



UDC 658:005

## BUSINESS PROCESS & RISKS: BIBLIOMETRIC AND VISUALIZED ANALYSIS

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**Summary.** Business processes form mechanisms for enterprises functioning. They drive actions, help enterprises achieve results, and be profitable and productive. However, in some cases, enterprises need help in providing new business processes, or some problems occur in old ones. The reason can be risks. In some cases, risks cause unexpected changes in all processes at the enterprise level. Fast and meaningful actions can help to prevent crises.

Based on bibliometric and visualization analysis, the research aims to study risk influence on business processes. The papers' search was conducted using bibliometric analysis. We used the Scopus database, one of the most consequential and up-to-date. Following the setup criteria, we've achieved 671 articles for further analysis. To determine articles, we used two keywords, «business process» & «risk», joined with the logical operator «AND». The «title, abstract, keywords» field was used as a search field. We've explored gathered and summarized papers in BibExcel. Pajek was used to present the obtained results and build visualization maps.

The research allowed achieve some insights. First, the investigated problem is on the rise. Intensification of publication activity only started in 2005. As for now, the peak of publications was in 2022, with 56 papers. Second, the most contributing authors present five countries. So, the investigated problem seems to have a global essence. Nevertheless, cooperation between scientists isn't deep, and no formed clusters exist. Third, scientists published 7% of papers in two influential journals – Business Process Management Journal & Sustainability. Both journals have high SNIP and belong to Q1. Fourth, scientists from Europe, Asia, North America, Australia, and Africa work on it. Though the United States and the United Kingdom perform in leading positions, Ukraine is tenth, with 23 articles published within ten years. Fifth, three of the most frequently used keywords form three clusters in connection with other keywords. They are risk management, risk assessment, and business process.

Thus, the importance of risk management during the implementation and management of business processes is crucial. Bibliometric analysis proves it.

**Key words:** business process, risk, keyword, bibliometric research, visualization.

[https://doi.org/10.33108/galicianvisnyk\\_tntu2024.02.060](https://doi.org/10.33108/galicianvisnyk_tntu2024.02.060)

Received 01.02.2024

УДК 658:005

## БІЗНЕС-ПРОЦЕСИ ТА РИЗИКИ: БІБЛІОМЕТРИЧНИЙ ТА ВІЗУАЛІЗАЦІЙНИЙ АНАЛІЗ

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**Резюме.** Бізнес-процеси формують механізми функціонування підприємств. Вони керують діями, допомагають підприємствам досягати результатів, бути прибутковими та продуктивними. Однак у деяких випадках підприємствам потрібна допомога в забезпеченні нових бізнес-процесів, або можуть виникнути проблеми в старих. Причиною можуть бути ризики. У деяких випадках вони викликають

несподівані зміни в усіх процесах на рівні підприємства. Швидкі та осмислені дії можуть допомогти запобігти кризі.

На основі бібліометричного та візуалізаційного аналізу здійснено дослідження впливу ризиків на бізнес-процеси. Пошук робіт проведено за допомогою бібліометричного аналізу. Основою використано наукометричну базу даних Scopus, яка є однією з найпотужніших і найсучасніших. Дотримуючись визначених критеріїв, для подальшого аналізу отримано 671 статтю. Пошук статей здійснено за двома ключовими словами «business process» і «risk», об'єднаними логічним оператором «AND». Як поле пошуку використано «title, abstract, keywords». Усі зібрані статті узагальнено за допомогою BibExcel. Pajek використано для графічного представлення отриманих результатів і побудови карт візуалізації.

Дослідження дозволило отримати такі результати. По-перше, досліджувана проблема є на етапі зростання. Активізація публікаційної активності почалася лише у 2005 році. Наразі пік публікацій припав на 2022 рік – 56 статей. По-друге, найпродуктивніші автори представляють п'ять країн. Отже, проблема, що досліджується, стає глобальною. Тим не менш, співпраця між вченими не є глибокою і сформованих кластерів ще немає. По-третє, вчені опублікували 7% робіт у двох потужних журналах – Business Process Management Journal & Sustainability. Обидва журнали мають високий SNIP і належать до Q1. По-четверте, над досліджуваною тематикою працюють вчені з Європи, Азії, Північної Америки, Австралії та Африки. Незважаючи на те, що Сполучені Штати та Велика Британія займають лідируючі позиції, Україна посідає десяте місце, маючи 23 опубліковані статті з тематики за десять років. По-п'яте, три ключові слова – управління ризиками, оцінка ризиків і бізнес-процеси використовуються найчастіше та утворюють три кластери.

Таким чином, важливість управління ризиками під час упровадження та управління бізнес-процесами є вирішальною. Бібліометричний аналіз це підтверджує.

**Ключові слова:** бізнес-процес, ризик, ключові слова, бібліометричне дослідження, візуалізація.

[https://doi.org/10.33108/galicianvisnyk\\_tntu2024.02.060](https://doi.org/10.33108/galicianvisnyk_tntu2024.02.060)

Отримано 01.02.2024

**Introduction.** The environment's dynamism requires enterprises to find new ways to strengthen their positions. Properly configured business processes can help with this. Correct business processes allow for streamlining activities, establishing relationships, and distributing responsibilities. In addition, business processes have become a powerful tool in risk management. Management of business processes permits the timely detection of dangerous risks and the development of a plan to reduce or overcome them.

Due to this, business processes concerning risks are essential to analyze.

**Review of the latest research and literature.** The issue of business processes is multifaceted and complex. Domestic and foreign scientists already have their work related to certain aspects of business processes. In works [1, 2], authors investigated the essence of business process organization. Tur O. V., Matusevich A. S. [3], Olshanskiy O. V. [4], Sharko V., Nikitishin A. [5] paid attention to business process management. Garafonova O., Zhosan H. [6], Chernikova N., Dolyna R., Didenko O. [7] discovered digitalization and automation of business processes.

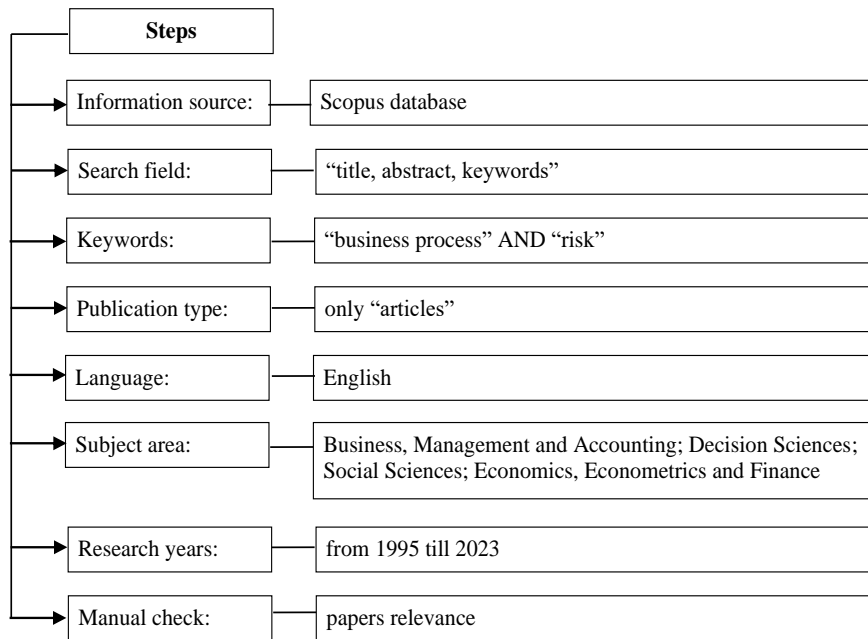
Nevertheless, the problem of risks in business processes **needs additional investigation.**

**Main purpose of the article** is to investigate the connection between the concepts of «business process» and «risk» based on bibliometric analysis.

**Task setting.** According to the purpose, the main tasks are:

- 1) defining steps and algorithm of bibliometric analysis;
- 2) gathering information about articles within the investigated problem;
- 3) data analysis using BibExcel [8];
- 4) data visualization using Pajek.

**Statements of main issues of the study.** In this article, we used bibliometric analysis [9–10] to investigate the problem of risk influence on business processes. The steps we followed are in Figure 1.



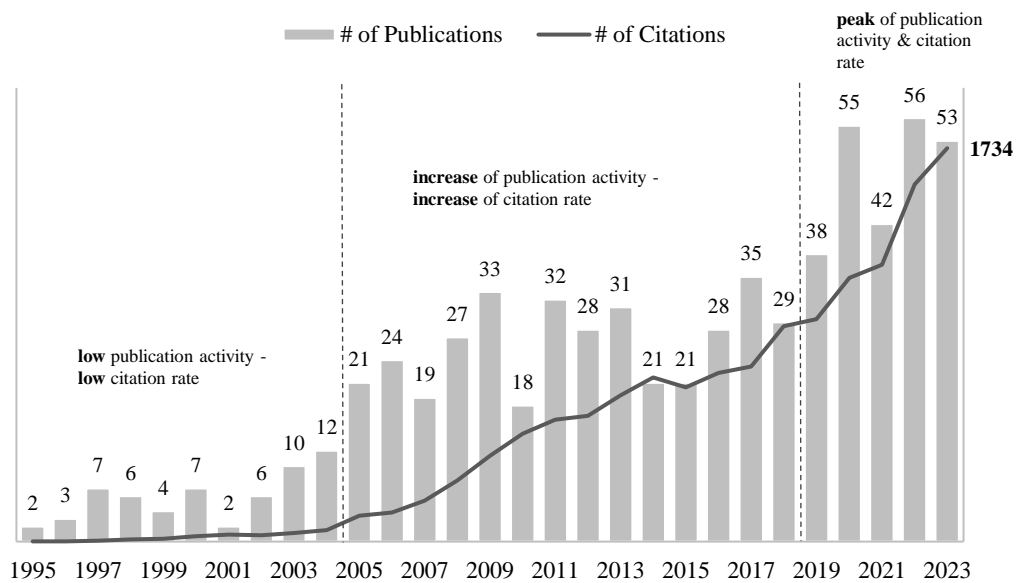
**Figure 1.** Structure of bibliometric analysis

Source: provided by authors.

Thus, in total, for in-depth analysis, we chose 671 articles.

First, look at the articles' distribution over the years to show the main trends (Figure 2).

The first articles are dated from the 1980s. Nevertheless, till 1995, authors' interest in the topic of business process and risk wasn't stable. The period from 1995 to 2004 wasn't fruitful either – authors published 59 papers. From 2005 to 2019, publication activity increased rapidly – in 2019, there were 38 articles, and the citation rate was 980. In 2022, the authors published 56 articles – it's the highest as of now. During the last five years (2019–2023), scientists published 244 articles, 36% of the analyzed papers.



**Figure 2.** Publication activity and citation rate from 1995 till 2023

Source: provided by authors, based on Scopus Database.

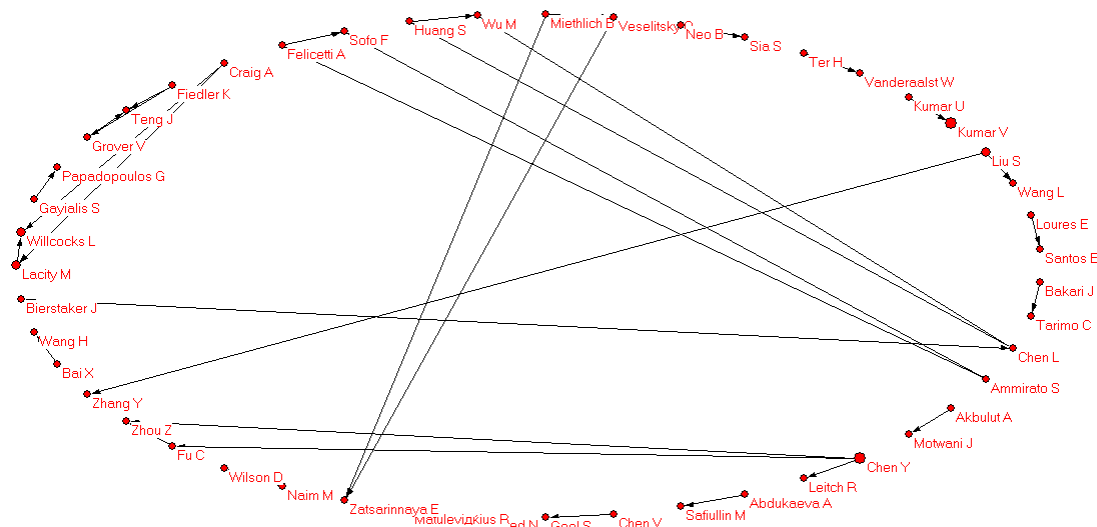
Top authors represent different countries and continents (Table 1). Three of five authors have an h-index over 30 in the Scopus Database. It proves that they contribute to the world scientific community and their articles are relevant to modern trends.

**Table 1.** Top-5 contributing authors in the research field

Author	Published articles #	h-index in Scopus Database	University & Country of affiliation
Gewald, H.	3	13	Fachhochschule Neu-Ulm/Germany
Lacity, M.C.	3	33	Sam M. Walton College of Business/United States
Liu, S.	3	35	Xi'an Jiaotong University/China
Spears, J.L.	3	7	Cleveland State University/United States
Willcocks, L.P.	3	52	School of Business, Economics, and Informatics/United Kingdom

Source: based on Scopus Database.

Additionally, we've built a cooperation network using Pajek (Figure 3). This network shows the connections between authors.



**Figure 3.** Network of authors (circular layout)

Source: BibExcel analysis, Pajek.

Mainly, the authors cooperate with each other to write specific articles. Strong author clusters have yet to be established. So, each scientist can be the first to begin the scientific school of Business Processes & Risks.

In the top-5 journals, scientists published 72 papers – 32 of them (44%) in the «Business Process Management Journal» (Table 2). More than 21% of articles were presented in «Sustainability».

All five journals have affiliations in different countries. The authors published 47 articles in two influential journals – «Business Process Management Journal» and «Sustainability». Both journals belong to Q1. Their H-index is 90 and 136, respectively. The total citations of «Business Process Management Journal» articles reached 888. Thus, the average number of citations per 1 publication equals 28.

**Table 2.** Characteristics of top-5 journals for articles publishing in the research field

<i>Journal</i>	<i>Published articles #</i>	<i>Total citations</i>	<i>Citations per 1 publication</i>	<i>H-index / Country</i>	<i>SNIP</i>	<i>The most cited article / Citation #</i>
Business Process Management Journal	32	888	28	90 / United Kingdom	1.451	Abdolvand, N., Albadvi, A., Ferdowsi, Z. Assessing readiness for business process reengineering. <i>Business Process Management Journal</i> , 2008, 14 (4), pp. 497–511 / 106
Sustainability	15	135	9	136 / Switzerland	1.198	Syed, M.W., Li, J.Z., Junaid, M., Ye, X., Ziaullah, M. An empirical examination of sustainable supply chain risk and integration practices: A performance-based evidence from Pakistan. <i>Sustainability (Switzerland)</i> , 201911 (19), 5334 / 27
Quality Access to Success	10	30	3	Romania	0.353	Mosteanu, N.R. Artificial intelligence and cyber security – a shield against cyberattack as a risk business management tool – case of European countries. <i>Quality – Access to Success</i> , 2020, 21 (175), pp. 148–156 / 23
International Journal of Accounting Information Systems	8	452	57	United States	2.070	Jans, M., Alles, M., Vasarhelyi, M. The case for process mining in auditing: Sources of value added and areas of application. <i>International Journal of Accounting Information Systems</i> , 2013, 14 (1), pp. 1–20 / 108
International Journal of Production Economics	7	195	28	the Netherlands	2.918	Fandel, G., Stammen, M. A general model for extended strategic supply chain management with emphasis on product life cycles including development and recycling. <i>International Journal of Production Economics</i> , 2004, 89 (3), pp. 293–308 / 91

Source: based on Scopus Database.

None of the most cited articles in each journal (Table 3) is mentioned within the research topic (Table 2).

As we can see, four of five articles were written in cooperation with two or more authors from different universities and countries. Thus, the topic of business processes & risk interests scientists all over the world and connects them. Also, two top authors – Lacity M. C. & Willcocks L. P. in cooperation with Khan S. A. wrote a highly cited article – «A review of the IT outsourcing literature: Insights for practice».

One of three papers of Spears J. L. – «User participation in information systems security risk management», is also one of the most cited.

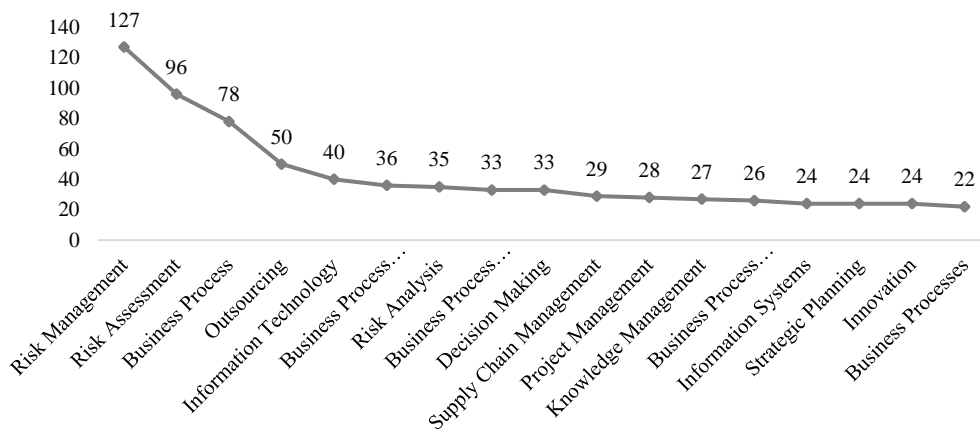
**Table 3.** The most cited papers in the research field

#	Article title	Author	Countries / # of affiliations	Journal/ Year of publication	Total citations
1	A review of the IT outsourcing literature: Insights for practice	Lacity, M.C., Khan, S.A., Willcocks, L.P.	United States, United Kingdom / 3	Journal of Strategic Information Systems / 2009	501
2	Risk factors in enterprise-wide/ERP projects	Sumner, M.	United States / 1	Journal of Information Technology / 2000	402
3	Knowledge management: A strategic agenda	Quintas, P., Lefrere, P., Jones, G.	United Kingdom, New Zealand / 2	Long Range Planning / 1997	398
4	Knowledge-enabled customer relationship management: Integrating customer relationship management and knowledge management concepts	Gebert, H., Geib, M., Kolbe, L., Brenner, W.	Switzerland, Germany / 3	Journal of Knowledge Management / 2003	342
5	User participation in information systems security risk management	Spears, J.L., Barki, H.	United States, Canada / 2	MIS Quarterly: Management Information Systems / 2010	321

Source: based on Scopus Database.

The United States and the United Kingdom have leading positions in publication activity. The authors from these countries published 147 and 76 articles, respectively. It is one-third of all analyzed papers. Ukraine is in 10th place, with 23 articles published from 2013 to 2023. Two articles Ukrainian scientists wrote in cooperation with colleagues from Poland. Moreover, Ukrainian scientists cooperated with scientists from Canada, China, Kazakhstan, the United Kingdom, and Uzbekistan. Three articles were published by scientists of the State University of Trade and Economics, and two articles each published by scientists of Khmelnytskyi National University, Lutsk National Technical University, Kyiv National University of Technologies and Design, Kyiv National Economic University named after Vadym Hetman, Interregional Academy of Personnel Management, and State Biotechnological University.

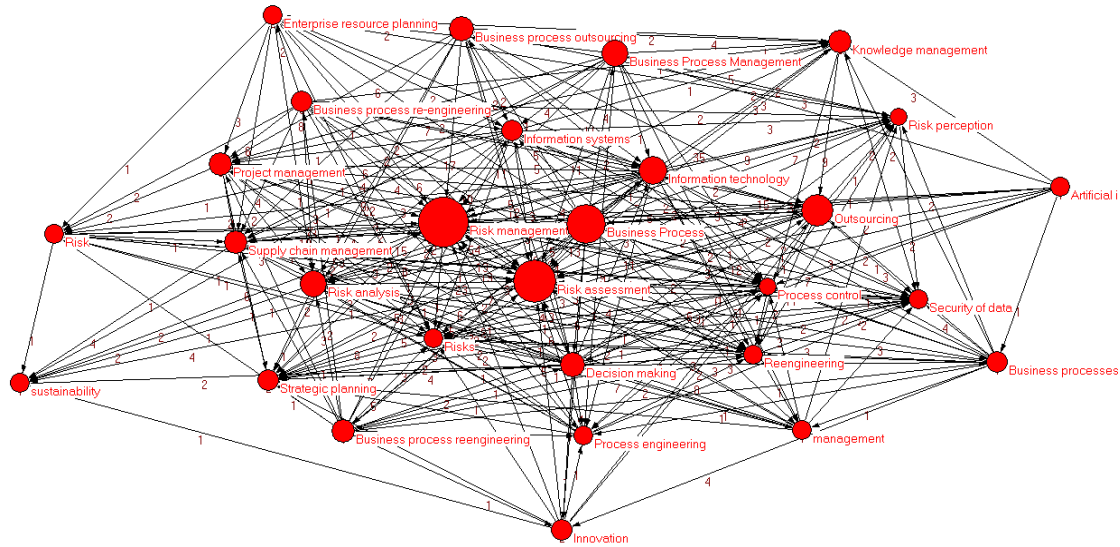
Next, we've identified the most frequently used keywords in the papers (Figure 4). In total, there are 3563 keywords in 671 investigated papers. The Figure shows 24 keywords with an appearance 22 times or more.



**Figure 4.** Crucial keywords in research topic

Source: based on Scopus Database, BibExcel analysis.

The network of relationships between the keywords that appear 17 or more times is in Figure 5.



**Figure 5.** Network of the most popular and relevant keywords (Kamada-Kawai layout)

Source: BibExcel analysis, Pajek.

Thus, crucial keywords are risk management, risk assessment, and business process. They are widely used in articles. Also, these keywords form the most significant clusters with many connections with other keywords. These keywords prove the essence of the research.

As we’ve mentioned above, Ukrainian scientists published 23 articles. Let’s focus more on these publications.

In Ukrainian articles, the most used keyword is Business Process. It occurs 5 times. Additionally, seven keywords occur at least twice – management, innovation, management accounting, crisis management, risk, economic security, and digitalization. So, in both cases, we have the keyword «business process».

In Table 4 are journals where Ukrainian scientists mostly published their papers.

**Table 4.** Characteristics of top-5 journals where Ukrainian authors published articles

<i>Journal</i>	<i>Published articles #</i>	<i>H-index / Country</i>	<i>SNIP</i>	<i>Q</i>
Economic Annals-XXI	4	19 / Ukraine	0.310	Q3
Economic Affairs (New Delhi)	2	2 / India	-	-
Problems and Perspectives in Management	2	25 / Ukraine	0.586	Q2
Eastern-European Journal of Enterprise Technologies	2	31 / Ukraine	0.514	Q3
Actual Problems of Economics	2	Ukraine (no longer in Scopus)		

Source: based on Scopus Database.

According to Table 4, Ukrainian scientists more often publish papers in journals with Ukrainian affiliation.

**Conclusions.** Thus, bibliometric analysis within the research topic of business processes and risks showed the current achievements of scientists and helped to determine the directions for further investigations. As a result, 671 were chosen from the Scopus database. They were analyzed using BibExcel and Pajek tools.

The topic of business processes and risks is relatively new. Publishing activity began in the 1980s but was unstable. So, we've investigated papers since 1995. 36% of all papers were published in the last five years, peaking in 2022.

Scientists from different countries keep investigating it, paying attention to other aspects. Scientists represent countries in Europe, Asia, North America, Australia, and Africa. Authors from the United States and the United Kingdom have made the most considerable contributions to the research problem. Thus, the most cited article (501 citations) was written in collaboration with authors from the United States and the United Kingdom.

Ukraine is tenth, with 23 articles published within ten years.

The most used keywords are risk management, risk assessment, business process, risk analysis, project management, business process reengineering, business process management, business process outsourcing, supply chain management, and information systems. These and other keywords define the depth and diversity of the research problem. Consequently, our research improves our understanding of the concepts of "business process" and "risk" and their interrelations.

**In further research**, the authors will look for bottlenecks in the business processes of various enterprises.

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