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Building a Robotic Capability Map of the Enterprise

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Currently, one of the major trends of digital transformation is business process automation, and, in particular, robotic process automation – i.e. replacing human work with software robots. In such context, the term Robotic Process Automation (RPA) may be viewed in two different ways – narrow and broad. In the narrow view, RPA is a fast growing class of software for developing software robots. In the broader view, it is a particular type of an organizational and technological change (the inherent part of which is the specific software implementation), leading to the emergence of a hybrid work environment within which humans and robots collaborate with each other. This is such a new field that a commonly accepted conceptual apparatus (terminology) has not been developed yet; also methodical tools for effective robotic process automation management are missing. Based on the above observations, it was deemed justified to conduct research aimed at: (G1): identifying the differentiators of robotic process automation and the key stages of its implementation, (G2): defining the "capability maps" concept and outlining the principles for designing capability maps; (G3): developing an initial version of the reference robotic capability map and completing its pilot verification.
A set of the following research tools was used for this purpose: literature analysis method, semi-structured interviews, creative thinking techniques, case study analysis. The outcome of the research conducted is the development of a proprietary, initial version of the reference robotic capability map that was verified at one of companies operating in Poland. This tool enables obtaining a complete view of the current and required capabilities of an organization to conduct an effective robotic process automation.

Keywords: robotic process automation, business capability, IT capability, robotic capability, capability map.

Budowa mapy zdolności robotycznych przedsiębiorstwa

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Jednym z istotnych trendów cyfrowej transformacji jest obecnie automatyzacja procesów biznesowych, a szczególnie ich robotyzacja – tj. zastępowanie pracy człowieka działaniami robotów programowych. W tym kontekście termin Robotic Process Automation (RPA) może być rozpatrywany w dwóch różnych ujęciach – węższym i szerszym. W ujęciu węższym RPA jest to intensywnie rozwijająca się klasa oprogramowania do budowy robotów programowych. W ujęciu szerszym jest to szczególny rodzaj zmiany organizacyjno-technologicznej (której immanentną częścią jest wdrożenie określonego oprogramowania) prowadzącej do powstania hybrydowego środowiska pracy, w ramach którego kooperują ze sobą ludzie

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i roboty. Jest to obszar na tyle nowy, że nie ukształtował się jeszcze powszechnie obowiązujący aparat pojęciowy, brakuje także narzędzi metodycznych do efektywnego prowadzenia robotyzacji procesów. Ze względu na powyższe obserwacje uznano, że uzasadnione jest przeprowadzenie badań, których celem jest: (G1) zidentyfikowanie wyróżników robotyzacji procesów biznesowych i kluczowych etapów jej realizacji, (G2) zdefiniowanie koncepcji „map zdolności" oraz określenie zasad konstruowania map zdolności, (G3) opracowanie wersji inicjalnej referencyjnej mapy zdolności robotycznych i wstępna jej weryfikacja. W tym celu zastosowano zestaw następujących narzędzi badawczych: metodę analizy literatury, wywiady częściowo ustrukturalizowane, techniki twórczego myślenia, analizę studium przypadku. Efektem przeprowadzonych badań jest opracowanie inicjalnej wersji referencyjnej mapy zdolności robotycznych, która została zweryfikowanej w jednej z firm działających w Polsce. Narzędzie to umożliwia uzyskanie kompletnego obrazu obecnych i wymaganych zdolności organizacji do przeprowadzenia efektywnej robotyzacji procesów.

Słowa kluczowe: robotyzacja procesów biznesowych, zdolność biznesowa, zdolność IT, zdolność robotyczna, mapa zdolności.

JEL: L86, O33

1. Introduction

The term "Robotic Process Automation" was used for the first time in the paper prepared by the analytical company HfS Research in 2012 (Fersht & Slaby, 2012). Within only a few years, IT solutions identified by this term have been introduced on a large scale at enterprises worldwide, becoming one of the tools used to conduct the digital transformation. This is confirmed by the research of a number of advisory and consulting companies indicating that the global value of the RPA tools market in 2018 was estimated to stand at USD 849 million, while in 2019 it is to reach even USD 1.3 billion (Gartner, 2019), and in 2021 as much as USD 2.9 billion (Clair et al., 2017).

At the same time, the robotic process automation field is so new that a developed, commonly applicable conceptual apparatus (terminology) does not exist yet – either among practitioners or representatives of the academic community. Also methodical tools (developed with scientific rigor) for effective robotic process automation are missing.

Based on the above observations, it was deemed justified to conduct research – both literature-based as well as empirical – and present the results thereof. The goal of the research was:

- (G1): identifying the differentiators of robotic process automation and the key stages of its implementation;
- (G2): defining the "capability maps" concept and outlining the principles for designing capability maps;
- (G3): developing an initial version of the reference robotic[1] capability map and completing its pilot verification.

The reference capability map presented in the article is a reference model. In accordance with Pajk, Indihar-Štemberger and Kovai (2012, p. 456), "a reference model is based on a small number of unifying concepts and may be used as a basis for education and explaining standards to nonspecialists". At the same time, the reference model is characterized by the following:

- it is of universal nature – i.e. it is related to a certain concept, and not a specific enterprise;
- it is reusable – i.e. it can be perceived as a starting point for developing the model (following the introduction of the required adaptations thereto) dedicated to a given enterprise.

Thanks to the use of reference models it is possible to:

- shorten the time required to develop the model dedicated to a given organization;
- reduce the costs of developing the model for such an organization;
- decrease, when developing the model for this organization, the probability of making an error that would be related to accidentally skipping some material component of such a model.

In accordance with the above, based on the reference robotic capability model presented in the article, it is possible to prepare a robotic capability model dedicated to a given organization. Thanks to such a model, you will be able to:

- determine the robotic capability required to achieve the robotic process automation objectives adopted;
- facilitate the communications among a number of stakeholders involved in the company's robotic process automation project (in particular IT, business, security department, management board).

To accomplish goals (G1) and (G2), an analysis of literature[2] was completed. To accomplish goal (G3), creative thinking techniques, literature analysis and case study method were used.

The article, due to its set goals, has the following structure. Following this introduction in the first part, related research of the robotic process automation concept and capability/capability map concept is described in the second part based on the results of the study works. The third part of the article presents the development of an initial version of the reference robotic capability map. The fourth part of the article presents pilot verification of the initial version of the reference robotic capability map. The article concludes with the summary and discussion of further research directions.

2. Related Research

2.1. Robotic Process Automation Concept

Currently, the term "Robotic Process Automation" is viewed, in the subject matter literature, in two different ways – narrow and broad.

In the narrow view, RPA is a class of IT tools that enable developing software robots using graphical wizards (or alternatively – by recording

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actions performed by a man-operator) that, based on the analysis of the key literature items (Aguirre & Rodriguez, 2017; Anagoste, 2016; Lacity & Willcocks, 2017; Willcocks & Lacity, 2016):

- are used primarily with respect to operational processes and business support processes, they are implemented less often in the direct customer service area (Chatbots/Voicebots are commonly used here); however, they are usually not used to robotically automate processes end-to-end, but for selected sub-processes of a given process or even individual activities;
- automate sub-processes or large scale (mass) operations (performed multiple times within the assumed time unit – e.g. within a month or a year), most often by faithfully reproducing actions carried out by an operator up to now;
- operate based on the preset algorithm, but more and more often are enriched with certain elements of artificial intelligence, and, as a result, are able to take more complex decisions (in particular, they are able to learn based on the data provided – both structured as well as unstructured) (Lacity & Willcocks, 2018, p. 26);
- perform operations directly on a graphical user interface of IT systems – the same way as a man-operator does it (although some RPA tools allow for performing operations directly on the database layer);
- use the business logic that constitutes an integral part of the applications that a software robot will be working with, which eliminates the problem of reproducing such logic that occurs in the traditional system integration or development model.

It is important to point out how the RPA tools are positioned versus other, classical robotic process automation solutions, such as workflow type systems or BPMS (Business Process Management System) tools (Shaw, Holland, Kawalek, Snowdon, & Warboys, 2007, pp. 92–94). It may be assumed that the goal of implementing both the RPA tools as well as the above-mentioned classical automation tools is similar: improving efficiency and minimizing the costs of performing business processes while ensuring the highest possible quality of the delivered products of such processes. However, this goal is accomplished in a completely different manner. Implementing workflow or BPMS type solutions involves process alterations (reengineering), and introducing changes thereto; the implementation of such systems frequently calls for software development works (to perform which one needs time and appropriate IT competences). On the other hand, to implement RPA class tools:

- no alterations – streamlining (optimization) or reengineering – in the robotically automated processes (although such actions are recommended) are required;
- developing dedicated Application Programming Interfaces (APIs) for exchanging data among individual applications, supporting the robotically automated processes, is not required;

- interfering with applications' source code or applications' databases is not required – and therefore no knowledge of internal designs (structures) of individual applications is necessary, which is very important in the case of legacy systems.

In the broader view of the term "robotic process automation", it is a particular type of an organizational and technological change (the inherent part of which is the implementation of specific software), leading to the emergence of a hybrid work environment (Fersht, Gupta, & Christopher, 2019). Such a work environment is understood as a coherent set of IT tools (business applications and software robots), processes and procedures, as well as people with specific competences and skills, performing specific business processes and processing specific data.

The latter, broader understanding of the robotic process automation concept is assumed applicable for the purpose of this article. This implies specific organizational and management related consequences. An effective implementation of robotic process automation in an organization cannot boil down solely to implementing a specific RPA class tool and developing software robots. It is necessary to apply a coordinated set of actions (most often of a project nature), and to subsequently continuously maintain the products of such projects. The effects of actions undertaken may include, for example: a robotic process automation strategy or management model, a new organizational structure set up to develop and/or maintain software robots, implemented RPA tool, appropriately prepared processes to be robotically automated, working software robots, implemented tools for monitoring robot performance, hybrid work environment change management procedures, activities related to communicating robotic process automation topics addressed to the organization's personnel, activities related to developing new competences among the organization's workforce, etc.

2.2. Capability and Capability Maps Concept

The Longman Dictionary states that capability denotes "the ability, skill, or power that makes a machine, person, or organization able to do something, especially something difficult" (Longman, 2019).

The term "business capability" functions in strategic management, which is a sub-discipline of the management science (see Hitt, Boyd, & Li, 2004). It is positioned in the area related to achieving an enterprise's competitive edge and considered in the Resource-Based View – RBV concept (see: Helfat & Peteraf, 2003), as well as in the dynamic capabilities context (see: Teece, Pisano, & Shuen, 1997).

According to the RBV approach, an organization can be viewed in terms of resources and capabilities, where resources are defined as all assets, tangible or intangible, that the organization can use in its processes aimed at creating, producing and/or offering its products (goods or services) on the market (Wade & Hulland, 2004, p. 109). On the other hand, business

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capabilities are defined as recurring action templates aimed at utilizing the already available resources to create, produce and/or offer products on the market (Wade et al., 2004). In this approach, capabilities usually refer to the organization's operations.

According to Eisenhardt and Martin, dynamic capabilities are a particular type of business capabilities, taking the form of an organizational and strategic routine according to which managers manage the resource base available to them in order to generate new value creation strategies – in particular, acquire, combine, reject, integrate them. Based on this approach, capabilities are key to building a company's competitive advantage (Eisenhardt & Martin, 2000, p. 1107).

The capability concept, and in particular the business capability concept, has become deeply rooted in corporate architecture research in recent years (Nowobilska, Schulz, Matthes, & Freitag, 2016; Offerman, Stettina, & Plaat, 2017; Khosroshahi, Matthes, Gernegroß, Hauder, & Volkert, 2018; Bondel, Faber, & Matthes, 2018). In this field, business capability is defined as an organization's ability to effectively carry out a specific action (Bondel et al., 2018). In particular, it means that business capability defines "what" the organization does. However, it does not define "how" such actions are performed, it also does not specify "where", "when" and "why" such actions are carried out. As a consequence, an organization model developed with the use of business capabilities is definitely much more stable over time (changes more slowly) than a model that uses business processes (Offerman et al., 2017). However, when analyzing individual capabilities, it is not possible to identify the detailed logic (understood as a sequence of actions over time) of an enterprise's operations and responsibilities for the performance of individual steps. The detailed comparison of organization modeling using business processes and business capabilities is provided in Table 1.

The literature analysis conducted by the author demonstrates that the set of an organization's business capabilities is characterized by the following features (Brits, Botha, & Herselman, 2007; Nowobilska et al., 2016; The Open Group, 2018, Khosroshahi et al., 2018; Bondel et al., 2018):

- identifying business capabilities for a given unit enables capturing the key areas of its business;
- each capability of an organization can be regarded as the organization's building block which is based on the organization's set of resources (tangible and intangible) used to implement such capability by specific roles within a process or processes in order to deliver a specific value – recognizable from the customer's standpoint or the organization's internal perspective;
- individual capabilities are unique within an organization in their class (no two identical capabilities) – however, they can be implemented in many places within the organization;

- individual capabilities are independent of one another (although information exchange between individual capabilities may take place);
- each capability can be decomposed into sub-capabilities (such a decomposition is usually possible down to levels V–VII);
- business capabilities are irrespective of a given organizational unit's organizational structure;
- business capabilities change slowly over time; however – as indicated by The Open Group (2018) – elements related to capabilities (resources, tools, processes) can change quickly;
- each capability must have a name that identifies it unequivocally – the applicable convention is that capability names are derived from nouns ("what is done"), not from verbs ("how it is done").

Organization modeling using business processes	Organization modeling using business capabilities
Similarities	
It is used to understand an organization's operations	
Enables understanding how IT can support business	
Differences	
Focuses on how an organization carries out specific actions	Focuses on what an organization does
Course of a process can often change over time	Business capabilities usually slowly change over time
Supporting optimization (streamlining) measures and implementing IT tools	Supporting decision making
Most often a high level of detail	Overall view of the entire organization, a low level of detail
Focus on indicating the responsibility of individual roles/positions	Focus on indicating the role of entire departments (divisions)

Tab. 1. Comparison of organization modeling using business capability maps and business processes. Source: Own compilation based on: Offerman, Stettina & Plaat, 2017; The Open Group, 2018; Bondel, Faber, & Matthes, 2018.

In reference to the organization under review, a given capability can be considered in two aspects:

- dychotomic – a given capability occurs/does not occur in the organization;
- gradual – a given capability may occur in the organization with a varying intensity (measured, for example, in the 0–10 scale, where 0 denotes a lack of capability, 10 – occurrence of the highest level capability).

An organization can acquire a capability in two ways:

- by implementing projects that increase intensity (an improvement) of the already existing capability or create a new capability;

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- through mergers and acquisitions – a company merges/acquires another company and acquires capabilities it did not have before.

Identified capabilities can additionally be complemented with a set of several or more than a dozen attributes. In particular, they can refer to the following issues (The Open Group, 2018):

- Is a given capability strategic, standard or supporting in nature? This allows for appropriately allocating the investment budget or identifying capabilities that can be potentially considered to be outsourced.
- Does a given capability provide value for the organization's end customer (and not for another department or internal organizational unit), or does the capability provide value for an internal customer (e.g. another department) or is necessary to ensure the company's business continuity?
- Is a given capability currently performed by the organization's external resources or outsourced?
- What is the level of support for a given business capability by the IT systems – current and expected? This, in practice, allows for identifying gaps in the IT support for the key capabilities.
- What is the assumed or required improvement of the organization's capabilities as a result of the projects implemented or planned to be implemented that can be related to both business as well as IT?

A list of capabilities complemented with specific attributes can be used to (Offerman et. al., 2017):

- develop an understanding of how an organization builds or wants to build a competitive edge on the market – by identifying strategic capabilities;
- discuss the directions of developing IT systems in an organization, focusing on technology neutral considerations (irrespective of specific IT solutions coming from vendors) – by defining current and desired IT support for individual capabilities;
- facilitate determining priority levels of the projects planned – by pointing out which of them and how they refer to individual capabilities of the organization;
- support activities related to mergers and acquisitions – by providing systematic evaluation of the capabilities in the company being acquired and the acquiring company.

Apart from business capabilities, some authors also distinguish IT capabilities. They are the organization's capabilities related to being aware what IT has to offer, to understanding when and how to use IT and how to achieve a competitive edge through the use of appropriate IT resources (that include hardware, networks, software, human resources with specific technical and management skills) (El Sawy & Pavlou, 2008, p. 141). The list of resources can also be extended by adding IT services – in particular, the ones performed in the cloud, but also by external entities (Yoon, 2019, p. 102).

Capability maps can be used in order to effectively present and communicate capabilities (both business and IT ones). A capability map is defined as a model of an organization in a graphic form, presenting its functioning from the point of view of capabilities that it has or may want to have in the future (Bondel et al., 2018).

A capability map represents a complementary approach to process-based modeling of the organization's operations with the use of such languages as BPMN, EPC or UML (activity diagrams).

Capability maps can be decomposed hierarchically – starting from the most general level down to the more and more detailed one. Between several and more than a dozen individual capabilities (depending on the scope of the organization we are building a map of) should be placed at the highest level (the most general one). Depending on hierarchy levels used to decompose the organization's capabilities, catalogues that include between several dozen to approximately 2 thousand identified elements, grouped hierarchically on V–VII levels of details, are obtained.

When decomposing individual capabilities, it is important that lower hierarchy level capabilities should, all the time, be:
- not redundant for one another;
- independent of one another.

Figure 1 presents a sample business capability map for the entire organization decomposed to level II.

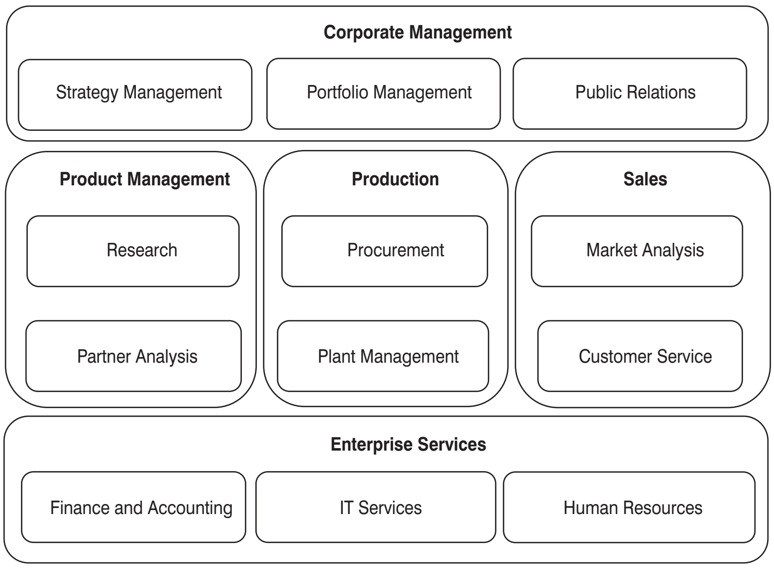

Fig. 1. Sample business capability map. Source: Bondel, Faber, & Matthes, 2018.

Figure 2 presents a fragment of the sample business capability map shown in Figure 1, decomposed to level IV – for human resource management.

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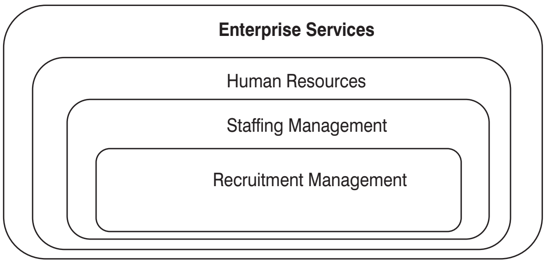

Fig. 2. Fragment of the sample business capability map with respect to human resource management. Source: Own work based on Bondel, Faber, & Matthes, 2018.

The best known, commonly available examples of capability maps are: BIAN reference architecture for the banking sector (Banking Industry Architecture Network, 2018) and Panorama 360 reference architecture for insurance companies (Insurance Frameworks, 2016). Government agencies also build and make publicly available capability maps. An example can be the Canadian Province of New Brunswick business capability reference model (Province of New Brunswick, 2015).

3. Development of Initial Version of Reference Robotic Capability Map

No methodical tools that would enable conducting robotic process automation effectively – in its broader understanding (not only as an implementation of a specific type of tool but as a change of the way an enterprise is operating – both on the organizational level as well as the technical one) – have been developed yet.

In order to reduce the identified gap, the author prepared an initial version of a reference robotic capability map as the basis for developing a map for a specific organization, where:

- robotic capability is defined as a business or IT capability which is related to robotic process automation (enables robotic process automation management, robot development, robot maintenance and robot change management or another key action from the robotic process automation point of view);
- reference capability map is defined as a reference robotic capability model, which is the basis (reference point) for developing a capability map dedicated to a specific organization.

The basis for the works were:

- study works in the field of robotic process automation and implementation of undertakings of transformational nature, conducted by the author (see the literature analysis in section two of the article);

- semi-structured expert interviews on robotic process automation conducted by the author (see further on in the section);
- author's own experiences in implementing projects related to robotic process automation.

In order to develop an initial version of the reference robotic capability map, the following research procedure was adopted (see Figure 3):

1. Conducting an analysis of the subject matter literature aimed at identifying business and IT capabilities that are important from the point of view of robotic process automation. The decision was taken to opt for the top-down approach to identify business capabilities: to begin with, 4 highest level capabilities were defined, which were subsequently decomposed to levels II and III. The initial version of the robotic capability map refers, at the highest level of generality, to all the key aspects related to the utilization of the RPA class tools at companies – i.e. robotic process automation management, robotic capacity delivery, its operational utilization and maintenance. At the same time, the author is aware of the fact that the proposed decomposing of level I capabilities is of initial nature and the subsequent works on developing the reference robotic capability map may lead to its modifications.
   The mind mapping technique was used to initially compile the list of capabilities and decompose them. More information on that technique can be found, among others, in Crowe and Sheppard (2012). The outcome of these works was the development of the initial list of the organization's robotic capabilities on levels I, II and III of decomposition, in the form of mind mapping developed using MindJet's MindManager tool.
2. Conducting semi-structured interviews with persons responsible for implementing robotic process automation[3]. During the interviews, in order not to influence the respondents' answers, respondents were not presented the list of capabilities prepared by the author earlier. However, this list constituted the basis for formulating questions during conversations with respondents. The initial list of robotic capabilities was modified based on the conversations. The changes were related to names of individual capabilities and an extension of the list of capabilities by adding new capabilities omitted earlier.
3. Developing an initial version of the robotic capability map – on levels I, II and III of decomposition (see Figures 4–8). The map was consciously not decomposed to further levels down, as the author's intention was to possibly quickly verify the tool created and obtain feedback that would enable directing its further evolution. Sparx Enterprise Architect tool was used to visualize the map. Two factors were behind the choice of this tool: a very broad range of functions offered to model corporate architecture and its widespread popularity in Poland. The language selected to develop robotic capability maps was ArchiMate, version 3.01, as it supports – from the notation side – business capability modeling (see The Open Group, 2017).

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4. Enhancing the initial version of the robotic capability map with additional attributes: capability significance and the way a given capability is implemented.
   a. Color will denote a given capability's significance from the point of view of the success of the robotic process automation works. The following convention is adopted here:
      i. blue – capability implemented by the deduced unit inside the company, dealing with robotic process automation,
      ii. yellow – capability implemented by an IT unit that is a part of the company,
      iii. grey – capability implemented by an external provider.
   b. Form of framing around a capability symbol signifies who (what unit within the organization or from the external environment) will be implementing a given capability. The following convention is adopted:
      i. continuous bold line – capability is of key importance,
      ii. standard continuous line – capability is of standard importance.

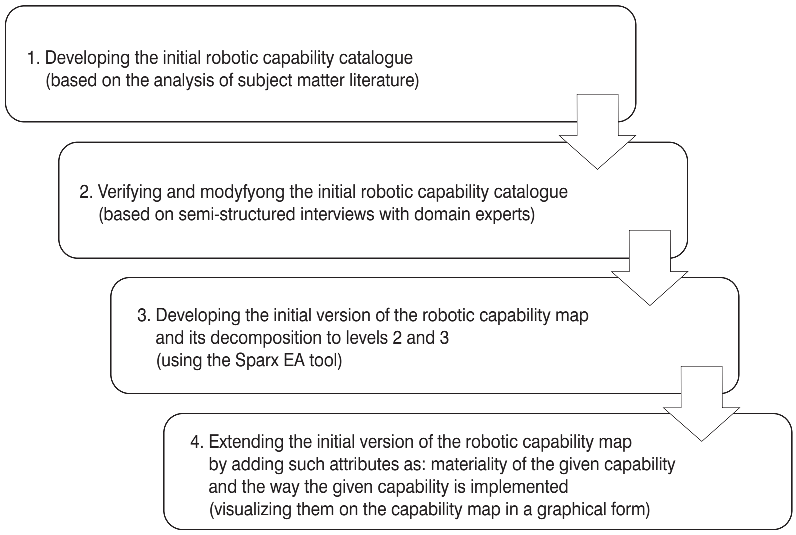

Fig. 3. Research procedure for developing an initial version of the reference robotic capability map. Source: Own compilation.

The initial version of the robotic capability map at the highest (i.e. I) level of generality is made up of 4 capabilities (see Figure 4) – i.e.:
- Robotic Process Automation Management
- Robotic Capacity Delivery
- Robotic Capacity Utilization
- Robotic Capacity Maintenance

In accordance with the principles presented in section 2.1 of this article, each of level I capabilities was decomposed hierarchically into, respectively, level II and III – i.e.:

- Robotic Process Automation Management – into 6 level II robotic capabilities and 18 level III robotic capabilities (see Figure 5);
- Robotic Capacity Delivery – into 5 level II robotic capabilities and 15 level III robotic capabilities (see Figure 6);
- Robotic Capacity Utilization – into 2 level II robotic capabilities and 6 level III robotic capabilities (see Figure 7);
- Robotic Capacity Maintenance – into 2 level II robotic capabilities and 6 level III robotic capabilities (see Figure 8).

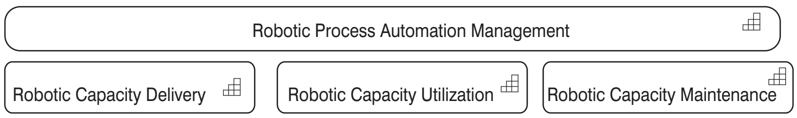

Fig. 4. Robotic capability map on level I of decomposition. Source: Own compilation.

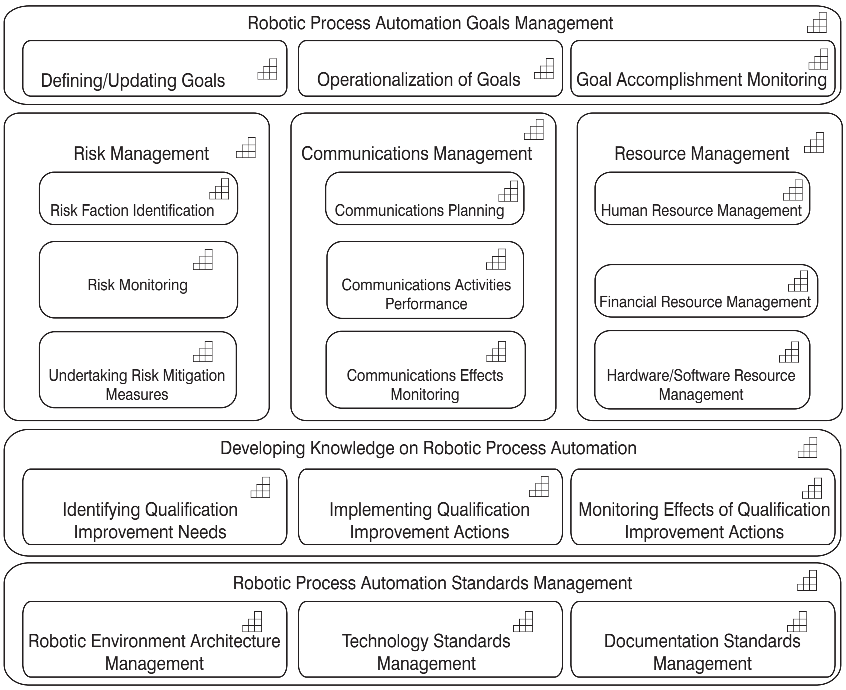

Fig. 5. Robotic capability map for Robotic Process Automation Management – on levels II and III of decomposition. Source: Own compilation.

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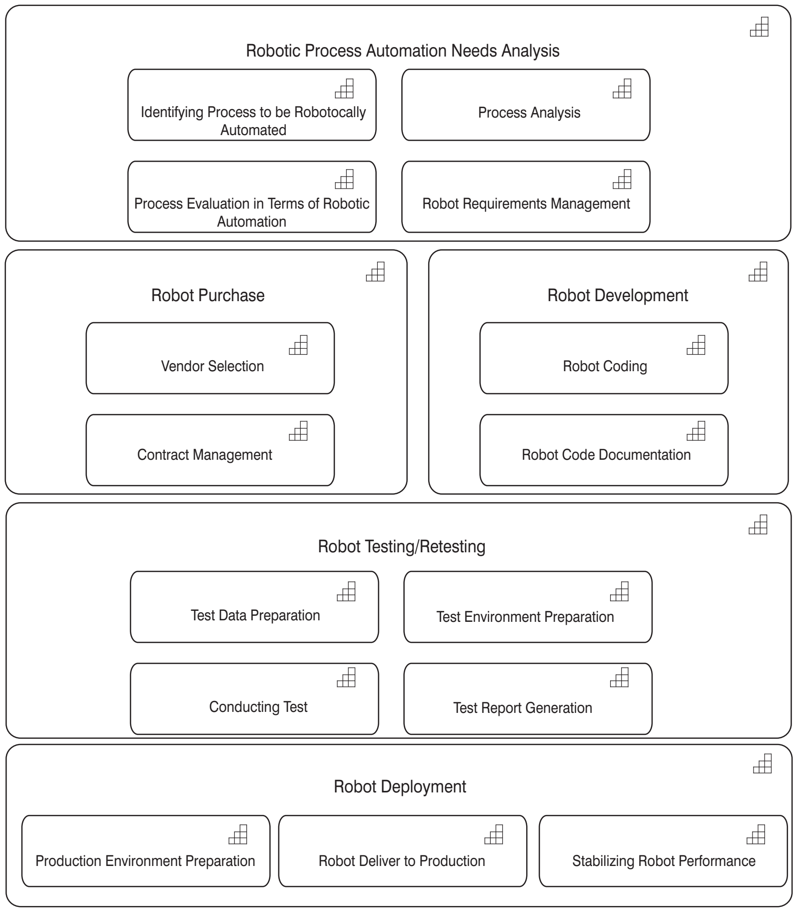

Fig. 6. Robotic capability map for Robotic Capacity Delivery – on levels II and III of decomposition. Source: Own compilation.

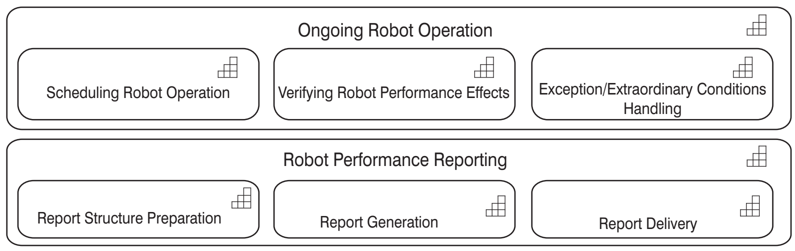

Fig. 7. Robotic capability map for Robotic Capacity Utilization – on levels II and III of decomposition. Source: Own compilation.

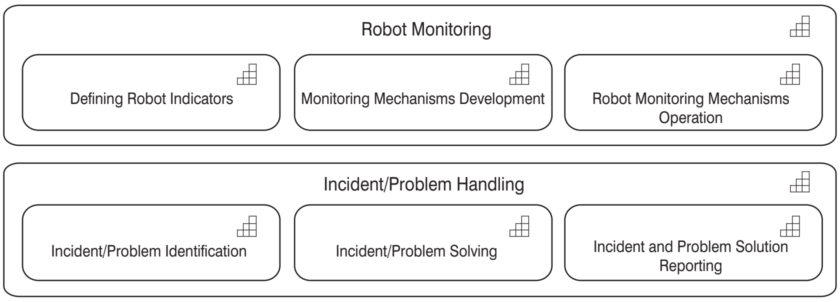

Fig. 8. Robotic capability map for Robotic Capacity Maintenance – on levels II and III of decomposition. Source: Own compilation.

4. Pilot Implementation of the Initial Version of the Reference Robotic Capability Map

A pilot implementation was completed at one of the companies operating in Poland in order to initially verify the initial version of the reference robotic capability map developed.

The company operates in the financial industry and has a large number of competitors – coming from both the domestic as well as the international market. As compared to such competitors, the company is, however, viewed as one of smaller entities in the area of its operations (both in terms of headcount – i.e. it employs approximately 500 persons – as well as market share). This company, like the majority of similar entities, is under very strong regulatory pressure, and at the same time it must continuously raise customer service satisfaction level. In addition, the company has recently (2018–2019) been feeling very strong pressure to increase wages coming from the workforce – in particular the back-office as well as the sales network personnel.

The Polish head office is located in Warsaw, but the company's scope of operations covers the entire country, with its products being offered primarily on the consumer market. The company operates both through its own sales network and partners as well as an online channel.

The company has been selected to conduct the pilot project for the following reasons:

- the company has identified business challenges that can be addressed using the RPA tools;
- the company understands benefits provided by robotic process automation – in particular, based on the first, positive experiences in this area;
- the company's technical capabilities enable implementing robotic process automation on a larger scale;

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- the company's management is open to the strategic approach to robotic process automation – in particular, the company has already defined the robotic process automation objectives.

This entity has already had the first experience in the robotic process automation field. Following positive results of the first works, the company's management board made the decision to expand robotic process automation activities. It was decided that the works were to be of strategic nature and not a short term undertaking. In particular, on one hand, it meant that material funds would be allocated to the project, while on the other hand, the company's management board was keen on appropriately positioning this undertaking and treating the project as a strategic initiative. The first step involved defining the strategic goals of robotic automation. They include:

1. Freeing human resources:
   - Goal accomplishment indicator: FTE (Full-Time Equivalent), indicating how many working hours full time employees actually complete, taking into account the hours they actually work. FTE equal to 1.0 means that a person is engaged for 100% of work time in a specific activity;
   - Expected value: /classified/.
2. Minimizing operational departments personnel overtime work hours:
   - Goal accomplishment indicator: aggregate number of operational departments personnel overtime work hours within a month;
   - Expected value: 60-65% of the current aggregate number of overtime work hours.
3. Minimizing the error count in robotically automated processes:
   - Goal accomplishment indicator: error count resulting from processing (copying, modifying) data used in robotically automated processes within a month;
   - Expected value: reducing the current error count by 80%.

These goals were the basis for developing the robotic capability map for the enterprise under review, starting from its reference version.

The scope of the pilot project implementation did not include the development of software robots with the use of RPA tools. This implementation concluded with the development of the robotic capability map dedicated to the given company.

As part of the pilot project implementation, the author performed the support role with respect to the project implementation methodology. He was responsible for explaining the idea behind the tool developed (i.e. the reference map) and provided support for the company in taking successive steps related to developing – based on the reference map – the robotic capability map dedicated to that company.

For this purpose, the author began collaboration with a person selected by the company to perform the role of the robotic process automation implementation leader. As part of these efforts, the author:

- became familiar with the specifics of the company, conditions of its operations, the up-to-now robotic process automation accomplishments,
- presented the initial assumptions of the reference robotic capability map,
- presented in detail the individual robotic capabilities shown on the map,
- obtained information to be used as the basis for developing – based on the reference version – a version of the map dedicated to the given organization. This process included a series of the following actions:
  - removing those business capabilities that do not apply to the specifics of the given company,
  - complementing attributes of individual capabilities with a value specific for the given company.

As a result of the pilot project completed, the produced map dedicated to the company under review – on levels I and II – did not differ from the reference map. The following modifications appeared on level III:

- A new "Security Standards Management" capability was added in the "Robotic Process Automation Standards Management" capability area. This change was due to the need to highlight the role of security in the robotic process automation context (it is a consequence of strong regulations in force in the financial industry that the company operates in).
- In the "Robot Testing / Retesting" capability area the "Conducting Tests", capability was split into two capabilities: "Conducting Internal Tests" and "Conducting Acceptance Tests". This change was due to the completely different scopes of responsibility of the company's individual units for the performance of such tests.

As a result of such works, a robotic capability map was developed and handed over to the company at which the pilot implementation was conducted. Additionally, it was complemented with recommendations, formulated by the author, on what capabilities should be developed as a priority at this organization.

As presented before, the final decision on whether and to what extent robotic process automation tool should be implemented in the given company as well as how many and what software robots should be developed was not included within the scope of the test project implementation prepared by the author and therefore it is not discussed in this article. Also, the decision on the long term use of the tool (robotic capability map) by the company is beyond the scope of the pilot project implementation.

Completion of the initial verification of the reference map, described in this section, allowed the author to formulate the following observations:

- The proposed form of communications (i.e. capability map) is understandable for its recipients. Understanding the capability concept itself gives rise to more difficulties (the process-based approach is a very natural and intuitive way of thinking). An indirect proof of the correct

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understanding of the capability map by its recipients can be the list of changes (presented before) to its reference version that were submitted;
- introduction of the map definitely facilitated a change in the way robotic process automation is perceived in that organization – as a strategic undertaking engaging specific resources but enabling a broad range of benefits to be gained;
- based on the capability map, a number of undertakings improving the enterprise's robotic capabilities can be planned;
- the capability map developed constitutes a good basis to begin discussions inside the organization on raising personnel qualifications with respect to two aspects:
  – what competences are required inside the organization to effectively implement robotic process automation,
  – what competences should be developed for persons currently involved in the performance of processes that will be subjected to robotic automation.

Based on the above observations, it can be stated that the tool developed fulfills its role in ensuring effective implementation of robotic process automation, although its further development will be necessary.

It is extremely difficult to compare the results obtained versus any alternative approaches. The author – as of the moment of preparing the article – had not found any article compiled in accordance with a scientific-regime-based approach that could be viewed as competitive versus the reference robotic capability map. At the same time, the author's project-based experience indicates that the most frequently used approach applied by companies implementing the RPA solutions in Poland is the sequential successive robot development method – a decision on robotic process automation is taken and, without preparing earlier any robot strategy, without thinking over the role of robotic process automation in the longer term, and even without thinking over the issues related to the maintenance of the developed robots, successive robots are developed.

5. Conclusion and Further Research Directions

An effective implementation of robotic process automation is a multifaceted issue that involves taking actions that are both of management nature as well as of technological one. They are at the center of attention of robonomics, a currently evolving interdisciplinary research area, dealing with advanced automation and robotic automation technologies from the point of view of their impact on economic and organizational aspects of the functioning of enterprises (Ivanov, 2017). At the same time, such actions can be a source of a number of risks (Lacit & Willcocks, 2017). Therefore, it is of key importance that an organization should acquire appropriate capabilities in this area. The details of such capabilities depend on the robotic automation goals adopted for a specific organization. The organization can acquire them from an external provider or develop them internally by implementing a specific project portfolio. The robotic capability map proposed by the author is a tool that enables coordinating works in these areas.

Three goals of this article are laid out in its introduction. The first goal is accomplished in section two of the article, where the differentiators of robotic process automation are defined. The second goal is accomplished also in the second section of the article, where the capability and capability map concepts are discussed. The third goal is accomplished in the third section of the article, where the process used to develop the initial version reference robotic capability map and conduct its pilot verification is described.

The author is aware of the limited scope of the pilot project completed and the ability to present the results thereof in the publication. Therefore, the author is planning to conduct further test implementations in the future in order to be able to verify and expand the tool developed on a broader scale.

The author assumes also a further evolution of the approach developed and presented in the article. In particular, a further analysis of the comprehensiveness of the capability map and its decomposition one level lower is planned. Additionally, works are planned to develop a method that would enable combining the robotic capability map with the portfolio management mechanism (Blichfeldt & Eskerod, 2008) – to enable ensuring coherence and rationality of the planned and implemented robotic process automation activities.

Endnotes

1 The term “robotic” is a relational adjective, i.e. an adjective created from a noun that indicates a property of a specific entity based on its relation with another subject. In this case, the term “robotic” comes from robotic automation.

2 The starting point for the literature research was an analysis – conducted in August 2019 – of the publications stored in databases: 1) Web of Science (WoS) Core Collection, 2) SCOPUS, 3) IEEE Xplore. The focus was on English language publications – articles in the reviewed publications, industrial standards and books. A conscious decision was made to reference reports prepared by consulting companies to a limited extent, due to a relatively low scientific rigor applied in compiling such documents. The phrases “Robotic Process Automation” and “Capability Map” were searched for accordingly. The searches were conducted on titles of materials, abstracts and key words. In the case of each database and each phrase, a similar procedure was applied: an appropriate key word was entered into the database search engine to obtain a basic list of documents. Each of these documents was initially analyzed and a classification was made to group the materials into: a) contents totally irrelevant to the issues discussed in the article, b) imitative content, c) documents overlapping the contents found in other databases, d) relevant documents taken into account

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in the more detailed analysis. As a result of the completed review of the literature related to robotic process automation, 11 items in database 1), 14 items in database 2), 2 items in database 3) were classified as category d). As a result of the completed review of the literature related to capacity maps, 1 item in database 1), 7 items in database 2), 0 items in database 3) were classified as category d).
In the final stage, the analysis of books on robotic process automation and business capabilities was conducted. Based on the criteria of relevance to the issues covered in the article, the currency of the content presented and the methodology apparatus used, the decision was taken to include: 5 items related to robotic process automation, 1 item related to capability maps, in the literature research. However, the author is aware of the limitations of the adopted research procedure that in its current form cannot be called a systematic literature review (Uman, 2011).

3 In total, 14 interviews were conducted with the representatives of medium and large companies, representing 7 industries (banking, insurance, telecommunications, financial services, business services (BPO – Business Process Outsourcing), e-commerce, traditional retail, manufacturing). The criterion for selecting respondents was having completed at least one pilot RPA tool implementation. The interviews were the CAPI (Computer Assisted Personal Interview) interviews. The interviews were conducted in the October 2018 – July 2019 time frame.

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