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Evolution of the BPM Lifecycle

Marek Szelągowski
Vistula University
ul. Stokłosy 3,
02-787 Warszawa, Poland
Email: marek.szelagowski@dbpm.pl

***Abstract*—The process lifecycle systematizes the method of implementing and managing business processes in the organization. Due to changes in the social culture and the availability of technologies, the process lifecycle are also undergoing constant changes. The aim of this article is to analyze the direction of these changes and to propose a new process lifecycle, which would account for the requirements of the knowledge economy.**

The article presents an overview of relevant literature on managing the process lifecycle. In the second part, it discusses changes to the principles of holding business operations, which are increasingly more limiting with respect to the scope of using traditional process management. In the third part, the article proposes an updated the business process lifecycle, which would adjust the lifecycle to observed business changes and make use of emerging ICT solutions. The proposed process lifecycle guarantees the coherence of the implementation process in KE.

I. Introduction

THE process lifecycle is a schematic overview of the method of implementing and managing processes in the organization. It has the role of a "map" of the fundamental business-process-managing process in the organization. Its role is to present the main idea, or the cardinal principles, of process management, in a manner which enables their coherent and intuitive understanding by those participating in the implementation at present or in the future. For this reason, the process lifecycle cannot be over-complicated, albeit it should nonetheless be detailed enough and practicable enough as to make possible the shift toward more detailed models, which capture in detail the workflow of specific stages of the process lifecycle in the organization.

Due to changes in the social culture and the availability of technologies, or, more generally speaking, changes to holding business operations, process management in general, and the process lifecycle in particular, are also undergoing constant changes. The aim of this article is to analyze the direction of these changes and to propose a new process lifecycle, which would account for the requirements of the knowledge economy and the development of ICT solutions, such as process mining, robotic process automation (RPA), machine learning (ML), and artificial intelligence (AI).

II. Methodology

The article presents an overview of relevant literature on managing the process lifecycle and on this basis puts forward a proposal of a more general approach to the process lifecycle in the organization; one taken from a process-centric perspective. In the second part, it discusses changes to the principles of holding business operations, which are increasingly more limiting with respect to the scope of using traditional process management and emerging ICT solutions. In the third part, the article proposes an updated model of the process lifecycle, which would adjust the lifecycle to observed business changes and make use of emerging ICT solutions, which offer real-time support to dynamic business process management.

III. The BPM Lifecycle In Traditional Process Management

Literature presents numerous models of process lifecycles in the organization, which emerged within the framework of the traditional concept of business process management and were authored by:

- consulting and implementation companies, e.g. Gartner [1]
- software vendors, e.g. Software AG [2]
- academic researchers [3].

A. The process lifecycle

The concepts present illustrative approaches to the process lifecycle in the organization as a sequence of cyclical stages [4]. As a point of departure for this analysis the article selected the DMEMO cycle (an acronym coined from the first letters of the names of the subsequent stages: Design, Model, Execute, Monitor, and Optimize) [5], which is analogous to the DMAIC (Define, Measure, Analyze, Improve, and Control) cycle known from SixSigma [6].

Other process lifecycle models prepared within the framework of traditional business process management are also divided into stages presenting subsequent steps of the process lifecycle in the organization. Examples include:

- Define, model, simulate, implement, execute, monitor, analyze, optimize (Gartner) [1]
- Strategize, design, implement, compose, execute, monitor & control [2]

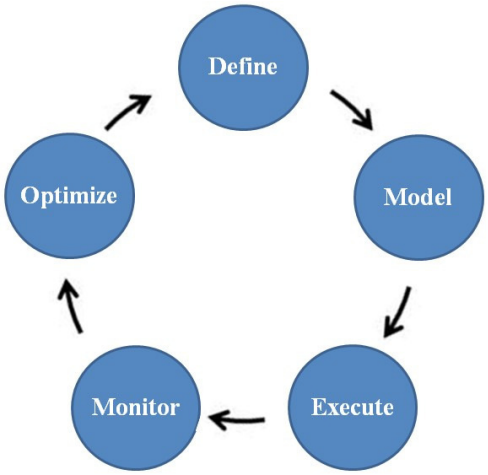

Fig. 1 The DMEMO process lifecycle
Source: [5]

- Model, simulate, implement, deploy & execute, monitor, optimize [7]
- Model, implement, execute, monitor, optimize [8]
- Discovery & remodeling, validation & simulation, deployment & execution, monitoring & performance management, improvement [9]
- (Re)design, configuration, enactment, diagnosis [10]
- Identification, modeling, implementation, controlling, process improvement [11]
- Analysis, design and modeling, implementation, monitoring and controlling, redefining and planning [12]

To generalize, within the framework of traditional process management the process lifecycle may be described as a cycle comprising sequentially executed stages with the aim of:

• Designing processes

This stage has the goal of preparing descriptions of processes existing in the organization (*as is*) and analyzing them on the basis of the organization's data, and, first and foremost, the knowledge of its personnel. In result of such analysis, an improved (*to be*) process model is prepared.

In traditional models that are commonly found in literature, this stage often contains or is defined as: identification, discovery, defining, redefining, designing, modeling, formalizing, simulation research, process optimization, etc.

• Implementing processes

This stage has the goal of accommodating the organization's operations to the designed process model. This accommodation encompasses both training and changes to the work of the personnel, as well as changes to the operations of the ICT infrastructure and the IT systems, including process performance automation.

In traditional models that are commonly found in literature, this stage often contains or is defined as: implementation, composition, positioning, process automation, etc.

• Process performance and monitoring

This stage has the goal of performing and monitoring business operations in accordance with prepared and implemented process descriptions. It is becoming increasingly more common in this stage to use techniques and analytical tools from the fields of BigData, internet of things (IoT), process mining, robotic process automation (RPA), machine learning (ML), artificial intelligence (AI), and expert systems.

In traditional models that are commonly found in literature, this stage often contains or is defined as: performance, monitoring control, measurement, etc.

• Process analysis and improvement

This stage has the goal of evaluating process performance and improving process descriptions with the aim of raising efficiency, minimizing risks, etc. At this point, techniques and analytical tools are used from the fields of BigData, process mining, artificial intelligence, and expert systems.

In traditional models that are commonly found in literature, this stage often contains or is defined as: analysis, diagnosis, optimization, improvement, etc.

B. The life cycle of processes in the organization (BPM Lifecycle)

Due to the identified necessity of approaching the process lifecycle from the perspective of implementing and performing multiple processes in the organization, the article proposes a process lifecycle model, which apart from the lifecycle of a single process also encompasses actions which from the perspective of the organization prepare the implementation of process management. This "global" life cycle of processes in the organization we will call Business Process Management Lifecycle in organization (in short: BPM Lifecycle). To this end, some consulting companies and researchers supplement the process lifecycle with an initial stage named:

- The formulation of vision [5]
- Process identification [3]
- Initial Process Planning and Strategy [4]

the aim of which is to define the goals and methods of process management in accordance with the strategy of the organization and its level of process maturity, prepare a corresponding plan of an implementation project for process management, as well as hold training courses for the organization's management and personnel.

This stage results in the preparation of a process architecture, which includes, among others, the agreed-upon goals and performance indicators, as well as priorities in the sequence of implementing particular groups of processes.

In traditional models that are commonly found in literature, this stage often contains or is defined as: planning, preparation, strategizing, identification, etc.

This elaboration, however, does not change the essence of depicting the process lifecycle (or BPM Lifecycle) within the framework of traditional process management as a sequence of stages performed one after another, preceded by a one-off execution of preparatory stages, which initiate the

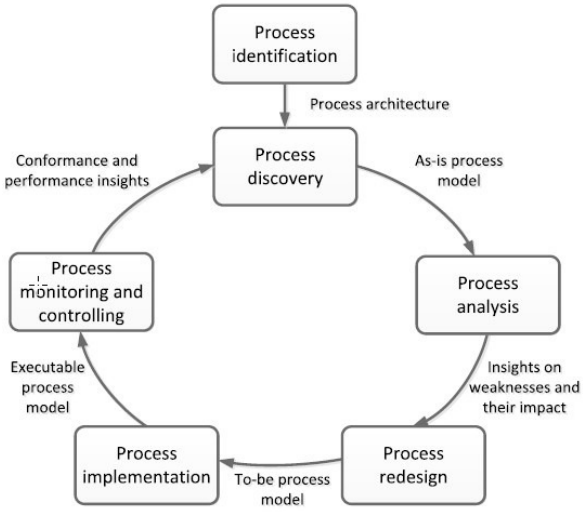

Fig. 2 The BPM lifecycle.
Source: [3]

implementation of process management in the organization. For all practical purposes, it is an extension of E. Deming's PDSA cycle, which has been designed over 50 years ago, usually supplemented with additional "modern" ICT elements, such as: simulation, exploration, implementation, automation, reporting, etc.

IV. The Limitations of Traditional Process Management

If we take a diagram depicting the BPM Lifecycle and replace symbols corresponding to subsequent stages (usually circles or ellipses) with symbols for subprocesses known from the Business Process Model and Notation (BPMN), the BPM Lifecycle (e.g. the model created by Dumas, La Rosa, Mendling, and Reijers from Fig. 2) will depict a normal, sequential "relay" process with a single feedback loop, the goal of which is to ensure periodical analysis and improve the process model on the basis of data derived in the course of its performance.

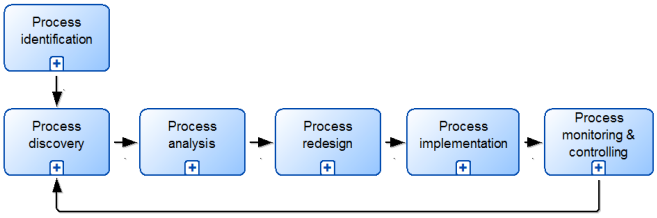

Fig. 3 The BPM Lifecycle as a process diagram in the BPMN notation.
Source: Author's own elaboration, on the basis of [3]

In effect, processes cannot be improved upon or even changed at all during performance itself – this is possible upon completion and analysis alone. Most process-supporting workflow systems, document management systems, and Business Process Management Systems (BPMS) worked exactly in accordance with this principle. Even upon introducing changes to the course of a process, such changes will only be visible for process performances which will be initiated after their acceptance (for new process instances). For processes which have already initiated performance (existing process instances) such changes are not visible. They are performed in accordance with an outdated version of the process description, even when it is apparent that it contains errors and may result in losses, and when we already know how the process may be improved upon. This nonsensical principle is further implemented in process-centric applications supporting process performance: the process performers use an application which was up to date in the moment of process initiation, even when an updated application is readily available.

This is fully in accordance with the principles of the traditional concept of process management, in which process performers are prevented from introducing changes in the course of performance itself. The course of the process is defined in the form of a description, or rather, an "algorithm," prepared prior to initiating performance itself. In consequence, traditional process management lacks the possibility of quickly using knowledge obtained by the performers in the course of performance. In effect, this concept also does not offer the possibility of the operational use of new technologies, such as process mining, machine learning, or artificial intelligence, in the course of performance. Such use would require the authorization to change the process in the course of performance as the result of analyzing information obtained in the course thereof. This limitation results in the traditional BPM Lifecycle being inadequate in the case of about 70% of the processes performed in the knowledge economy [13][14]. This particularly pertains to essential processes, in which knowledge is constantly being created and verified, such as e.g. diagnostic-therapeutic processes, research and development processes, and personalized services.

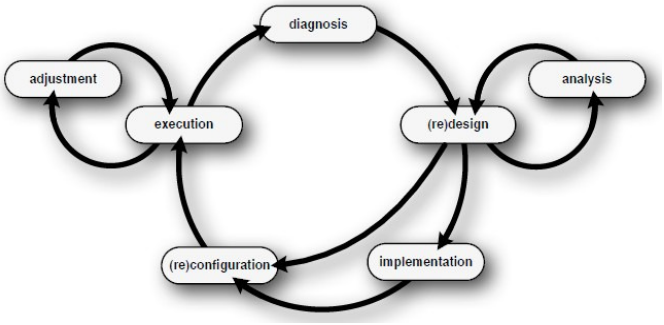

Fig. 4 The process lifecycle in the process mining methodology.
Source: [15]

The management of such processes requires the process performers (or artificial intelligence) to be empowered to shape the processes on their own behalf, which requires introducing changes to the process lifecycle (and BPM Lifecycle), which are qualitatively deeper than just adding or subtracting subsequent stages of a sequential, routine cycle.

Among the process lifecycle models within the framework of traditional process management, a truly significant qualitative change was proposed in 2012 by the authors of the Process Mining Manifesto belonging to the IEEE Task Force on Process Mining (Fig. 4) [15].

The process execution stage has been supplemented with an additional “Adjustment” loop, the aim of which is to adapt the process in the course of performance itself. The standard process lifecycle has also been supplemented with a (re)configuration stage, in which changes are made to process-based executive systems (e.g. workflow management, document management, RPA, or BPMS) without having to repeat the implementation stage performed e.g. as the result of creating separate process performance scenarios. When recommending the change of the process lifecycle, the authors of the Process Mining Manifesto have stressed that organizations should also include the possibility of adjusting processes in the stage of designing processes and their supporting IT tools ("Analysis" loop). It has been clearly underlined that in the (re)design stage, analysis is held in the form of e.g. simulation research on the proposed process model or in the form of comparative analyses of the new process pattern with data on completed performances (researching compliance or extending the model as the result of process mining search) [13], with the end result being redesigned and reconfigured systems supporting process performance, e.g. RPA / using elements of AI or its integrating workflow systems / document management / BPMS.

This is a clear step toward changes to the process lifecycle, which allows for the dynamic management of processes. Having the option to improve processes in the course of their performance in the form of fixes, updates, adaptations, or limited experiments provides the process performers with the power to verify and create new knowledge in the course of their work with the use of machine learning or artificial intelligence. At the same time, the analysis of process performance in the (re)design stage allows for the uncovering of such knowledge thanks to process mining or analyzing the course of machine learning.

V. The BPM lifecycle in dynamic BPM

For full compliance with the concept of dynamic business process management, it is essential to manage the uncovered knowledge through the systemic combination of revealing knowledge with its evaluation and distribution. This, however, requires us to take the concept of process lifecycles in a direction in which the performance of a process will not be equal with the perfect repetition of the standard, but rather, the repetition or adaption of the standard with the best possible results in mind, in a manner which is the most adequate in a given context and within the limits of the executive privileges of the performer. Such adaptations may be introduced by:

- process performers
- process performers with the use of ICT solutions (e.g. online machine learning)
- elements of autonomic artificial intelligence

The postulated changes have been introduced in the process lifecycle model designed by the author in accordance with the concept of dynamic BPM. The model is presented on Figure 5.

The subsequent stages of the BPM Lifecycle of dynamically managed business processes are as follows:

Defining goals

In this stage, the goals of the project of implementing business process management, the goals of the megaprocesses, and the goals of knowledge management in the organization, as well as the principles of implementation themselves, are defined and agreed upon with the stakeholders.

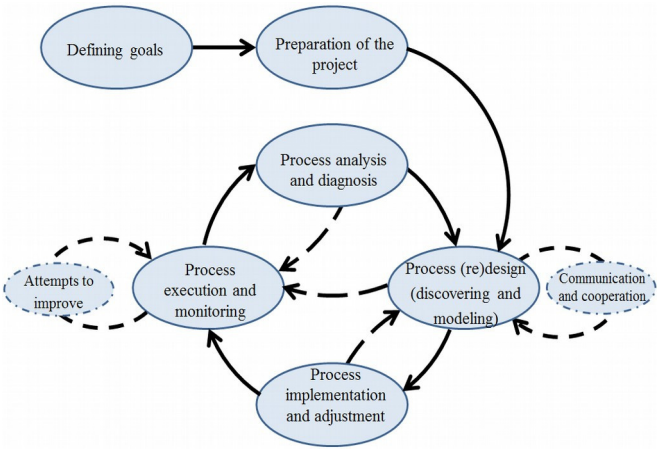

Fig. 5 The BPM Lifecycle in accordance with dynamic process management.
Source: author's own elaboration.

This stage results in the formulation of a definition of goals and a process map (and the de facto decision to initiate the implementation of business process management).

Preparation of the project

The goal of this stage is to prepare the organization for the implementation of process management by:

- defining or verifying the organization's level of process maturity[16]
- developing a method of process description and communication which is the most suited to the character of the performed processes
- holding training sessions for the management and the personnel of the organization.

The performance of this stage results in the creation of a process architecture and an implementation plan, which take into account the level of process and technological maturity and the culture of the organization.

(1) The (re)Design stage

In this stage, process descriptions and their corresponding data are created. Process discovery is performed with the use of:

- standard models for the field in which the organization operates,
- the knowledge of the employees,
- exploratory research ("discovery" / "mining"),
- analyses of data and the results of machine learning.

Depending on the level of dynamism of the processes involved, process descriptions may take the form of:

- for static processes – detailed descriptions, usually process models comprising interconnected process diagrams,
- for dynamic processes – detailed process descriptions In the form of models comprising process diagrams and/or collections of tasks to be accomplished during process performance (e.g. in the form of an ontology), as well as the data required during the decision-making process and in the documentation stage.

This stage should also encompass the preparation of requirements for RPA, as well as the preparation of prototypes of process-driven applications, which in the least should include the information content of the user interface, the possible range of standard reports, and the scope of integration with ICT infrastructure or BigData repositories. Furthermore, in this stage, the organization's internal rules and regulations should be – where required – updated for consistency between process management and other fields of management.

Communication and cooperation

In the (re)Design stage – in accordance with the principles of dynamic business process management – in order to make good use of the broadest possible part of the organization's intellectual capital, proposed process descriptions, prototypes, or applications and robotic process automation, which have been cleared for testing, should be consulted with in-house and external experts, and, first and foremost, with practitioners themselves, who use them on a daily basis, through e.g. communities of practice or social media websites.

(2) The Implementation and adjustment stage

In this stage, process descriptions are implemented (and eventual changes to other internal regulations are introduced) along with their supporting RPA and process-centric applications within the organization. In this stage, it is possible to adapt process descriptions and the configurations of their supporting robotic process automation and systems to the needs and requirements identified during implementation. Should it turn out that a designed process or configuration of a process-centric application does not meet the expectations of the users, it is possible to return to the (re)Design stage in order to prepare the process descriptions and applications once again.

(3) The Execution and monitoring stage

In this stage, business processes are performed and data on their performance is collected on an ongoing basis. For transaction systems (e.g. MRPII, CRM, ERM, HIS, etc) and process-based systems (workflow / document management / BPMS), as well as RPA and AI, they are stored in event logs. Data from other sources (e.g. mobile applications, social media applications, e-mail accounts) should be integrated within a unified data source (BigData). Such information should be monitored by control systems on an ongoing basis, as well as analyzed and used in the ongoing support of knowledge workers by robotic process automation and/or elements of artificial intelligence.

Attempts to improve

In accordance with the 2nd principle of dynamic business process management [17], knowledge workers (and in the future – autonomic artificial intelligence as well) have the power to create or adapt described business processes to the requirements of a specific context of performance and the changing general conditions of process performance (e.g. changing technologies, principles of competition, or the individual, unpredictable context of performance). Such active experiments have the goal of arriving at new solutions enabling the performance, or the optimization of the performance, of a process.

(4) The Analysis and diagnosis stage

In addition to business processes being monitored in the Execution and monitoring stage, business processes are nevertheless evaluated ex-post by means of:

- standard control actions, including the control of process efficiency, duration, costs, resources used, risks involved, etc.;
- discovering the actual course of the performed processes and evaluating the results of the implemented improvements with the aim of:
  - broadening the processes of the organization through communication (adding to the list of best practices and informing about the update), as well as redesigning and tailoring processes and their supporting applications and robots;
  - communicating information on the negative results of specific attempt at improving a process (adding to the list of wrong practices and informing about the update);
  - initiating a broader evaluation of the possibilities of using a discovered potential improvement (while informing the stakeholders about the possibility of participating in the discussion).

Knowledge obtained in this stage should be systematically communicated to authorized members of the organization, with a particular focus on the employees who are directly responsible for process performance, for whom new or verified knowledge might have direct significance (in the Execution and monitoring stage). This requires the existence within the organization of a culture and mechanisms of internal communication, which allow for the ongoing, broad improvement of processes and the distribution of knowledge, as well as the existence of an ICT

infrastructure enabling the rapid introduction of changes and their communication.

At the same time, within the proposed lifecycle model for dynamically managed processes improvements resulting form practical attempts at innovation, which have been given a positive evaluation, may be introduced in the Execution and monitoring stage directly following the (re)Design stage, without the necessity of going through the Implementation and adjustment stage. As previously, this requires organizations to develop efficient mechanisms of internal communication both on the level of social culture, as well as on the level of ICT infrastructure, understood as e.g. the broad acceptance and the efficient use of mobile devices, social media applications, or elements of artificial intelligence.

VI. Conclusion

In the knowledge economy, a mere 30 percent of processes within the organization are static in nature, for which detailed models or even algorithms may be prepared prior to performance[18][19][20]. The remaining 70 percent of processes are processes which require dynamic management, or the empowerment of their performers to introduce changes in the course of performance itself. As has been shown in the article, the development of process management requires the introduction of a qualitative change to the process lifecycle, which would account for the possibility, and in the case of a large majority of dynamic processes – the necessity, of using the knowledge of the process performers to tailor the processes to the context of a specific performance. Without this change it is impossible to make efficient use of new technologies, such as process mining, machine learning, or artificial intelligence. Within the framework of traditional process management, the use of such technologies in the course of a process lifecycle is impossible or ineffective, as it provides benefits only upon subsequent performance of the process in question (or upon an even more delayed approval of the change by a group of process owners). In the knowledge economy, implementations of process management in accordance with the traditional BPM Lifecycle were seen and remain to be seen as a success only because:

- they pertain to static (repeatable, routine, unchangeable) processes, the optimization or automation of which (e.g. through RPA) allows us to raise the pace of performance and lower costs and risks
- sub-optimal performance or losses during performance are so high that in effect any improvement initiatives bring about tangible effects

However, the situation is changing due to:

- the number of static processes in the organization steadily becoming lower
- the possibility of using new ICT technologies, among which one should primarily mention those which work in real time: process mining, machine learning, and artificial intelligence.

Taken together, both these factors result in the scope of processes requiring dynamic management becoming larger, and, at the same time, allow access to a growing number of tools supporting knowledge workers in this regard. Nevertheless, they exert growing pressure on the organization on the part of the competition and the clients. The BPM Lifecycle proposed in this article requires the adjustment of methodologies and tools supporting process management with a view to the efficient use of both emerging ICT technologies and the intellectual capital of the organization, encompassing the entire process lifecycle.

VII. References

[1] G. Polancic, “Learning BPMN 2.0 – Business Process Vs Workflow,” 2013, http://blog.goodelearning.com/bpmn/business-process-vs-workflow/

[2] Software AG, “Enterprise BPM series: a summary,” 2011, http://www.ariscommunity.com/users/nina-uhl/2011-07-26-enterprise-bpm-series-summary

[3] M. Dumas, M. La Rosa, J. Mendling, and H. Reijers, *Fundamentals of Business Process Management*. Heidelberg: Springer, 2016.

[4] R. Macedo de Morais, S. Kazan, S. Dallavalle de Padua, and A. Costa, “An analysis of BPM lifecycles: from a literature review to a framework proposal,” *Business Process Management Journal*, May pp. 412-432, 2014, doi: 10.1108/BPMJ-03-2013-0035.

[5] BPM Resource Center, “Understanding BPM and Related Improvement Methodologies,” 2014, http://www.what-is-bpm.com/get_started/bpm_methodology.html

[6] P. Pande, R. Neuman, and R. Cavanagh, “Six Sigma”, Warszawa, K.E. Liber S.C., 2003, pp. 37, 141-142.

[7] T. Gulledge, S. Hiroshige, and D. Manning, “Composite Supply Chain Applications,” 2011, https://www.intechopen.com/books/supply-chain-management-new-perspectives/composite-supply-chain-applications, p. 49, doi: 10.5772/21927.

[8] PNM SOFT, “BPM Lifecycle,” 2017, http://www.pnmsoft.com/resources/bpm-tutorial/bpm-lifecycle/

[9] A. Pourshahid, D. Amyot, L. Peyton, S. Ghanavati, P, Chen, M. Weiss and A. Forster, “Business process management with the user requirements notation,” *Electronic Commerce Research*, vol. 9, 2009, pp. 269–316, doi: 10.1007/s10660-009-9039-z

[10] C. Di Ciccio, A. Marrella, and A. Russo, “Knowledge-intensive Processes Characteristics, Requirements and Analysis of Contemporary Approaches,” *Journal on Data Semantics*, vol. 4, no. 1, pp. 29–57, https://www.researchgate.net/profile/Claudio_Di_Ciccio/publication/269629902_Knowledge-Intensive_Processes_Characteristics_Requirements_and_Analysis_of_Contemporary_Approaches/links/576a501a08ae1a43d23bca3c.pdf

[11] A. Bitkowska, „Zarządzanie procesowe we współczesnych organizacjach,” 2013, Warszawa: Difin SA, pp. 66-83.

[12] R. Bernardo, G. Ribeiro, and S. Dallavalle de Pádua, “The BPM lifecycle How to incorporate a view external to the organization through dynamic capability,” *Business Process Management Journal*, vol. 23, no. 1, 2017, pp. 155 – 175.

[13] E. Olding and C. Rozwell, “Expand Your BPM Horizons by Exploring Unstructured Processes.”, 2009, Gartner Technical Report G00172387,.

[14] K. Swenson, “Mastering the Unpredictable: How Adaptive Case Management Will Revolutionize the Way That Knowledge Workers Get Things Done.” Tampa (USA): Meghan-Kiffer Press. 2010. pp. 30-31.

[15] Process Mining Manifesto. 2012, http://www.win.tue.nl/ieeetfpm/doku.php?id=shared:process_mining_manifesto

[16] K. Kania, „Doskonalenie zarządzania procesami biznesowymi w organizacji z wykorzystaniem modeli dojrzałości i technologii informacyjno-komunikacyjnych,” Katowice: Wydawnictwo Uniwersytetu Ekonomicznego w Katowicach, 2013, pp. 85-87.

[17] M. Szelągowski, “Becoming a Learning Organization Through Dynamic Business Process Management,” *Journal of Entrepreneurship,*

Management and Innovation (JEMI), vol. 10, no. 1, 2014, pp. 147-166.

[18] HandySoft, "Dynamic BPM – The Value of Embedding Process into Dynamic Work Activities: A Comparison Between BPM and Email." 2012, http://www.bizflow.com/system/files/downloads/HandySoft%20-%20Dynamic%20BPM%20White%20Paper_0.pdf.

[19] T. Austin, "Gartner Says the World of Work Will Witness 10 Changes During the Next 10 Years." 2010, https://www.gartner.com/newsroom/id/1416513

[20] J. Ukelson, "Adaptive Case Management over Business Process Management." 2010, http://it.toolbox.com/blogs/lessons-process-management/adaptive-case-management-over-business-process-management-40002.