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PROCESS ORIENTED INFORMATION SYSTEMS

Abstract: The article deals with the Business Process Orientation (BPO) and Information Systems (IS) supporting this approach. At the beginning the Business Process (BP) concept and Business Process Management (BPM) approach are introduced. Next, the article describes the main processes in organizations and the IS which support them. Then, the BPM lifecycle is presented and the IS maintaining their steps. The important role of Business Process Management Systems (BPMS), the system designed for managing business processes, is also discussed here. This study is based on an analysis of literature, empirical experience, as well as critical thinking and inductive inference methods.

Keywords: Information Systems, Business Process Management, Business Process Orientation, BPM lifecycle.

1. Introduction

Nowadays, more business processes performed in organizations should be supported by Information Systems (IS). There are also business processes which might be run automatically by IS, without human involvement. "Those aspiring to improve the way work is done must begin to apply the capabilities of information technology to redesign business process" [Davenport, Short 1990]. Unfortunately, in many organizations there is a gap between business processes and the IS that are in place. Finding the gap and implementing IS for Business Processes Management (BPM) is very important for organizations. Recently, management and computer science researchers have debated the use of IS for tackling the issue of representing, analysing and managing business processes in organizations [Kirchmer 2009].

The implementation of IS, which includes the mechanisms influencing organizations and also impacting on events in its surrounding environment, is the essence of Business Process Orientation (BPO) [Cieśliński 2011]. These mechanisms influence in particular quality, information and efficiency management. These elements contribute to the improvement of the economic situation in an organization.

The aim of the research was to define the business processes in an organization and to present IS which improve and support them and also the impact of IS on life cycle management processes. To achieve this goal, cognitive and utilitarian studies were carried out. In this study an analysis of literature and empirical experience was used in designing and implementing IS for improving the business process in different kinds of organizations, as well as the critical thinking and inductive inference methods. Critical thinking is a broad concept of analyzing and synthesizing information gathered by reasoning, experience and communication [Saavedra, Saavedra 2011], while inference methods allow to deduce a general rule from the examples [Eide, Showalter 2012].

This article provides an overview of the BPO idea and IS that influence an organization's benefits, challenges, and critical success factors. The first part of the article defines a process-oriented organization. Then, a concept of Business Process Management (BPM) is introduced and different categories of business processes are characterised. The next part presents the life cycle of business process management (BPM Lifecycle) and the IS supporting business processes in each stage. Finally, current Information Technology (IT) trends are also covered.

The results obtained may be useful for managers, business analysts and IT specialists in dealing with the planning and implementation of IS in business process driven organizations.

2. Related works − process oriented organizations

2.1. Business process orientation approach

From the point when the process approach to an organization became a mandatory requirement, awareness of Business Process Orientation (BPO) has grown. In other words, the organizations, in order to accomplish their goals and aims, should be designed in a process manner [Daft 2004]. There is a need to look beyond functional boundaries to understand by the means of process the way in which business actually works. This approach demands a business process orientation. BPO is a way of thinking which emphasizes a process and abandons a hierarchy to gain outcomes and customer satisfaction [McCormack, Johnson 2001]. Business process orientation was promoted by such authors as Harrington (1991), Davenport (1993), as well as Hammer and Champy (1994).

Starting from the basics, a Business Process (BP) is defined as a collection of activities that take one or more inputs and create an output that is of value to the customer [Hammer, Champy 1994]. A business process is also defined as a work activity in a specific order, at an exact time and place, and with a specified beginning and end, and clearly identified inputs and outputs [Davenport 1993]. A business process might be simple and straightforwardly limited to one unit of an organization,

but also when needed, complex and cutting across several business partners. It is also believed that a business process is a set of activities running in parallel, in a sequence or conditionally, leading to changes in an organization's resources, and brings the final effects as a product or service [Perechuda 2000]. Strictly speaking, a business process might be defined as a coordinated chain of activities which are organised into a logical sequence, and transform elements into the desired result. Each business process requires inputs such as data and information in order to create outputs, such as information and knowledge. A business process is a complex chain of actions designed to produce results of operations [Silver 2006]. It is also defined as a repeating cycle which aims at achieving business benefits [Debevoise 2005]. A business process is a series of steps designed to produce a product or service. It is obvious that the transformation which occurs in a business process should add value to an input and create an output which is more effective and useful to a recipient [Lindsay 2003]. A business process is also considered as a concept facilitating collaboration of people and enterprise resources such as IS. This collaboration allows for achieving goals in an efficient and effective manner, especially when the IS are well suited to the needs of organizations.

There is one more aspect referring to the processes in an organization which should be mentioned. BPO and BP are correlated with each other, and also with Business Process Management (BPM), literally the management of business process. The relation is presented in Figure 1.
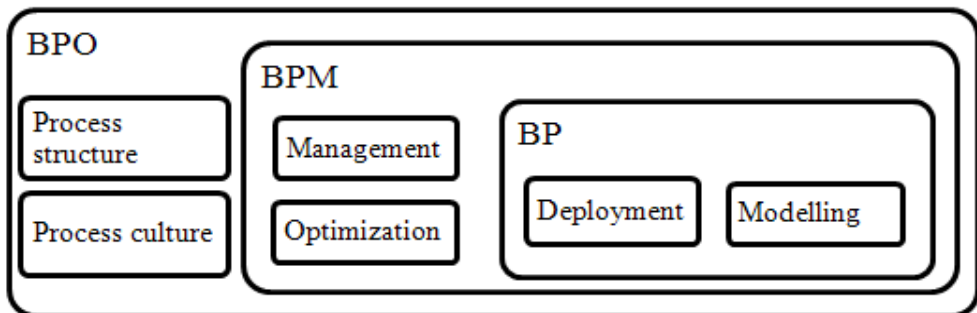

Figure 1. The components of business process orientation

Source: [Van Looy, De Backer, Poels 2010].

BPO is a broad understanding of processes and a process approach in an organization. BPM is a way of managing many BPs through their constant improvement [Jeston, Nelis 2008]. BP is a key instrument in organizing BPM and improving the understanding of its interrelationships. This aspect is further explained in the next part of the article.

2.2. Business process management

BPM is a collection of concepts, methods and techniques to support the administration, configuration and analysis of business processes [Weske 2007; Smith, Finger 2003; Rudden 2007]. It is also defined that BPM is the management of cross organizational processes by gathering all sorts of methods, techniques, design tools and analyses of operational business processes involving people, organizations, applications, documents, and other sources of information [Aalst, Hofstede, Weske 2003; Gartner 2011].

Nowadays there is a third wave of BPM [Smith, Fingar 2003]. The evolution started from the first wave − Process Improvement in the 1970s-80s, through the second wave − Process Re-engineering in 1990, to the third wave – Business Process Management. The third wave is a new approach to business process innovation and management, it is a merger of IS and IT and its assistance to business processes. That connection is the methodology of BPM and its technology engine i.e. Business Process Management System (BPMS). The BPMS is described further in the article. The new concept is not about redesigning the business process, but rather a single computer program that is capable of implementing and managing a continuous stream of business process innovations [Smith, Fingar 2002].

2.3. Business process management lifecycle

BPM has a specific lifecycle which consists of several steps that aim at improving the quality of the business process in an incremental way [Debevoise 2005; Keen 2006; Vonderheide-Liem, Pate 2004]. Usually it is described in literature that BPM
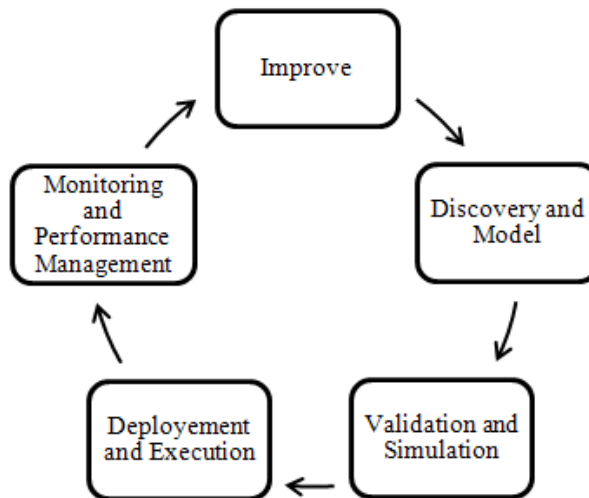

Figure 2. The BPM lifecycle

Source: [Pourshahid et al. 2009].

follows a life cycle that consists of three phases, namely: process modelling, execution of the process and process monitoring [Schumm, Leymann, Streule 2010]. There is also representation of the BPM lifecycle in four parts: design (modelling), implementation, enactment, and analysis [Muehlen, Rosemann 2004]. However, there is also a wider understanding of the lifecycle [Pourshahid et al. 2009]. This is presented in Figure 2.

The BPM lifecycle starts with the discovery and modelling of the business process. Next it goes to validation and simulation, after that deployment and execution are performed. The next step is monitoring and performance management and the whole cycle finishes with improving the process and starts everything from the beginning again.

2.4. Business process management as compared to other managerial methods

BPM is one of many managerial methods. In the context of IT management there are almost forty management concepts [Sanli 2010]. The most significant one is Change Management. Change Management is considered to be the most important method in the BPM perspective, because without change there is no improvement of the process [Smith, Fingar 2002; Oracle 2008]. Change Management is a process of transformation from current state to desired future. It is also an ability to manage the change over and over [Anderson, Ackerman-Anderson 2010; Subha, Dharshni 2012]. Apart from it, there are other common methods like Knowledge Management (KM) and Collaborative Innovation Process (CIP). KM is a process of systematically and actively creating, identifying, sharing and distributing knowledge in an organization [Jemielniak, Koźmiński 2008; Karlsen, Gottschalk 2004; Zhu 2008]. CIP is a framework built on sharing ideas and inventions with the world and getting new ideas from developers, customers, and leaders outside of the corporate structure. [Amidon, Mahdjoubi 2000; Perry, Candlot, Schutte 2010]. These management methods have in common one thing − they stress the significance of the business process and its management, especially the possibilities given by IS and IT.

Within managerial concepts and organizations as entities functioning in society there is Corporate Social Responsibility (CSR). CSR is a way the organization manages social, ethical, human rights issues for business operations in collaboration with stakeholders. This is a broad concept requiring the management of multiple processes inside and outside the organization [Brammer, Millington, Rayton 2005; Bevan, Corvellec, Faÿ 2011; Angus-Leppan, Metcalf, Benn 2010].

2.5. Main processes in organizations

Generally, business processes in organizations might by distinguished as main processes and supporting processes. The main processes are those which are linked directly to the customer and business cycle from the initiation of contact with the

customer to the finalized transaction. The supporting processes are backing the main processes with particular products or services. They are linked to the customer indirectly and are specialised in a particular activity [Repa 2011].

International Benchmarking Clearinghouse defines six main processes and seven supporting processes in organizations [APQC 2012]. The main processes responsible for management and support are: human resources development and management, information management, financial and physical resources management, environ-mental management program execution, external relationship management, improvement and change management. The supporting processes responsible for operational processes, are: markets and customers' understanding, vision and strategy development, design of products and services, marketing and sales management, production and delivery for manufacturing organizations or production and delivery for service organizations, invoicing and customer services management.

Another classification of the processes in organizations is presented by Grajewski, who defines: the main processes, supporting processes and auxiliary processes [Grajewski 2007]. The main processes are: product development, customer services management, strategy management, supply management, planning, production management, staff management, financial management. The supporting processes are: quality assurance, and controlling. The auxiliary processes are: investments, repairs, asset management.

In this article, the processes in organizations are classified to analyse the overall structure of the organization and examine which of those processes are covered by the existing IS. Further in the article, there are presented IS supporting the processes in organizations. For that purpose, the main processes from APQC and the Grajewski classification have been taken into consideration. To cover all the essential processes for a model organization these two classifications have been merged; however, the processes which are similar, like financial resources and financial management, have been combined into one. As a result, there have been identified eleven main processes: customer services management, external relationship management, financial management, human resources development and management, improvement and change management, information management, planning, product development and management, production management, strategy management, supply management. This classification is the basis for further research for this article.

Regarding processes in organizations, there is an assumption that first the main processes should be defined, and after that the other processes which are not so important for conducting business [Hernaus 2008]. Not all processes are equal, some are prioritised higher than others. Weighting these processes helps to concentrate on the business goals and the processes generating added value to organizations. Every organization has its own main processes dependent on the industry, market and organizational culture.

3. Research findings − Information Systems in process-oriented organizations

3.1. Information Systems supporting the business process management lifecycle

Business processes and IS are related to each other and their relationship is developing rapidly. On the one hand, it is expected that the management of the organization will influence the structure of IS in the context of business processes. On the other, fast growing computerisation and the exploration of new technologies can generate new opportunities for organizations and that might influence the design of business processes.

BPO organizations should mainly concentrate on using systems supporting BPM such as Business Process Management Systems (BPMS) [Winn, Thwe Oo 2011]. These systems are strictly dedicated to the support and management of processes in organizations. Nevertheless, they are not responsible for conducting the processes themselves. BPMS provide support services to business customers in the implementation of a sequence of activities which consist of the processes. BPMS integrate IT with BPM.

IS supporting operational activities are: Enterprise Resource Planning (ERP), Manufacturing Resource Planning II (MRPII), Customer Relationship Management (CRM), Supply Chain Management (SCM), Quality Management System (QMS) Computer Aided Design (CAD), Manufacturing Execution System (MES) and Advanced Planning and Scheduling Tools (APS).

ERP is a multi-module application system that integrates the activities of cross-functional departments, from product planning, parts purchasing, inventory control, product distribution, to order tracking [Umble, Haft, Umble 2003]. ERP systems may include application modules for financial, accounting and human resources aspects of a business. They are responsible for the effective planning of all resources of manufacturing organizations [Feng 2000]. CRM systems are a widely implemented strategy for managing the interactions of organizations with customers, clients and sales prospects [Richards, Jones 2008]. SCM systems aim at facilitating collaboration among organizations, their suppliers, manufacturers, distributors and partners [Ketchen, Giunipero 2004]. QMS systems are a set of coordinated activities to control organizations in order to continually improve the effectiveness and efficiency of their performance [van der Wiele, Dale, Williams 2000]. CAD systems use IT for the process of design and design documentation. This is a combination of hardware and software that enables engineers and architects to create complex virtual products [Matin et al.; Hirz, Harrich, Rossbacher 2011]. MES and APS layer support planning and control the execution of the production process. They create the link between the ERP and MRP II systems and the production line by integrating a solution that supports computer-aided design and manufacturing process control [Klonowski 2004].

Besides these systems, there are also systems such as Business Intelligence (BI), Business Activity Monitoring (BAM), Enterprise Application Integration (EAI), and Business Service Management (BSM). BI systems are applications and technologies for gathering, storing, analysing, and providing access to data in order to support decision processes, and help organizations to make better business decisions [Olszak, Ziemba 2007; Januszewski 2008]. BAM systems proactively define and analyse critical opportunities and risks in organizations to maximize profitability and optimize efficiency [Dresner 2003; Gartner 2005; Ensemble 2004]. Continuous monitoring and alerting about the status of significant factors improves decision-making and optimization processes. EAI systems are able to integrate a set of enterprise computer applications [Urlich 2001; Mantzana, Themistocleous 2006]. BSM systems are responsible for alignment between the needs of a customer and the objectives of organizations. The listed systems are not all that can be found in the literature, however, they are the most relevant in the concept of process oriented organizations [Sattarova 2009]. There are also, for example, systems such as Business Process Intelligence (BPI) − a composite of BI and BPMS systems. This is the
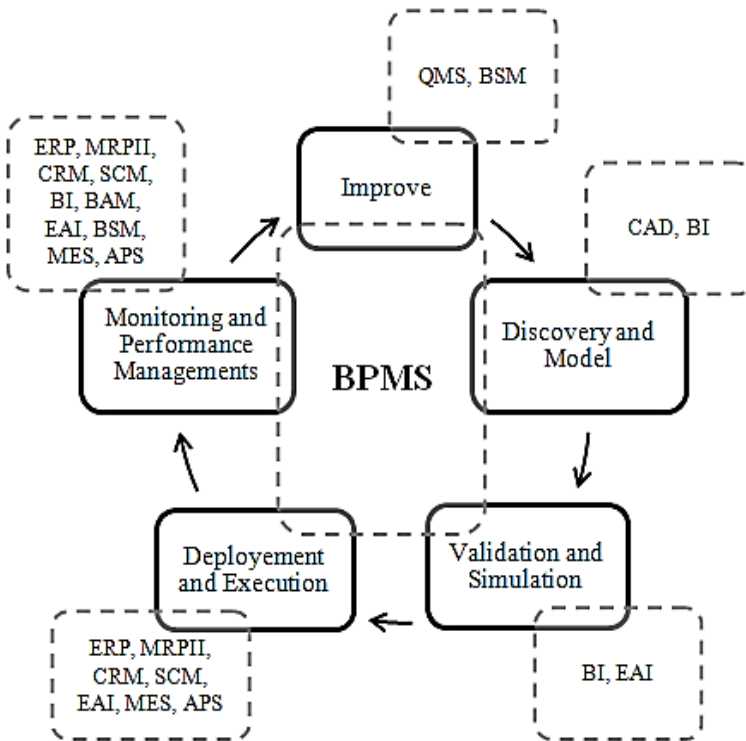

Figure 3. The BPM lifecycle and IS

cooperation of standard BI systems with the process approach systems [Kimball, Ross 2002]. These types of correlation and hybrid systems are quite popular, nevertheless, they are not essential for further investigation in this article.

IS are directly connected with several BPM lifecycle steps. ERP, MRP II, CRM, SCM, MES, APS systems take part in two BPM lifecycle steps. These are deployment and execution, monitoring and performance management, as presented in Figure 3. QMS systems, regarding their quality improvement process, are included in the BPM lifecycle improved step. CAD systems partly cover discovery and a model step in a discovery part.

BI systems support discovery and model, validation and simulation, monitoring and performance management BPM lifecycle steps. BAM systems are only responsible for the monitoring and performance management step. EAI systems take care of three core steps − validation and simulation, deployment and execution, monitoring and performance management. BSM systems mainly cover monitoring and performance management, and improve steps of the BPM lifecycle.

3.2. Information systems supporting main business processes

IS are important elements in organizations, especially if they are well suited to business needs. BPMS are defined as essential for business process oriented organizations, however their functionalities might slightly differ depending on the organization's size and business industry. The main processes and the IS supporting them are presented in Table 1. In principle, almost all processes have the assigned IS that support them and are responsible for their improvement and automation.

Table 1. IS supporting main business processes

Main processes in organizations	Information systems support
Customer service management	CRM
External relationship management	BSM, EAI
Financial management	ERP
Human resources development and management	ERP
Improvement and change management	QMS
Information management	BAM, EAI
Planning	BI, ERP
Product development and management	BI, CAD
Production management	APS, ERP, MES, MRPII
Strategy management	BAM, BI
Supply management	SCM

The processes of customer service management are endorsed by CRM systems, which are responsible for managing contacts with clients. All the activities included in these processes are supported by CRM functionalities. CRM systems bring customer data into focus, allowing businesses to sharpen their customer services, sales, and marketing initiatives.

The processes of external relationship management are backed by BSM and EAI systems. BSM systems are accountable for relationships with customers, suppliers and colleagues. They manage not only processes of external relationships but also internal ones. They definitely improve processes of service quality and reduce cost through improved efficiency and a reduction in service outgoings. EAI systems are responsible for the integration of several systems and their applications. They ensure that information in the multiple systems is kept consistent. They provide essential support for integration processes.

The processes of financial management are endorsed by ERP financial modules. The financial module is the core of many ERP systems. It can gather financial data from various functional departments, and generate valuable financial reports such as balance sheet, general ledger, trial balance, and quarterly financial statements. Financial modules support all processes combined with accountancy and financial documents.

The processes of human resources development and management are supported by human resources, a module of ERP systems. This module streamlines the management of human resources and human capital. Routinely, it maintains a complete employee database including contact information, salary details, attendance, performance evaluation and the promotion of all employees. It supports all processes regarding vacancies, starting from recruiting, and finishing at managing redundancy.

The processes of improvement and change management use the assistance of QMS systems, which are dedicated to quality and improvement management. QMS systems enable organizations to achieve the goals and objectives set out in their policy and strategy. It provides consistency and satisfaction in terms of methods, materials, equipment, and interacts with all activities of organizations. The whole quality process is organised with existing QMS systems.

The processes of information management are widely supported by EAI and BAM systems. EAI systems integrate processes involved in information flow and make them more efficient. BAM systems are performing an automated analysis of the impact that all IS incidents have on the business. BAM systems provide a complete end-to-end picture of critical business processes. They record, report and alert all activities essential for business fulfilment.

The planning processes are assisted by BI systems and a planning module of ERP systems. BI systems support the planning process by making simulations and predictions. The ERP planning module optimizes the utilization of manufacturing capacity, parts, components and material resources using historical production data and sales forecasting.

The processes of product development and management are supported by CAD and BI systems. CAD systems, by enabling the creation of a virtual product from the beginning till the final version, aim at assisting development processes. The product development process is highly innovative, however, it might by supported by BI systems which forecast trends in the market and the way new technologies are developed.

The processes of production management are supported by MRP II, MES and APS systems and the ERP production module. ERP systems evolved from MRP II systems which are purely responsible for manufacture management and all additional processes. The ERP production module is more suitable for organizations which have services as a product. MRP II is for manufacturing organizations. MES and APS systems integrate the production processes directly related to the product line with information stored in ERP and MRP II systems.

The strategy management processes are managed by BI systems. They provide advanced analyses and reports which are essential for successful strategy planning. One of the main assumptions of the BI system is to support decision-making processes, and make the systems a perfect match for the strategy and management processes.

The supply management processes are assisted by SCM systems. This solution is designed especially for this purpose. SCM systems are the management of supply chain processes. They involve connected businesses network in the ultimate provision of product and service packages required by end-users/customers.

3.3. The influence of information systems on process oriented organizations

Using IS in BPO organizations provides several benefits. IS cover a range of strategic, managerial and operational activities involved in gathering, processing, distributing and using information. IS are designed to manage information and provide the easiest possible access to that information. This is achieved through central access and the central distribution of information. The information is stored and presented in different levels of aggregation, depending on the organization's needs. Moreover, IS keep consistency of information and prevent loss of data by performing periodic backups. All these benefits are essential to BPO organization, as the information is key to maintaining the processes.

IS are implemented within BPO organizations for the purpose of improving the effectiveness and efficiency of that organization. All systems, like transaction processing systems (ERP, MRPII, CRM, APS, CAD, MES), information management systems (BSM, EAI, QMS, SCM) and decision support systems (BI, BAM) are used in an organization to stand up to the challenges. IS provide crucial information to an organization which helps it in facing up to unexpected occurrences, incongruous process needs, changes in the industry structure, demographic changes, changes in perception and new knowledge [Chandan, Urhuogo 2012].

Critical success factors are necessary for BPO organizations to achieve business objectives. Critical success factors include vital issues to an organization's current operating activities and its future success. To that end, the proper management and functionality given by IS are essential. Without IS, some processes which influence critical success factors may not be applicable. In particular, the support provided by BPMS is crucial in this area [Trkman 2010].

3.4. Current trends in information systems technologies

According to the latest Gartner research, the most needed technologies have been prioritised [Gartner 2012]. In first place there are mobile technologies, in second analytics and business intelligence, third is cloud computing. Then in the following order: virtualization desktop, collaboration technologies (e.g. workflow management, team collaboration), legacy application modernization, IT management technologies (e.g. program, project management, change management), security technologies, customer relationship management applications, enterprise resource applications. Cloud computing is rapidly gaining prominence and emerging as the core of BPM initiatives, due to its ability to provide up-to-date information in a usable format. Analytics and business intelligence are technologies used in BI and BAM systems; mobile technologies are also used in BAM systems to notify users about current indicators. Other mentioned technologies can be found in APS, BSM, CAD, CRM, EAI, ERP, MES, MRPII, QMS and SCM systems.

The newest technologies are especially used in business process outsourcing services provided by organizations. Business process outsourcing is the contracting of a specific business task to a third-party service provider. In comparing experience and know-how, the organizations are able to provide excellent business process management services to other organizations. The business process outsourcing usually includes services like accounting and financial services, tax consultancy, data entry and data conversion, document processing, market research, customer support and telemarketing. Technologies such as cloud computing, business analytics software (BI, BAM) and process automation software (BPMS) are being used within business process outsourcing to enable them to lower costs and be more effective [Willcocks et al. 2004; Flinders 2012].

Currently, information systems support process management in the organization and automate most of the processes as well as affect the speed of operations and increase the security of information. It is also important that information systems, thanks to the development of technology, become more flexible, efficient and reliable. The usage of information systems is no longer limited only to the PC, but laptops, notebooks, tablets and even cell phones can be used.

4. Conclusion

The aim of this study was to investigate the organization business processes and define IS which support them, and the importance of the life cycle management processes was also introduced. The findings of the study provide a clear indication that the BPO approach has become the way organizations are managing their business. With the support of methods, tools and technologies, BPO is more and more approachable. IS are designed to follow business processes, so their sole implementation is enough to make organizations work with the business process approach.

Theoretically, this study contributes significantly to the identification of IS in business process orientation that may lead to an organization's success. Nonetheless, BPO is the best path organizations can follow - IT is evolving in the direction to help organizations manage their processes and follow the business process lifecycle. IT is moving towards faster and easier process management which can be observed in business process outsourcing organizations where, for example, the distinct distance between organizations is not an issue at all thanks to cloud computing, workflow management and virtualization desktop technology.

Each defined process in an organization has IS which support its flow. Besides, every step in the BPM lifecycle is assisted by IS. Accordingly, IS positively influence BPO organizations in context of benefits, challenges and critical success factors from an organizational point of view. It could be even stated that well-suited IS guarantee organizational success.

However, it would not be advantageous to use all the listed IS to support business processes. Only the main processes in organizations should be fully supported by a corresponding IS. IT is going in the direction of complex solutions where one system has all the functions needed, such as Business Performance Management systems merging BI, BAM, BPM, BSM, EAI systems in one solution [Olszak, Ziemba 2010; Eckerson 2004; Melchert, Winter 2004; Miranda 2004]. The Internet also contributes to the development of the BPO approach by using Web 2.0. technologies. This allows going beyond the organization and sharing the experience with similar processes' users [*Technologie informatyczne…* 2010].

The study is a prelude to further research dealing with IS for business process management in public administration organizations. Further research will be devoted to defining the critical success factors in the implementation of IS in public administrations and its influence on process oriented management.

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SYSTEMY INFORMATYCZNE ZORIENTOWANE NA PROCESY BIZNESOWE

Streszczenie: Artykuł opisuje systemy informatyczne wspierające podejście procesowe w organizacjach. W części teoretycznej zaprezentowano istotę procesu biznesowego i koncepcję zarządzania procesami. Następnie zidentyfikowano i scharakteryzowano systemy informatyczne wspomagające kluczowe procesy biznesowe w organizacji oraz poszczególne etapy zarządzania procesami biznesowymi. W badaniach wykorzystano analizę literatury, doświadczenia empiryczne, jak również indukcyjne metody wnioskowania i konstruktywne myślenie.

Słowa kluczowe: systemy informatyczne, procesy biznesowe, zarządzanie procesami biznesowymi, orientacja na procesy biznesowe, cykl życia procesów biznesowych.