Manufacturing industry
- Electricity, gas and heat production and distribution
- Water supply, water and waste activities
- Construction
- Wholesale and retail trade; repairs and maintenance
- Transport and storage
- Accommodation and food service activities
- Information and communication activities
- Financial and insurance activities
- Real estate activities
- Professional scientific and technical activities
- Administrative and support service activities
- Public administration and defense; social security
- Education
- Health and social care
- Arts, entertainment and recreation
- Other activities (please specify)

(2) How many employees does your organization have? (you can include part-time employees)

- Less than 10
- 11–50
- 51–250
- 251–500
- 501 and more

(3) What turnover did your organization achieve last year? (25 CZK is approx. 1 €)

- Up to 55 mil. CZK
- 55–270 mil. CZK
- 270–1350 mil. CZK
- More than 1350 mil. CZK

(4) Do you or do you not use process approach in your organization?

- Yes
- No
- I don't know

(5) What activities do you perform within process management?
- Process modeling
- Process simulation
- Process improvement by industrial engineering methods
- Process improvement by Six Sigma
- Process reengineering
- Automation and workflow
- Activity based costing
- Process performance measurement
- Others (please specify)

(6) Are the processes in your organization documented or not? If yes, in what form?
- Directives and other textual documents
- Process maps (tables or diagrams, e.g. Excel, Vision, etc.)
- Process models (in specific SW, e.g. ARIS, Bizagi, etc.)
- Process performance measurement (dashboards, balanced scorecard, etc.)
- Processes are not documented
- Other documentation (please specify)

(7) Do you use any specialized software applications for process management or not?
- ARIS Platform
- Appian
- Attis
- Bizagi
- Bonitasoft
- IBM business process manager
- Visio
- We do not use specialized SW
- Other SW (please specify)

(8) Which department is prevalently responsible for process management in your company?
- Independent department for BPM (BPM Center of Excellence)
- Quality management department
- Production/operations department
- ICT department
- Other (please specify)

(9) To whom this department reports, i.e. to whom is it subordinate? (please specify)

(10) Have you implemented any roles within process management?
- BPM center of excellence manager
- Chief process officer

- Process owner
- Business analyst
- Process designer
- Process architect
- Industrial engineer
- Six Sigma role: master/black belt, green belt
- IT architect
- Process/project sponsor
- We do no't have any roles within process management
- Others (please specify)

(11) What responsibilities and competencies do individual roles have? Please write down briefly for every role you selected above its activities and competencies.

(12) What benefits does process management have for your organization? (On the scale where 1 means the least and 5 means the most beneficial).

- Transparency and assigning responsibilities
- Improving productivity
- Increasing quality/lowering defects
- Cost reduction
- Process automation
- Process standardization
- Better management system
- Others (please specify)

(13) What negatives or risks does process management have for your organization? (On the scale where 1 means the least risky and 5 means the riskiest).

- Lack of leadership
- Resistance to change
- Small budget
- We have priorities elsewhere
- Functional silos – rivalry between functional departments
- Others (please specify)

(14) In case you consider necessary to inform about other facts related to process management in your organization, please use the next field.

Appendix 2. Outline for interviews

Questions about BPM maturity (APQC maturity model)

Every question has pre-defined answers on the scale 1–5. An output is the BPM maturity level.

(1) How is process management currently operating in your organization?

(2) To what extent are processes documented in your organization?

(3) Who has visibility into or understanding of process management in your organization?

(4) Who has governance over process management in your organization?

(5) How does your organization use metrics to measure its process performance?

(6) How often do you identify improvement opportunities for your processes?

(7) How does your organization respond to the need for agility or deal with process anomalies?

(8) What is the relationship between process management and quality/risk management in your organization?

(9) How does process management contribute to job role creation and understanding?

(10) How does your organization leverage process management tools and technology?

Questions about the roles in BPM

(1) What roles do you use in process management?

(2) What activities and tasks do these roles have?

(3) What competencies do workers in these roles need? (Required knowledge, skills, behavior, etc.)

(4) Does process management have any benefits for your organization?

Appendix 3

Competence / Level	Competence description	1 - Basic level	2 - Advanced level	3 - Professional level	4 - Expert / mentor
Knowledge					
Professional knowledge	Professional knowledge according to the process nature. It can consist of knowledge of functions such as technologies, manufacturing, sales, marketing, etc. Further, e.g. legislation, market environment, etc.	Has education in the given field. Has only limited experience or without business practice	Has professional knowledge enabling independent work. Provides stable performance and standard results	Knows best practices in the field. Thinks in context. Independently solves problems and suggests improvements	Can educate and mentor other colleagues in the given field
Business process management	BPM knowledge includes understanding differences between a functional and a process organization, understanding process models ans their attributes such as inputs, outputs, roles, objectives and performance indicators	Knows a difference between the organization structure and process model. Understands his or her role in the given process	Is oriented in company's processes (e.g. documentation, process portal). Is involved in process mapping and attributes set up	Knows and applies best practices in the given process. Sets up performance indicators according to the company strategy	Knows best practices in BPM. Is a process owner of BPM in an organization. Educates and mentors colleagues in BPM
Business process management system/suite	Knowledge of a software application for BPM. Orientation in models repository	Knows given BPMS and used notation. Is orienting in models repository. Can map and model a simple process	Creates complex as-is models. Develops to-be models. (Designer)	Knows reference models. Defines conventions for modelling. Governs models repository	Develops and implements BPMS. Educates and mentors colleagues in BPMS
Project management	Knowledge of project management consists of methodologies and tools used in a company, including the process of projects approving, managing and monitoring	Knows company policy in project management and its project types. Can apply for an improvement. Can be a member of the improvement team	Is instructed in company's methodology of project management. Independently manages projects lasting, e.g. two months with a small team. Can be a	Independently manages big projects lasting, e.g. more than two months and with bigger teams	Governs the company's project portfolio. Is a process owner of project management. Educates and mentors colleagues in project management
Industrial engineering	Knowledge of industrial engineering, methods for eliminating waste and improving productivity	Knows types of waste and basics of industrial engineering (Lean)	Independently performs analyses and creates standards. Applies basic methods such as 5S, SMED and times standardization	Applies advanced methods, e.g. total productive maintenance, shop floor management, teamwork or	Educates and mentors colleagues in industrial engineering (Lean)

(*continued*)

Table A1. Description of competencies and their levels

Table A1.

Competence / Level	Competence description	1 - Basic level	2 - Advanced level	3 - Professional level	4 - Expert / mentor
Technical knowledge	Technical thinking, knowledge of technologies and a given process, orienting in technical documentation	Has knowledge of basic technologies. Can read technical documentation, e.g. drawings, and apply it	Has knowledge of modern technologies. Independently creates technical documentation	Creates complex technical documentation. Develops new procedures and	Educates and mentors colleagues in the field of technologies
Skills					
Leadership	Ability to setup shared vision, mission and strategy. Applies management style of leading by an example for colleagues	Knows and communicate company vision and mission. In his or her actions, respects company values	Can define and communicate vision and mission of a department, project according to the company vision and	Can define and implement strategy of a department, project or process according to the company vision and mission	Can define company mission and vision. Can define and implement company strategy
Management skills	Management skills necessary for managing resources and people - planning, organizing, communicating and controlling	Is able to manage small groups and teams. e.g. a team leader	Is able to manage middle-sized groups and teams. e.g. a foreman, a manager	Is able to manage organizational units, e.g. with several departments with tens of colleagues. e.g. a	Is able to manage a company or a group of companies. e.g. a chief executive officer or chairman of the board
Communication skills	Communication, presentation and negotiation skills necessary for sharing information, leading meetings and problem solving	Is able to present own results. Handles written communication, e.g. reporting, e-mail	Is able to present results and thoughts to a team. Can lead a meeting	Is able to present results and thoughts to an audience. Can resolve conflicts among colleagues	Educates and mentors colleagues in communication skills
Performance measurement	Ability to setup performance indicators according to process objective incl. gathering data, analysis and reporting	Knows company objectives and is able to interpret own or departmental objectives and performance indicators	Knows company performance indicators. Is able to analyse and interpret performance indicators of the company and process	Is able to define performance indicators for a department and processes according to the company's objectives and performance indicators. Uses basics of statistics for performance	Implements and develops company performance measurement system. Knows advanced statistics. Educated and mentors colleagues in the field of performance
Moderations	Ability to moderate workshops and meetings with the aim to map, analyse and improve processes	Knows principles of leading meetings and sticks to them	Is able to plan objectives, agenda and members of workshops and meetings. Efficiently leads smaller workshops and	Efficiently leads bigger workshops e.g. of multi-functional teams. Can ask good questions and guide the course of meetings	Educates and mentors colleagues in the field of moderations. Can be independent moderator of workshops

(*continued*)

Competence / Level	Competence description	1 - Basic level	2 - Advanced level	3 - Professional level	4 - Expert / mentor
Computer literacy	Advanced knowledge of software applications (Office, modelling, workplace design, etc.), or programming	Handles office software, e.g. text editor, table processor or e-mail. Uses company's intranet or other information systems	Handles advanced functions of table processor. Uses other applications, e.g. for project management, process mapping, workplace design, etc.	Handles difficult software applications, e.g. simulations. Is able to program and perform program changes	Programs new software applications. Educates and mentors colleagues in software applications
Behavioral competencies					
Systemic thinking	Ability to see details as interconnected elements within the whole. Recognition of context within the company, perception of the context of the company	Knows context of the organization (internal and external aspects) and company culture. Understands own role in the organization and process	Knows context of the organization (internal and external aspects), company culture and stakeholders. Understands context of the organizational units and processes	Knows context of the organization (internal and external aspects), company culture and stakeholders. Understands context of the organizational units, processes and systems	Is able to manage relationships with stakeholders and changes across the organization
Analytic thinking	Ability to split the whole into smaller units suitable for analysis and management, individual assessment and evaluation of an issue	Is able to systematically solve simpler problems. Uses e.g., 5 whys, Ishikawa diagram, etc.	Is able to decompose a problem to individual parts and assess them. Uses basic statistical methods, e.g. Six Sigma Green Belt	Is able to decompose a more difficult problem to individual parts and solve them. Uses statistical methods, e.g. Six Sigma Green or Black	Handles advanced statistical methods. Educates and mentors colleagues in statistical methods, e.g. Six Sigma Master Black Belt
Emotional intelligence	Ability to perceive own emotions and experiences, as well as empathy - empathizing with others	Perceives own emotions and understands their causes. Is able to regulate own behavior	Is able to work under pressure. Is empathetic, able to empathize with others	It is stress resistant. Is empathetic and trustworthy. Adapts own behavior to different people and	Is able to lead and coach colleagues in the field of emotional intelligence -self-control, empathy and
Proactivity and creative thinking	Openness to other opinions and opportunities for improvement. Constantly looking for improvements and managing changes. Coming up with own new ideas, improvements and innovations. Sense of design and user-friendliness of proposed solutions	Is open to other opinions and thoughts. Cooperates during implementations of new approaches	Actively seeks and proposes improvement opportunities. Motivates colleagues during implementation of new approaches. Has a sense of user-friendliness of results. e.g. continuous	Gets support of colleagues for change and new approaches. Designs and participates in implementing improvements across the company, e.g. process redesign, implementation of new	Designs and implements changes and improvements for the whole company. Innovates products, systems or processes, e.g. reorganization, reengineering

Table A1.