ERP SYSTEM IN DIGITAL ENVIRONMENT: A COMPREHENSIVE BIBLIOGRAPHY REVIEW OF THE LITERATURE IN PERIOD 2010-2015

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Abstract: ERP (Enterprise Resource Planning) system represents the largest, most complex and most demanding business information system that organizations implement, which is a big step ahead of individual (i.e. department) applications and information systems that have prevailed in the past. Today, when the world is dramatically dependent on the data, the need and use of the ERP systems are steadily increasing. In the last ten years, the most important technology associated with the redesign and standardization of the business processes in terms of best practices were ERP systems. In this paper, a comprehensive review of published articles in various journals on the topic of ERP systems in the period 2010-2015 has been elaborated. All processed papers have been indexed in Web of Science (WoS) database. Since the academic knowledge about ERP systems reached a certain level of maturity, this paper presents the bibliographic review of works in the ERP systems field and other related areas. Analysis of the literature indicates that more and more various research disciplines contribute to the development of the field of ERP systems. Therefore, it is expected that the future area of research related to the ERP system depends on technical and technological progress, and sophisticated business ideas that include functionality that are currently outside the ERP system.

Keywords: *Enterprise Resource Planning; ERP systems; ERP trends; ERP reviews; ERP research productivity; ERP keyword; ERP co-citation analysis*

JEL Classification: *M11, O33*

Introduction

In today's global economy, which under the influence of globalization not only expands the market, but also brings closer the competition, many organizations are seeking better ways to optimize their business and increase efficiency. Therefore, the philosophy of the process approach, enables vertical and horizontal flow of information to organizations, necessary for the achievement of organizational goals. Acceptance of this approach as a key element of business highlighted the importance of IT technology in designing the strategy that provides the competitive advantage. The importance of this approach best reflects the conclusion of

consulting firm Gartner, "Business Process Management wins the triple crown: saving time, saving money and adding value"(Vuksic, Hernaus, & Kovacic, 2008).

Today when the world is dramatically dependent on the software, the need and usage of ERP (Enterprise resource planning) system is steadily increasing. The establishment of ERP system is motivated by the needs of management for timely and constant access to information that crosses the functional and/or organizational boundaries, and integrates all business processes that take place within the organization. Therefore, managers must carefully weigh the advantages and disadvantages, ie. the costs of introducing such a system to ensure that it is worth implementing. Implementation of ERP system represents the single largest IT investment (Hooshang M Beheshti, 2006), which in terms of the scope and complexity has an impact on the greatest number of individuals in the organization. Typical motives for the establishment of ERP include compliance with regulations, upgrading old systems, business process reengineering, business integration and support of the decision-making process.

Regardless of the fact, that the roots of ERP systems started in the 60s of the last century, great interest for ERP research and practice has led to a considerable amount of publications in past ten years. Scientific papers that belong to this field mainly provide different views on the ERP, transparent study on industrial experiences, recent trends in ERP and research related to the ERP papers. In the period up to 2000, research has mainly focused on issues related to the introduction of the ERP (Esteves & Pastor, 2001), given that the majority of organizations were in the phase of ERP implementation. During the next five years (until 2005) many organizations implemented the ERP system, in order to satisfy the growing need for the integration business. A second literature review of research efforts in the area of ERP system was provided by (Møller et al., 2004), covering the period between 2000 and 2005. Next, authors (Botta-Genoulaz, Millet, & Grabot, 2005), (Cumbie, Jourdan, Peachy, Dugo, & Craighead, 2005), (Dery, Grant, Harley, & Wright, 2006), (Esteves & Bohórquez, 2007) and (Moon, 2007) also covered the period with literature reviews. Therefore, the next steps of the ERP life cycle, such as the use and evolution are starting to gain importance in the period 2005-2010, although a large number of papers are still focused on the ERP implementation. According to (Nazemi, Tarokh, & Djavanshir, 2012) in the period 2005-2010 many articles belonging to this field, were still focused on individual steps of the ERP life cycle. This period covers the following literature review: (Addo-Tenkorang & Helo, 2011), (Haddara & Zach, 2011), (Eden, Sedera, & Tan, 2012) and (Nazemi et al., 2012). All in all, the previous period is characterized by research related to individual steps of ERP system implementation, as well as that it can observe the absence of systematic comparative research among organizations, industry sectors and geographical regions.

The analysis of articles in the period 2010-2015 noticed the change of research focus on the way that the accent is placed in a new environment in order to monitor the current technological advances. The new environment which is global, massively interconnected, intensely competitive, 24/7/365, real-time, rapidly changing and information-intensive represents a new challenge for research in the area of ERP systems. To compete successfully, an organization must survive in an environment that has been radically transformed by information technology. Throughout the years, many communication technologies and infrastructure changes have evolved and been introduced to ERP systems, like internet, web, service oriented architecture (SOA), cloud computing, wearable technology, etc. The interdisciplinary nature as well as the technical, organizational and societal potentials in ERP research field is some main challenges for research in context global economy and digital

environment. Consequently, the main objective of this study is to provide a more comprehensive overview on the global research in ERP systems field within a certain time frame in order to display the relevant findings. We limit the observation to the time period of 2010-2015, and apply different approach, in order to analyze the key aspects in ERP research field. Assuming that the scientific activities reflected through scientific publications, a comprehensive review of published articles on the topic of ERP systems covered by Web of Science (WoS) database has been elaborated. In total, we investigate 521 publications. The next section will focus on the methodology. Then, a discussion on research questions will be described in Section 3. In Section 4, the detail results of the existing and future trends are discussed. Lastly, the conclusion and future work are outlined in the last Section.

Methodology

The collection of relevant publications establishes the foundation for a comprehensive bibliography analysis of a specific research field (Jokić, 2005). As indicated, this study intends to cover peer-reviewed journal articles covered by Web of Science (WoS) database during the period 2010-2015. As manual processing of bibliographic data can be extremely time demanding, we use Thomson Reuters WoS database to collect and process structured data of journal papers. Compared to other databases, WoS has decisive advantages because it has been designed specifically for researchers in the citation analysis field (Huang et al., 2017). In order to cover a large part of paper in ERP field, search query from Table 1 is used. Next, subsection will be identifying the research questions that will lead to results, which is also useful to identify the scope of the paper.

Research Questions

In order to achieve the research aim and objectives of this paper, we defined the following five research questions:

- Which scientific areas have contributed to the ERP field, according to WoS ?
- Which countries and authorship have most contributed to the ERP field ?
- Who are the most productive and influential researchers in the ERP system field ?
- What are the leading scientific journals in the ERP system field ?
- The most commonly used keywords in the ERP system field ?

Search Strategy

In order to efficiently answer our five research questions, we defined search string to help us identify the relevant article.

Table 1. The query and additional search options are used during the search

Search query	Additional search options
TS=(Enterprise OR Company OR Firm) AND TS=("Resource Planning" OR "Requirements Planning" OR "Material Planning") Refined by: Databases: (WoS) Timespan= 2010 -2015 Search language=English	Advanced search: Use field : title; abstract; author keyword; keywords plus®

Source: Authors' own work

The search for relevant articles was carried out by 2010-2015 time periods and is focused on the title, abstract and keywords. Table 1 shows a query with additional possibilities for the search that has been applied within Thomson Reuters WoS database. This search yielded 512 articles, which are categorized as publication from journals. The main criteria for

inclusion/exclusion of publication into a further analysis were the focus of the articles, which should be within the ERP systems research field. On the basis of the inclusion/exclusion criteria, the titles, keywords and abstracts were read by authors. In order to answer the research questions, 413 articles have been finally selected for the bibliography analysis. Results for top ten mostly cited articles in the ERP field generated by WoS database are shown in Table 2 below in a descending-order.

Table 2. Ten most frequently cited articles according to WoS database, from the analysed set of publication (Accessed 1/9/2015, Revised 1/6/2017)

Cites		Author	Title	Year	Publisher
WoS	Google Scholar				
77	280	(Morris & Venkatesh, 2010)	Job characteristics and job satisfaction: understanding the role of enterprise resource planning system implementation	2010	Management Information Systems Research Center
59	189	(Zhu, Li, Wang, & Chen, 2010)	What leads to post-implementation success of ERP? An empirical study of the Chinese retail industry	2010	Elsevier
57	98	(Hooshang M. Beheshti & Beheshti, 2010)	Improving productivity and firm performance with enterprise resource planning	2010	Taylor & Francis
44	117	(Lin, Chen, & Ting, 2011)	An ERP model for supplier selection in electronics industry	2011	Elsevier
42	130	(Ram, Corkindale, & Wu, 2013)	Implementation critical success factors (CSFs) for ERP: Do they contribute to implementation success and post-implementation performance?	2013	Elsevier
38	56	(Wang, Gao, & Ip, 2010)	Measurement of resilience and its application to enterprise information systems	2010	Taylor & Francis
35	79	(Pollock & Williams, 2010)	e-Infrastructures: How Do We Know and Understand Them? Strategic Ethnography and the Biography of Artefacts	2010	Springer
34	75	(Salmeron & Lopez, 2010)	A multicriteria approach for risks assessment in ERP maintenance	2010	Elsevier
32	157	(Elbashir, Collier, & Sutton, 2011)	The Role of Organizational Absorptive Capacity in Strategic Use of Business Intelligence to Support Integrated Management Control Systems	2011	Amer Accounting Assoc
32	102	(Su & Yang, 2010)	Why are enterprise resource planning systems indispensable to supply chain management?	2010	Elsevier

Source: Authors' own work

Data Analysis

Identification scientific disciplines

In order to obtain insights about the general structure and development of ERP research field, analysis of scientific disciplines was conducted (see Table 3). Based on the selected publication pool, each publication is categorized according to WoS research areas and can be associated with a greater than one scientific area. Table 3 shows that the majority of publications come from the area of computer science and engineering, which implies that the observed research period primarily focuses on new technologies. This observation is supported by other publications (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011) because, while the technological innovation permeate an increasing number of business processes, the ERP systems adapt to technological development trends.

Table 3. Research areas according to Web of Science (Average> = 2%)

Research areas	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)	2015 (%)	Avg. (%)
Computer science	50,00%	50,77%	43,06%	44,16%	38,60%	59,76%	47,72%
Engineering	33,33%	44,62%	40,28%	27,27%	29,82%	19,51%	32,47%
Business economics	18,33%	26,15%	30,56%	24,68%	28,07%	26,83%	25,77%
Operations research management science	13,33%	18,46%	20,83%	15,58%	15,79%	10,98%	15,83%
Information science library science	16,67%	15,38%	13,89%	16,88%	7,02%	13,41%	13,88%
Automation control systems	3,33%	1,54%	4,17%	3,90%	3,51%	0,00%	2,74%
Psychology	3,33%	3,08%	1,39%	1,30%	7,02%	1,22%	2,89%

Source: Authors' own work

According to (Marston et al., 2011), it is equally important to consider the possibility of the business issues i.e. the interaction of new technologies and organizations within the ERP research fields. The numbers show a slight trend of research support related to business issues, in the areas such as business economics and management. We believe that this trend will continue, and that the organizational and societal aspects of the ERP system will become the dominant segment of research.

Contribution countries and authorship

To provide a better insight into the current state of the ERP system field, we further investigate the distribution of publications by country and authorship. As shown in Table 3 (R. - Rank), most of the research on ERP systems is conducted by researchers from the United States (20.07%), Taiwan (8.76%) and China (7.12%). Because numbers alone do not provide sufficient insight into the importance of contributions by country, ranking impact of countries is generated for publications cited in at least 20 other publications.

Table 4. Contribution country (left: all publications; right: publications cited at least 20 times)

R.	Country	f(%)	R.	Country	f(%)
1	USA	20,07%	1	USA	2,74%
2	Taiwan	8,76%	2	China	1,46%
3	China	7,12%	3	Taiwan	1,28%
4	UK	5,66%	4	Australia	0,73%
5	Australia	5,47%	4	UK	0,73%
6	Canada	5,47%	5	Canada	0,55%
7	Spain	4,38%	5	France	0,55%
8	South Korea	3,65%	5	Spain	0,55%

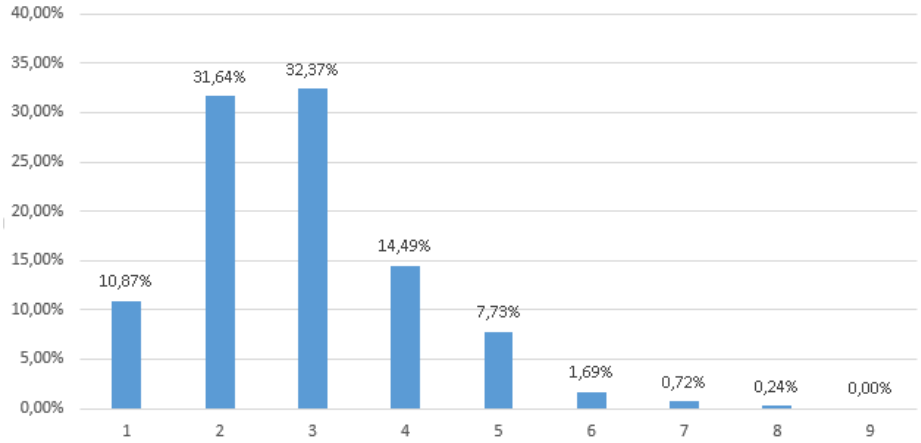
9	Turkey	3,10%	6	Italy	0,36%
10	France	2,55%	6	South Korea	0,36%
11	Iran	2,19%	7	Iran	0,18%
12	Netherlands	2,19%	7	Malaysia	0,18%
13	Denmark	1,64%	7	Slovenia	0,18%
14	Germany	1,64%	7	Sweden	0,18%
15	Serbia	1,64%	7	Turkey	0,18%
Total:		75,55%	Total:		10,22%

Source: Authors' own work

The numbers in the right area of Table 4 show that a small number of publications are very influential and responsible for the relatively large reverberations within the research field.

As for the authorship of the publications published in the period 2010-2015 in Figure 1 is shown the percentage contribution in relation to the number of authors. Distribution of authorship shows that more than half of the publications were published through the cooperation of two and/or three co-authors. The connection between the relatively high percentage of publications with four and five co-authors, shows that cooperation can have advantages over individual research. The interdisciplinary nature of ERP research may be one reason for the dominance of common research papers.

Figure 1. Co-authorship distribution (n = 413)



Source: Authors' own work

Researcher productivity

In the above-mentioned period, 974 different authors published papers in ERP research areas. To evaluate author's productivity, we used a method of full counting (Gauffriau, Larsen, Maye, Roulin-Perriard, & von Ins, 2007) for each individual author. Based on the method of counting, each individual author achieved the result according to the number of publications issued as shown in Table 5. We observed that the most productive researchers come from the United States (4), Australia (4), Canada (3), Portugal (3), China (2) and Spain (2).

Table 5. Researcher productivity in the ERP systems field (full count ≥ 4)

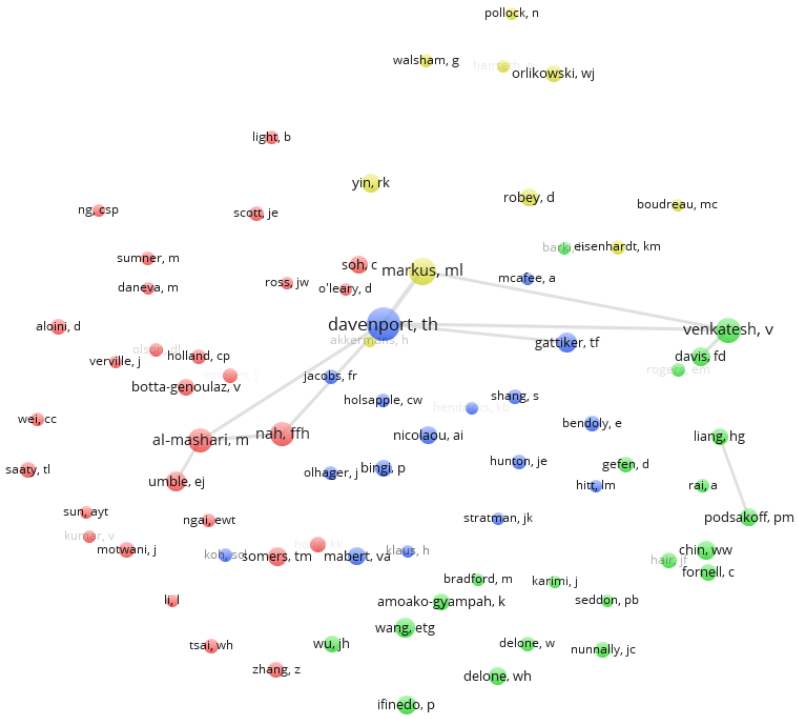
RESEARCHER	INSTITUTION	COUNTRY	PAPER NUMBER		CITATION NUMBER
			WoS	Different	WoS

				journals	
Leger Pierre-Majorique	HEC Montreal	Canada	7	7	43
Tsai Wen-Hsien	National Central University	China	6	4	76
Ram Jiwat	University of South Australia	Australia	6	5	75
Wu Ming-Lu	United International College	China	6	5	75
Skibniewski Miroslaw J.	University of Maryland	Australia	5	5	44
Corkindale David	University of South Australia	Australia	5	4	64
Salmeron Jose L.	Universidad Pablo de Olavide	Spain	4	4	79
Lopez Cristina	University Pablo de Olavide	Spain	4	4	79
Olson David L.	University of Nebraska at Lincoln	USA	4	4	61
Ifinedo Princely	Cape Breton University	Canada	4	4	49
Johansson Bjorn	Lund University	Sweden	4	4	48
Neto, Miguel	Universidade Nova de Lisboa	Portugal	4	4	50
Oliveira, Tiago	Universidade Nova de Lisboa	Portugal	4	4	50
Ruivo, Pedro	Universidade Nova de Lisboa	Portugal	4	4	50
Xue Yajiong	East Carolina University	USA	4	3	51
Liang Huigang	East Carolina University	USA	4	3	51
Pellerin Robert	University of Montreal	Canada	4	4	19
Yeh, Chung-Hsing	Monash University	Australia	4	4	19
Cronan Timothy Paul	University of Arkansas	USA	4	3	11

Source: Authors' own work

To determine which researchers had the greatest impact on publications published in the period 2010-2015, we have created a co-citation network of authors. Each circle in Figure 2 presents the author (authors with at least 25 citations are shown), while the size of the circle represents the intensity of the impact of the current research measured by the number of citations. Distance between authors is also important. Generally, the smaller the distance between two authors, the stronger the authors are connected. The calculations were operated in WOS mapping techniques in 2D space (Van Eck & Waltman, 2007). Ten strongest co-citation connections are shown by lines, while color determines a group of interconnected authors, on the basis of co-citations.

Figure 2. Researchers co-citation network



Source: Authors' own work

To determine which papers had the greatest impact on publications published in the period between 2010 and 2015, the ten most influential papers, as well as the frequency of their occurrence (f) are presented in Table 6.

Table 6. Ten most influential papers in the period 2010-2015 on selected paper

RANK	AUTHOR	TITLE	YEAR	F
1	(Davenport, 1998)	Putting the enterprise into the enterprise system	1998	86
2	(Umble, Haft, & Umble, 2003)	Enterprise resource planning: Implementation procedures and critical success factors	2003	61
3	(Al-Mashari, Al-Mudimigh, & Zairi, 2003)	Enterprise resource planning: A taxonomy of critical factors	2003	50
4	(Bingi, Sharma, & Godla, 1999)	Critical Issues Affecting an ERP Implementation	1999	41
5	(W. DeLone & McLean, 1992)	Information systems success: The quest for the dependent variable	1992	39
6	(Hong & Kim, 2002)	The critical success factors for ERP implementation: an organizational fit perspective	2002	39
7	(Soh, Kien, & Tay-Yap, 2000)	Enterprise resource planning: cultural fits and misfits: is ERP a universal solution?	2000	39
8	(Gattiker & Goodhue, 2005)	What happens after ERP implementation: understanding the impact of interdependence and differentiation on plant-level outcomes	2005	38
9	(W. H. Delone & McLean, 2003)	The DeLone and McLean model of information systems success: a ten-year update	2003	37
10	(Davenport, 2000)	Mission Critical: Realizing the Promise of Enterprise Systems	2000	35

Source: Authors' own work

Relevant ERP journals

We found papers on ERP systems in 176 journals, but the total number of journals with such papers is much higher. Twelve journals published more than 7 or more papers on ERP systems, which are approximately 26.81% of published research in the WoS database. To identify the most influential scientific journals in the area, we defined them as journals with: long-term interest, published papers (min. 10) and number of citations received from published papers (min. 50) in the ERP system field. The first four journals in Table 7. meet the required criteria. This indicates that a small number of most important journals are very influential and responsible for the relatively large reverberations within the research area. If we compare the results of the systematic review of the literature (Møller et al., 2004) for the period 2000-2004, the analysis shows that the list of the most influential scientific journals has changed significantly.

Table 7. Most important ERP journals

RANK	JURNAL	PAPER NAMBER	CITATION NUMBER	IMPACT FACTOR
1	Enterprise information systems	22	326	2.269
2	Computers in industry	20	154	1.685
3	Industrial management & data systems	19	176	1.278
4	International journal of production research	15	135	1.693
5	Computers in human behavior	9	98	2.880
6	Expert systems with applications	8	140	2.981
7	International journal of operations & production management	8	56	2.252
8	Information systems management	7	27	1.021
9	International journal of advanced manufacturing technology	7	56	1.568
10	International journal of production economics	7	90	2.782
11	Journal of computer information systems	7	22	0.764
12	Production planning & control	7	35	1.532

Source: Authors' own work

Relevant ERP keyword

As every scientific journal requires, after the abstract, several important paper related keywords should be indicated. The choice of the same, requires a lot of experience and can provide a wide availability of paper. Keyword analysis shows that 1107 unique words and phrases were used for classification of ERP papers. Of course, the most frequently used keywords were: Enterprise resource planning, ERP, ERP systems and resource planning (ERP) with 299 appearances. Twenty-four (24) keywords with the appearance of more than 20 are shown in Table 8.

Table 8. Most important ERP keywords

Keyword	f
1. IMPLEMENTATION	203
2. MANAGEMENT	114
3. SYSTEMS	94

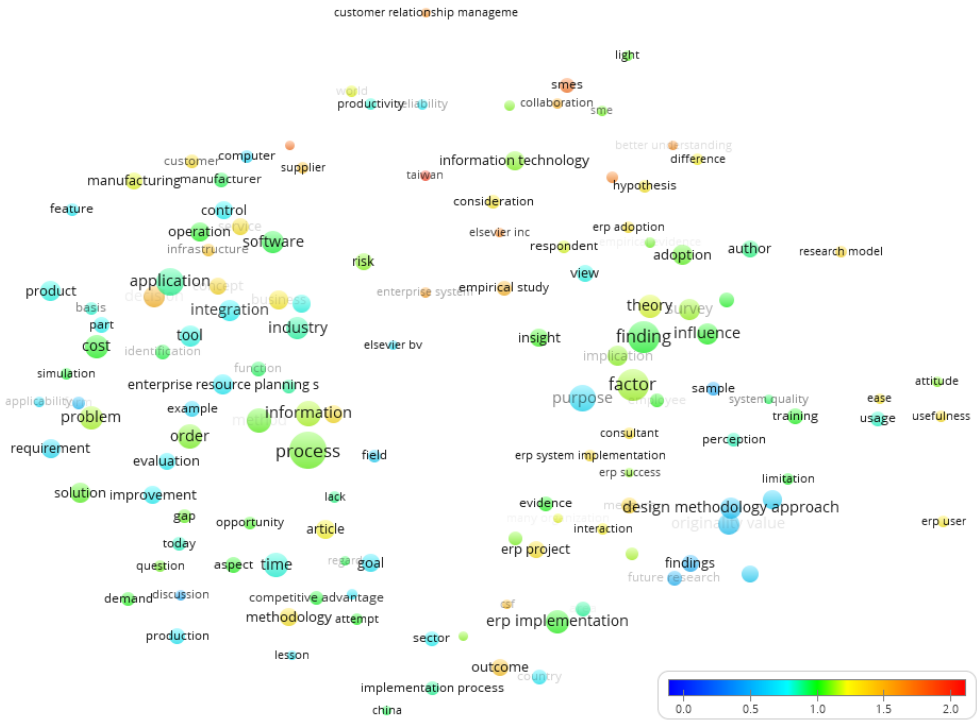
4. MODEL	86
5. PERFORMANCE	77
6. Information-technology	70
7. PERSPECTIVE	69
8. Critical success factors	64
9. information systems	62
10. Enterprise systems	53
11. Enterprise	51
12. FRAMEWORK	49
13. INTEGRATION	42
14. TECHNOLOGY	40
15. Adoption	38
16. IMPACT	38
17. SUCCESS	33
18. INNOVATION	29
19. SOFTWARE	24
20. Supply chain management	21
21. ACCEPTANCE	20
22. Business	20
23. DESIGN	20
24. SMEs	20

Source: Authors' own work

To visualize the ERP research field, a methodology of the term map (Van Eck & Waltman, 2011) was used, based on the analyzed sample of 413 publications published in the period 2010-2015. Using the term map or co-appearance of words has a long history of 30 years and represents a two-dimensional representation of the research areas, where it strongly relates the words that are close to each other, and less the words that are distant from each other. Different areas on the map correspond to different research subfield or fields. Using the techniques of natural language processing, words from titles and abstracts of analyzed publications are separated to obtain a list of words that appear in these publications. By applying the algorithm (Van Eck & Waltman, 2011) 285 words or phrases are obtained, which can be considered the most specific terms of the selected data sets within the ERP research field. Individual terms or phrases that co-appear at least ten times are taken into consideration. By applying WOS mapping techniques in 2D space (van Eck, Waltman, Dekker, & van den Berg, 2010), a location in the two-dimensional space is determined for each term. The terms which have strong tied tend to be located close to each other, while the terms that do not have strong ties are more distant from each other in two-dimensional space. Each circle in Figure 5 represents a term or a phrase (with a minimum of 10 co-occurrences

shown), while the size of the bubble represents intensity measured by the number of co-appearance.

Figure 3. Term map of ERP system field



Source: Authors' own work

In the map-terms (Figure 3), color is used to indicate a difference in the practice of quoting various research fields. For each term or phrase, the average citation impact of publications is determined in which the term appears in the title or abstract. The colors range from blue (the average value of 0) to green (with an average value of 1) and red (with an average value of 2 or more). So, blue terms point to the fact that the publication in which the term occurs have low average citation impact, while red terms point to the fact that the publication in which the term occurs has a high average citation impact.

ERP trends and perspectives

The analysis of articles in the period 2010-2015 noticed the change of research focus on the way that the accent is placed in a new environment in order to monitor the current technological advances. The way technology advances, following the evolution in the field of information and communication technologies (ICT), new business models must face the future needs of the organization that is characterized by integration, sustainability, competitiveness, agility and mobility. In order for organization to become really sustainable and competitive, in front of them are challenges in environment that have been radically transformed by information technology. New environment, with a service-oriented architecture, web data, services in cloud computing and smart objects on the Internet have enabled the implementation of ERP systems in small and medium organizations (Peng & Gala, 2014). This is corroborated by the fact that most research and articles are focused on the study of ERP systems in the context of service-oriented architecture, cloud computing and implementation of ERP systems in small and medium oragnizations, because they expect

rapid implementation, reducing costs, business improvement, rapid return on investment and increase of competitiveness.
A common observation of future trends in the ERP field represents a further expansion of the domain. Several articles have attempted to provide directions for future development of ERP research community by analyzing the ERP articles. McKinsey's report on IT-enabled business trends for the next decade (Bughin, Chui, & Manyika, 2013) shows the future role of ICT in organizations. The report lists the trends that will enable organizations to gain a competitive advantage. In the context of these trends, the existing and future technological focuses are: service-oriented architecture (SOA), cloud computing, mobile/wearable technology, big data analytics and Internet of Things (IoT). The following is a brief overview of each of these areas.

Service Oriented Architecture & ERP
One of the current trends in the technological transformation that has had the greatest impact on redefining the ERP market and enabling rapid business change is Service Oriented Architecture (SOA). SOA can be defined as an IT architecture that supports the transformation of the business environment in a set of loosely connected services that communicate among themselves by exchanging messages or by coordinating an activity and thereby providing a rounded flow of business processes they support. The basic concept of this technology lies in the object that software systems should be made less complex by packing code into separate functional units called services, which implement simple services. This eliminates redundancy, which is the most serious flaw of the previous work in software design, through the ability to use the services, as well as modify them in order to comply with special needs.
Using the concept of service-oriented architecture (SOA) provides the flexibility, convenience and scalability of the ERP system that can rapidly reconfigure and monitor new business processes that reflect new business requirements (Zhao & Ye, 2014). One can say that SOA tends to bring together business and ERP architecture, while the implementation enables flexible and agile use of business services. The advantage of SOA lies in the fact that it contains components that ensure interoperability and transparency of the application, regardless of their physical location or technology implementation and that it makes the integration of different systems easier. Basically, SOA is all about optimal and efficient alignment of business and ERP systems that support it (Zhao & Ye, 2014).

Cloud computing & ERP
New paradigms of development and use of computer resources (hardware and software) demanded the technology that will allow organizations a flexible platform for building and executing customer-oriented services. Most cloud computing is built on the basis of modern computer centers, where the IT hardware and (or) software infrastructure is rented as a service (IaaS - Infrastructure as a Service, PaaS - Platform as a Service and SaaS - Software as a Service), that is charged on the basis of consumption (Al-Ghofaili & Al-Mashari, 2014; Saini, Khanna, & Peddoju, 2014). The aforementioned resources are delivered to end users through a global network in real time, and service charges are based on consumption. Therefore, we can say that "cloud" is a metaphor for the service of computer resources (hardware and software) usage which end users access without having to know where the hardware and software really is (A Vouk, 2008). Some main features of this technology are (Laukkanen, Sarpola, & Hallikainen, 2007): lower costs, licensing the application, saving time in the implementation, ease of delivery and customer service, availability, agility in the development and so on.

In recent years, research related to ERP systems is adapting to existing technology trends and is incorporating the concept of cloud computing and ERP in one form (Peng & Gala, 2014; Weng & Hung, 2014). So far, there is no literature review on the subject of cloud ERP, that can be found in academic databases (Peng & Gala, 2014). So, there is a gap that needs to be filled. The focus of research related to the concept of ERP in the cloud is the possibility of using computing cloud to maximize the success of ERP implementation. The paper (Al-Ghofaili & Al-Mashari, 2014) proposes the use of the ERP cloud, and identifies and compares the critical factors of successful implementation. Although the traditional ERP systems were primarily intended for large organizations, using cloud based ERP system improves the availability and the ability to use it in small and medium organizations (Addo-Tenkorang & Helo, 2011; Saini et al., 2014). The success of cloud based ERP system does not require abandoning the traditional model of ERP systems, but rather its improvement in the terms of adaptation to new technologies.

Mobile technology & ERP

Nowadays, mobility is a general phenomenon that dramatically affects the business environment, giving prominence to the rapid, timely and effective ways of communication. Wireless devices are increasingly used, especially in all those situations in which it is important to communicate in real time. The lack of functional connections between the communication infrastructure of the organization and the mobile environment are causing many problems, which can greatly slow down business processes since they are often highly dependent on communications. Progressive development of mobile technologies and wireless data transmission led to the development of new computational models, which provide services regardless of time and place (Rocha et al., 2010). Therefore, the understanding of mobile technologies and the transformation process in the mobile organization is the key to successfully accepting the mobility of business. This approach, based on mobile technology, mobile access to the global network and mobile applications has created the opportunity for organizations to adapt this technology to their business needs.

Mobile ERP is still young thematic research, which is currently in the process of development. According to (Parsons & bA, 2009), the mobile ERP enabled the second phase expansion of ERP systems, enabling organizations to achieve their full capabilities and benefits, confirming the fact that "Mobile ERP is undoubtedly one of the areas with the greatest opportunities today." The paper (Dospinescu, Fotache, Munteanu, & Hurbean, 2008) proposed an architecture model with a set of needed functionalities to be used for mobile services delivery. The usage of mobile ERP goes beyond the limits of technology, it's becoming the paradigm that provides organizations with a clear business strategy to improve: the ability to operate in real time, a mobile environment and with reduced waiting time. By increasing the number of smartphones available on the market, mobile devices are more and more often appearing as clients of ERP applications. According to (Al Bar, Mohamed, Akhtar, & Abuhashish, 2011), the mobile ERP is a mobile web-based business solution in a cloud, which takes advantage of the global network infrastructure to deliver software as a service (SaaS). Most of the research related to mobile ERP covers issues related to different modules and applications, system architecture and standard integration (Al Bar et al., 2011; Brüllmann, Celebic, & Geiser, 2012; Frank & Kumar, 2012). However, continuous usage of mobile technology in the organization represents a new challenge in achieving competitive advantage, and improving profitability and efficiency.

Big data analytics & ERP

Recognizing the value of information as a resource on disposal, helps organizations to gain effective access to the processed data and to identify the new, potentially useful and understandable patterns in data. In fact, " Big data " is defined as the amount of data that needs to be preserved, managed and processed in an efficient manner (Kaisler, Armour, Espinosa, & Money, 2013) and in an appropriate time frame to allow analysis of these data in real time. The phenomenon of large amounts of data (Big Data) is characterized by three things (Zaslavsky, Perera, & Georgakopoulos, 2013): quantity - size data (Volume), the dynamism - the speed and intensity at which the information is coming and is being processed (Velocity), diversity - data structures being processed (Variety), but also properties such as credibility of data (Veracity), validity of data and volatility. When it comes to amount of data available today, best speaks the fact that the total amount of generated data (by social networks, sensors, smart phones, etc.) of the entire population, in 2010 amounted 1 zettabyte (ZB), and by the end of 2011 that number almost doubled (1.8 ZB). The expected amount for 2020 is 35 ZB (Zaslavsky et al., 2013). With increasing amounts of data available, the possibility of their understanding drastically decreases, and new challenges are set before organizations. Regardless of the data origin (internal or external), the challenges that the phenomenon of large amounts of data sets, are: storage, search, sharing, visualization, analysis and processing of the same. For successful treatment of such information, it is necessary to define efficient algorithms for processing in real-time, which are customized to application for which they are used and the infrastructure on which the processing is performed.

For this reason, it is necessary to improve and expand the existing ERP systems, exploring the possibilities of combining the technology of large data with ERP systems (Elragal, 2014). Using Big Data technology is a new challenge and an opportunity for ERP systems, particularly when viewed in the context of decision making. Big Data is an additional building block in the ERP system, which can potentially bring new knowledge through the ability of predicting future events (based on external data). Big Data cannot be a substitute for Business Intelligence, but it can bring new value to ERP trough the existing systems. By combining ERP and Big Data, the possibility of building a single framework is provided, as a basis for creating automated decision-making. Definitely, ERP and Big Data integration should allow organizations a better and wider coverage in the context of best practices (Elragal, 2014).

Internet of Things & ERP

Internet of Things (IoT) is a concept that uses wireless or wired connections to connect the movable or immovable objects from different environments into a global network based on the Internet Protocol (IP), forming the basis for the development of smart environment on a large scale. After thorough research of technologies used in the IoT field, standards should be established for the architecture, platforms and communication between the individual components (i. Consortium; I. W. Consortium; O. Consortium). Until now, research has focused on the development of standards and platforms that will enable the development of advanced services. In order for these services to be possible, the platform for IoT must enable efficient processing of the received data in real time, because the user wants to be notified as soon as the event of interest occurrs. So, the ability of networked objects to collect data from the environment where there are (to feel) and to transmit, share via global network (to communicate), so that other objects or people could do something based on that data, opened an area for further research.

Confirmation that the concept of IoT has a growing influence is evident from the number of connected devices. It is anticipated that by 2020. around 212 billion smart devices / objects

(D., 2012) will have the possibility of mutual communication and communication with the environment (ie. The exchange of data collected from the environment) through a global network. In other words, in the near future, the construction of smart systems (including the integration of people and technology) will have a global impact on the exchange of data, information, knowledge, business environment, as well as on the essential factor of the economy. Therefore, the next generation of ERP system should support S^3- organization (ie. Eng. Sensing, Smart and Sustainable Enterprise) (Weichhart, Molina, Chen, Whitman, & Vernadat, 2015), which combines the sensor concept with mobile technology and distributed intelligence in order to perform analysis and make decisions in real and digital world.

Conclusion

The ERP research field is diverse, very broad and truly multidisciplinary and interdisciplinary. In a relatively short period, researchers have contributed to the field so much so, that this field is pretty well covered from different angles. Thanks to modern technological solutions, research related to ERP systems is still ongoing and geared towards improving and adapting them. A common observation of ERP field represents a variety of topics for potential perspective research, such as: importance of using ERP, ERP selection, educational ERP, critical success factors, ERP implementation in organizations located in countries that are in development, ERP post-implementation phase and ERP in small and medium organizations, and they are all gaining the importance and becoming the subject of continuous research.

Although ERP systems have matured in a relatively short period, research related to them has to face the environment challenges that are or will be radically changed by information and communication technology. This environment is now global, multiple interconnected, it is highly competitive, constantly active, operative in real time, quickly changing and packed with information. It is clear that such a dynamic business environment defines new rules by creating new market opportunities, but also endangering the existing market leaders. This is entirely new way of thinking about how enterprises should organize and function in the digital environment. The new environment with a service-oriented architecture, cloud computing and smart objects on the Internet enabled the use of concept of ERP system as a Service (SaaS). In other words, in the near future, the construction of smart systems (including the integration of people and technology) will have a global impact on the exchange of data, information and knowledge. Therefore, the next generation of ERP systems should support S^3 - organizations (Sensing, Smart and Sustainable Enterprise) (Weichhart et al., 2015), which combine sensor concept with mobile technology and distributed intelligence, in order to perform analysis and decision making in real, as well as digital environment. In the context of these trends, the existing and future technological focuses of ERP systems are: service-oriented architecture (SOA), cloud computing, mobile/wearable technology, big data analytics, artificial intelligence and Internet of Things (IoT). Finally, the technology boom in the domain of information, communication and computer technology opens up a wide array of possibilities, unimagined directions and possibilities for future development and integration with different system solutions (Banjanović-Mehmedović, 2011). Without a doubt, in the near future, artificial intelligence (AI) will have a profound impact on ERP system solutions. AI-enabled ERP solutions in digital environment will enable organizations to manage and optimize business processes in real time.

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