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Exploring the Research Landscape of Business Applications of Robotic Process Automation Through Bibliometric Analysis

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Abstract

The field of business process optimization and automation has seen the emergence of robotic process automation (RPA) as a disruptive technology. This research aims to give a systematic bibliometric analysis of the research ecosystem of robotic process automation in business to identify trends, patterns, and developments in this quickly developing area. Bibliometric methodologies, such as co-authorship analysis, keyword analysis, citation patterns, and publishing trends are performed in this work. Research papers from Scopus scientific databases are incorporated into the analysis through the identification of key writers, organizations, and nations that have made a substantial contribution to the growth of RPA literature. The report also explores the temporal evolution of RPA research, highlighting the development of research areas over time and identifying pockets of active research as well as prospective paradigm shifts. The research reveals key publications that have significantly influenced the course of RPA research by looking at citation networks.

The results of this bibliometric analysis enable scholars, practitioners, and policymakers to develop a more detailed grasp of the RPA research landscape in business. This study provides a roadmap for future research directions in robotic process automation by identifying research gaps and emerging trends in business management.

Keywords: Robotic Process Automation, Bibliometric Analysis, Biblioshiny, Bibliometrix, Business Process Automation.

1. Introduction

Robotic Process Automation (RPA) is a ground-breaking technological paradigm that has just evolved and is revolutionizing how businesses approach process automation and optimization. RPA uses software "bots" to automate repetitive and rule-based processes that were previously completed by human operators [1], [2]. With the use of this technology, operational effectiveness could be increased, human error could be decreased, and human resources could be freed up for more innovative and strategic projects [3]. A thorough analysis of the research contribution in the area of RPA integration in business is essential in identifying the major trends, developments, and difficulties in this emerging area which is considered as one of the most disruptive technologies of the present era.

Application of RPA in the Business process is becoming more common, which has increased in research publications aimed at thoroughly examining its many facets of this technology[4]. Researchers in various fields, including computer science, engineering, business management, and economics, have been adding to the body of knowledge that is developing around RPA [5]. As a result, this enormous and expanding body of knowledge needs to be analyzed and synthesized to give academics, professionals, and decision-makers

new perspectives on how to conduct research, execute strategies, and make policy decisions [6].

A systematic and numerical method for analyzing the academic output in a given field of study is bibliometric analysis [7]–[11]. Bibliometric methods allow for the extraction of significant insights from a sizable body of literature by scrutinizing publishing patterns, author relationships, citation networks, and subject clusters. Such a study can show significant authors, organizations, and nations as well as the trajectories of research themes across time [12]–[14]. This study can also reveal the theoretical foundations of robotic process automation by pointing out key texts and their influence on later research.

Bibliometric analysis is the study and investigation of trends, structures, and patterns in literature and scientific publications using quantitative methods [15], [16]. It involves performing statistical analysis on books, papers, and other publications to understand the development, characteristics, and historical trajectory of a specific field or body of literature [10]–[13], [15], [17]. Bibliometric techniques are frequently used in the fields of library and information science, as well as in the evaluation of research in a specific area and the creation of policy [18]–[20].

The R-package Bibliometrix is used to carry out bibliometric analysis and visualize scientific articles through a graphical user interface (GUI) called Biblioshiny [21]. The bibliometrix package in R provides a set of tools for conducting quantitative bibliometric and scientometric research, and biblioshiny makes these methods accessible to users who may not be experts in the R programming language [22].

Nees Jan van Eck and Ludo Waltman of the Centre for Science and Technology Studies (CWTS) at Leiden University in the Netherlands created the software program known as VOSviewer [23]. Its objective is to build and display bibliometric networks [24]. A variety of data formats, including information on publications, authors, journals, and terms directly extracted from publication titles and abstracts can be used to generate these networks [25], [26]. VOSviewer is frequently used in bibliometric and scientometric research to analyze and visualize the structure and growth of scientific fields, to identify key contributors, and to understand the connections between various components of the scientific landscape [11].

Identifying core journals and articles, analyzing collaboration patterns, keyword and topic analysis, citation analysis, geographical distribution of research contributions, and understanding interdisciplinary connections are the major investigations performed in the bibliometric analysis.

The goal of this research article is to give a thorough bibliometric analysis of the robotic process automation literature. We want to reveal the complex web of academic relationships, identify major research issues, highlight developing trends, and trace the evolution of RPA research in the business area from its beginnings to the present day using advanced bibliometric methodologies where the first research paper about the RPA applications in business was published in 2016. Insights from this analysis will not only give a comprehensive picture of the RPA landscape but will also be an invaluable tool for researchers attempting to navigate the field, practitioners hoping to use RPA to improve organizations, and policymakers hoping to foster an environment encouraging technological innovation. The technique employed in data collecting and analysis, the main findings drawn from the bibliometric analysis, and the consequences of these findings for the course of RPA research in the business environment and its practical applications will be covered in more detail in the following sections of this study.

2. Review of literature

Robotic Process Automation (RPA) offers distinct advantages to businesses by automating repetitive tasks, enhancing operational efficiency, and reducing errors. This technology accelerates processes, enabling quicker response times to customer needs, while also ensuring data accuracy and compliance through standardized workflows [5]. RPA's scalability

supports business growth, and its ability to work 24/7 contributes to continuous operations. By freeing up employees from routine activities, RPA fosters innovation and engagement, while cost savings and improved customer satisfaction further solidify its role as a transformative tool for businesses seeking to optimize processes and gain a competitive edge.

Applying RPA in business processes has advantages in terms of production, costs, speed, and mistake reduction. The majority of these applications were executed on back-office business processes, which don't directly involve customers. A study on the effectiveness of RPA adoption in a BPO environment was done by Aguirre and Rodriguez to confirm the advantages and outcomes in the business process with front and back office operations. The findings indicate that the main advantage of RPA is increased productivity and time reduction [27].

Robotic Process Automation (RPA) is revolutionizing the field of marketing by streamlining repetitive tasks and optimizing operational efficiency. In the realm of marketing, RPA involves the use of software bots to automate routine activities such as targeted marketing, product recommendations, report generation, social media posting, email marketing, and customer segmentation. By taking over these manual and time-consuming processes, RPA allows marketing teams to allocate more resources toward strategic initiatives, data analysis, and creative endeavors, ultimately enhancing campaign targeting, customer engagement, and overall marketing performance [28].

Gotthardt, Max, et al identified that Robotic Process Automation (RPA) has emerged as a transformative tool within the accounting domain, profoundly altering traditional financial processes. By automating repetitive tasks like data entry, invoice processing, reconciliation, and financial reporting, RPA enables accounting professionals to redirect their focus toward higher-value activities such as financial analysis, strategic decision-making, and compliance management. This technology not only accelerates workflow efficiency and reduces error rates but also ensures greater accuracy in financial data handling, thereby enhancing the overall precision and reliability of accounting operations [29].

Robotic Process Automation (RPA) is transforming Human Resource management by automating a variety of repetitive tasks and administrative processes. This enables HR professionals to focus on strategic policies and better employee engagement. RPA restructures routine clerical activities such as shortlisting applications, RPA-based automated interviews, employee data management, payment processing, leave management, and recruitment documentation. RPA integration leads to increased accuracy and efficiency [30], this technology also plays a vital role in enhancing the employee experience by ensuring better responses to inquiries and unbiased policy enforcement. By utilizing the power of RPA, HR teams can focus on more policy-related activities like talent development, diversity and inclusion initiatives, and nurturing a progressive company culture [31].

Robotic Process Automation (RPA) has prominent applications in business operations management. This increases the effectiveness across various operational processes [32] through RPA. Robotic Process Automation can automate data collection, evaluate equipment performance, and quality control checks, reducing human error and enhancing production output [33] in manufacturing. In logistics, RPA can monitor order processing, shipment tracking, and inventory management. This results in faster and more accurate deliveries [34] resulting in better customer satisfaction. Within supply chain management, RPA optimizes demand forecasting, vendor management, and procurement processes, leading to cost savings and improved inventory control. RPA can also be employed for monitoring and maintaining IT infrastructure, automating routine maintenance tasks, and minimizing downtime. Overall, RPA in operations management contributes to streamlined processes, reduced operational costs, and increased overall productivity [35].

With less expense and time involved, RPA technology has increased a business process's efficiency and capability in the area of customer support. To improve tourism, the importance of automation in customer service request desks in the travel and tourism industry is proposed by Goyal, Nitin, and Harpreet Singh [36]. Additionally, a study on the work done in

the field of travel and tourism for customer service request desks has been conducted. It has been suggested that automating the customer care request desk process can increase customer relationships, customer happiness, and customer loyalty in the travel and tourist industry.

3. Methodology

Bibliometric analysis is a valuable research methodology for studying the scholarly literature within a specific field or topic. In the context of "RPA in Business," which stands for Robotic Process Automation in Business, bibliometric analysis can help to identify trends, key contributors, influential journals, and the overall structure of the research landscape in this domain. The methods used in the study were to collect the research materials and analyze the information using bibliometric tools as given in figure1.

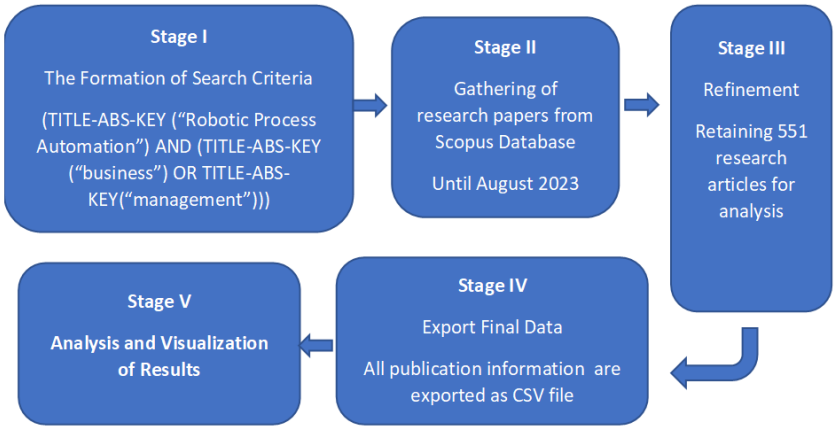

Figure 1. Stages of the analysis

3.1. Research Objectives

The objective of this research is to conduct a comprehensive bibliometric analysis of research publications in the field of RPA in Business, aiming to identify key trends, influential authors, most cited papers, and emerging research themes over a specified period. This analysis will provide insights into the intellectual landscape of the field, helping researchers, policymakers, and practitioners to better understand the evolution of knowledge, research collaboration patterns, and the impact of research output, ultimately contributing to informed decision-making and the advancement of application of Robotic Process Automation in Business.

3.2. Data Collection

This bibliometric analysis includes research papers indexed in the Scopus database. Only the research papers indexed in the Scopus database through research journals and conference proceedings are included in the study. The research papers from Scopus in the area of Robotic Process Automation in Business are selected for the analysis. The query for filtering the research papers is given in Table 1.

Table 1. The query used for document retrieval

(TITLE-ABS-KEY ("robotic process automation") AND TITLE-ABS-KEY ("business") OR TITLE-ABS-KEY ("management"))

A total of 575 documents were retrieved based on the query given and only the research papers published through indexed journals and conference proceedings were retained.

duplicates, irrelevant records, and non-academic content are excluded. The retrieved documents were cleaned by removing duplicates, irrelevant records, and non-academic research content, 551 research papers were finally selected for further analysis after this cleaning process.

3.3. Bibliometric Analysis

Popular bibliometric analysis tools like VOSviewer, and Bibliometrix are used for the analysis and to generate visualizations, calculate metrics, and derive insights for the collected research articles. The most prolific and influential authors in the field of "RPA in Business" are analyzed as a part of this study. Their publication output, collaboration patterns, and the impact of their work are also considered for analysis. The publication trends over time to identify periods of increased research activity in the area of Robotic Process Automation are also analyzed and visualized. To identify the journals that publish the most relevant articles on "RPA in Business", the quality and impact of the journals based on their citation counts, and relevance to the field are also analyzed. The citation patterns to identify influential articles and the most cited papers in the field to understand key foundational works and their impact on subsequent research are also performed in this analysis.

4. Materials and Methods

The research articles for this bibliometric research were retrieved from the main collection of the Scopus database on September 20, 2023. The search for documents was carried out using a specific keywords such as “Robotic Process Automation”, “Business” and “Management”. This search included all languages and was limited to only journal articles and conference papers. In total, we collected 551 articles from 289 different sources, covering the period from 2016 to August 2023. The duplicate entries in the selected research papers are removed to ensure accuracy, after thorough reviews. The results were saved in a 'CSV' file, and we performed a bibliometric analysis on the data using VOSviewer version 1.6.19 and Biblioshiny software. Figure 1 provides a visual depiction of the methodology. The detailed information regarding the sources of research articles, number of documents selected for analysis, average age of documents, total number of citations etc. are provided in Table2.

Table 2. Detailed information about the articles selected for the investigation.

Description	**Results**
Search Query	((TITLE-ABS-KEY("Robotics process automation") AND TITLE-ABS-KEY("Management") OR TITLE-ABS-KEY(business)))
Main Information about Data	
Timespan	2016 : 2023 August
Sources (Journals, Books, etc)	289
Documents	551
Annual Growth Rate %	77.49
Document Average Age	1.87
Average citations per doc	7.105
References	14835
DOCUMENT CONTENTS	
Keywords Plus (ID)	1934
Author's Keywords (DE)	1235
AUTHORS	
Authors	1346
Authors of single-authored docs	56
AUTHORS COLLABORATION	
Single-authored docs	61

Co-Authors per Doc	2.92
International co-authorships %	13.79
DOCUMENT TYPES	
Article	162
Book	14
book chapter	59
conference paper	259
conference review	46
Review	11

5. Results

The results of the bibliometric analysis are presented here. Systematic analysis is performed using VOSviewer and Biblioshiny. Various factors like document collection in the application areas of RPA, authors with their associations, citations, and sources with keywords are analysed to showcase the progress and research trends in this area.

5.1. Documents by subject area

In the beginning of the analysis we gathered the research documents in the applications areas of RPA in various domains. This collection provides a comprehensive snapshot of the distribution of research across various disciplines. In this distribution, Computer Science leads with 386 documents, followed by Engineering with 203. Business, Management, and Accounting have 179 documents, while Decision Sciences and Mathematics have 146 and 120 documents respectively. Economics, Econometrics, and Finance have contributed 64 documents, and Social Sciences have 51. Energy-related research has 30 documents, Physics and Astronomy have 20, and Medicine has 17. Materials Science, Environmental Science, and Chemical Engineering have 14, 13, and 9 documents respectively. Other fields such as Multidisciplinary, Psychology, Earth and Planetary Sciences, Arts and Humanities, Chemistry, Health Professions, Agricultural and Biological Sciences, Biochemistry, Genetics and Molecular Biology, and Pharmacology, Toxicology, and Pharmaceutics have contributions ranging from 1 to 5 documents. This distribution highlights the diverse applications of RPA in various domain areas and the range of research areas represented in the dataset as shown in figure 2. The application of RPA in business spreads over the domain areas of business management, accounting, economics, and Computer Science. 551 research articles addressing the RPA applications in business were collected from these domain areas and considered for further analysis.

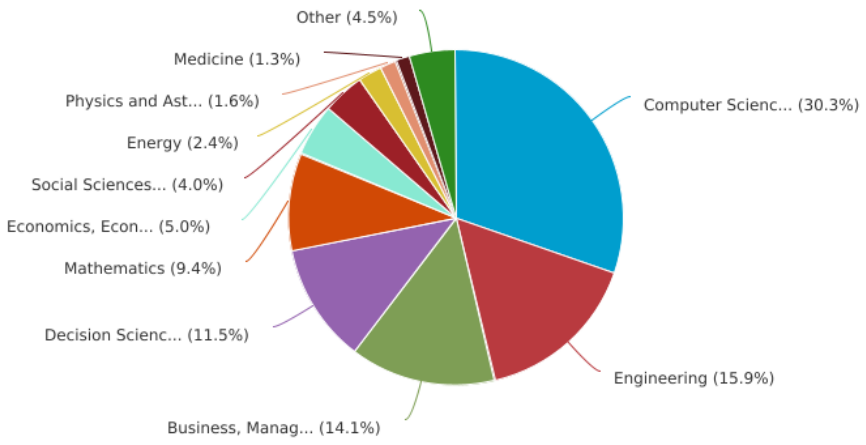

Figure 2. Documents by areas of applications of RPA

5.2. Top Cited Papers

Table 3 presents a list of the ten most frequently cited papers in the field of robotic process automation. Leading the list is the article "Automation of a Business Process using Robotic Process Automation (RPA): A Case Study" authored by Aguirre S. and Rodriguez A. in 2017, which has garnered a remarkable 170 citations. The paper "Turning robotic process automation into commercial success - Case Opus Capita" written by Asatiani A. and Penttinen E. in 2016, has received 139 citations. These papers highlight how the contributions made by the authors in the domain of business applications of RPA paved the way for further research contributions and advancements in the area.

Table 3. Top cited papers

Authors	Title	Year	Cited by
Aguirre S.; Rodriguez A.	Automation of a business process using robotic process automation (RPA): A case study	2017	170
Asatiani A.; Penttinen E.	Turning robotic process automation into commercial success - Case OpusCapita	2016	139
Hofmann P.; Samp C.; Urbach N.	Robotic process automation	2020	112
Mendling J.; Decker G.; Reijers H.A.; Hull R.; Weber I.	How do machine learning, robotic process automation, and blockchains affect the human factor in business process management?	2018	99
Kokina J.; Blanchette S.	Early evidence of digital labor in accounting: Innovation with Robotic Process Automation	2019	93
Benbya H.; Nan N.; Tanriverdi H.; Yoo Y.	Complexity and information systems research in the emerging digital world	2020	88
Ribeiro J.; Lima R.; Eckhardt T.; Paiva S.	Robotic Process Automation and Artificial Intelligence in Industry 4.0 - A Literature Review	2021	87
Hartley J.L.; Sawaya W.J.	Tortoise, not the hare: Digital transformation of supply chain business processes	2019	84
Willcocks L.; Lacity M.; Craig A.	Robotic process automation: Strategic transformation lever for global business services?	2017	75
Ivančić L.; Suša Vugec D.; Bosilj Vukšić V.	Robotic Process Automation: Systematic Literature Review	2019	68

5.3. Annual Scientific production

In recent years, the field of robotic process automation (RPA) has witnessed a remarkable surge in research and development, as depicted in Figure 3. This graph illustrates the yearly scientific output of articles dedicated to RPA from 2016 to 2023. A clear upward trend is observable, underscoring the growing interest and advancements in this domain. Notably, the years 2021 and 2022 stand out as landmark periods, each recording a peak production of 137

articles. This data emphasizes the significance and attention RPA in business as a research area in the scientific community.

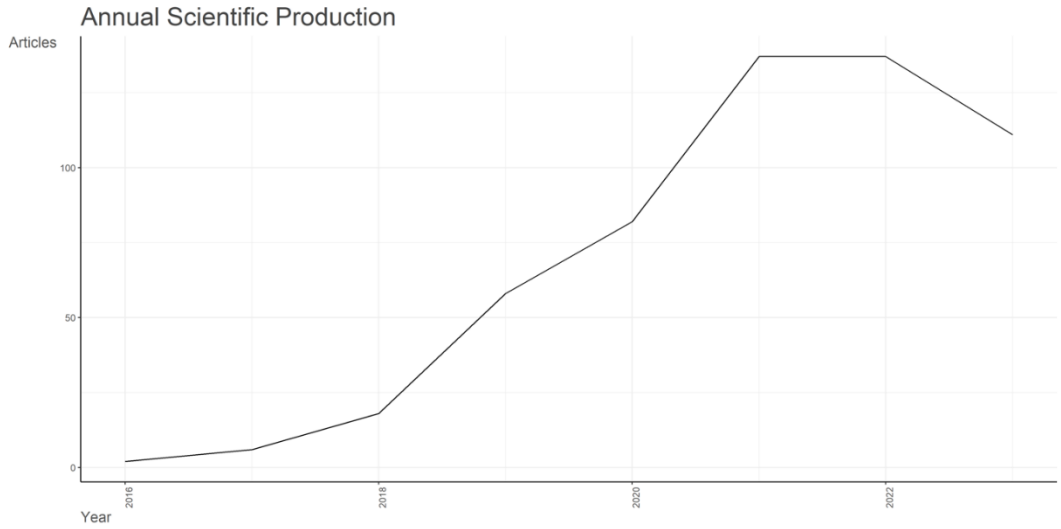

Figure 3. Annual scientific production

5.4. Most Relevant Sources

Figure 4 highlights the primary sources that have made significant contributions to the field of robotic process automation in business through their publications. Topping the list is the journal titled "Lecture Notes in Business Information Processing," which has notably published 42 articles on the subject. Not far behind is the "Lecture Notes in Computer Science," which also encompasses its subseries "Lecture Notes in Artificial Intelligence" and "Lecture Notes in Bioinformatics." This journal has contributed a commendable 27 articles to the domain.

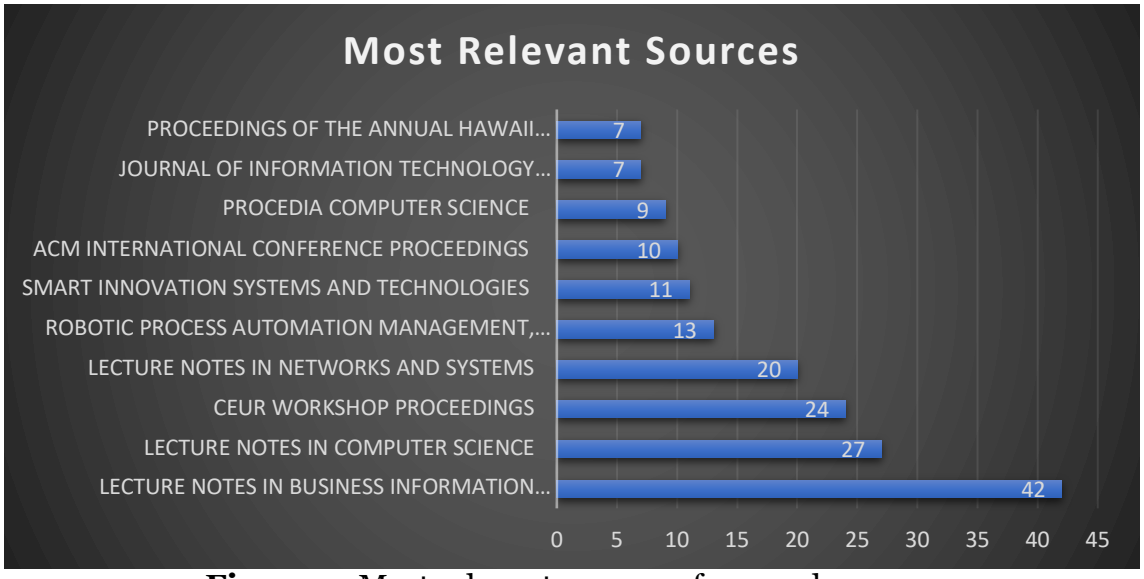

Figure 4. Most relevant sources of research papers

5.5. Most Relevant Authors

A visual representation of the leading authors in the field of robotic process automation in business is give in Figure 5. Topping the list is CZARNECKI C with 8 publications, closely followed by JANIESCH C and WEWERKA J, each with 7 publications. PLATTFAUT R and

REICHERT M are also notable contributors, having authored 6 publications each. This data underscores the significant contributions these individuals have made to the number of research articles published in the area of robotic process automation applications in business.

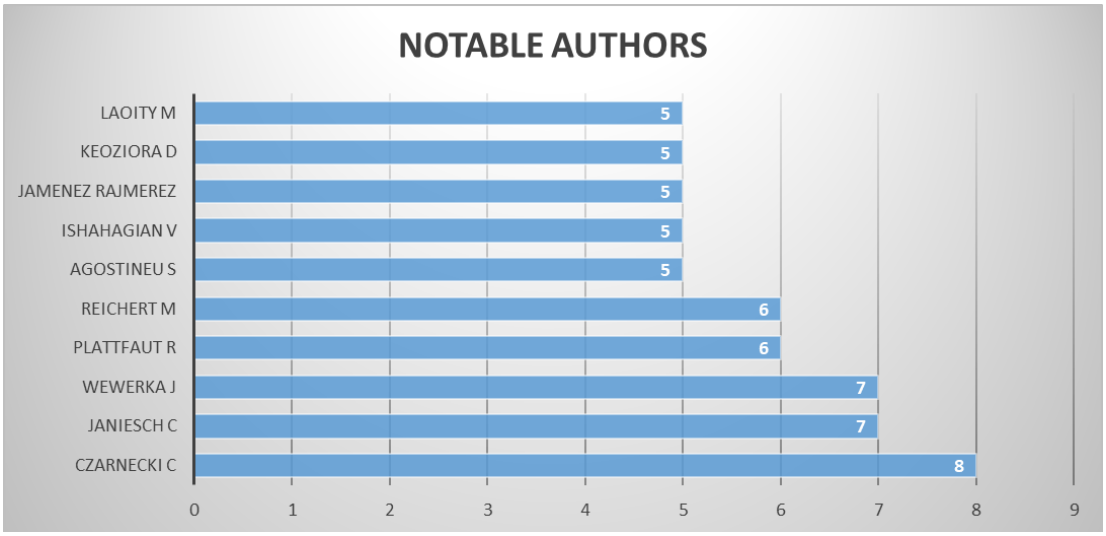

Figure 5. Most relevant authors

5.6. Most Relevant Affiliations

A graphical depiction of the leading affiliations in the realm of robotic process automation in business is illustrated in Figure 6. At the forefront of this domain is IBM RESEARCH AI with a notable 19 affiliations. Following closely are SAPIENZA UNIVERSITÁ DI ROMA and UNIVERSITY OF SEVILLE, each with 11 affiliations. BANNARI AMMAN INSTITUTE OF TECHNOLOGY, QUEENSLAND UNIVERSITY OF TECHNOLOGY, and UNIVERSITY OF SÃO PAULO are also significant contributors, each boasting 10 affiliations. This data underscores the prominent institutions driving advancements in this innovative field. There are 13 publications where authors have not reported their affiliations.

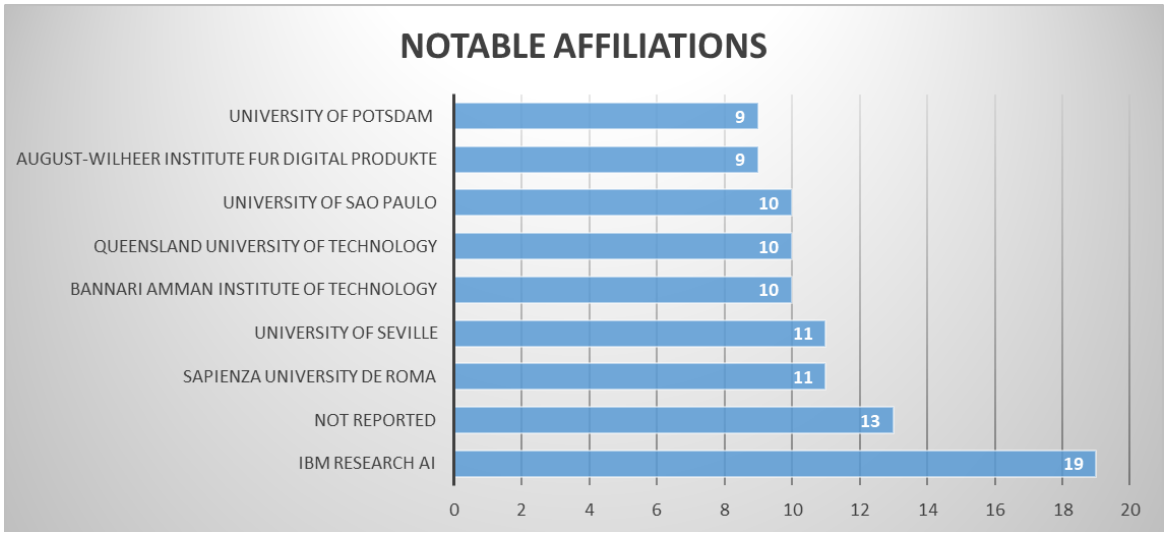

Figure 6. Most relevant affiliations

5.7. Three Field Plot

Figure 7 presents a diagram exploring the connections between keywords (on the left), authors (in the middle), and publications (on the right) in the robotic process automation

field. The research aimed to identify terms frequently used by authors in their articles. An analysis of the main keywords, authors, and journals revealed phrases like "robotic process automation", "rpa," and "artificial intelligence." “robotic process automaton” and “rpa” were used as two separate terms because these terms were appearing as different keywords in research articles. Notably, authors such as Mamede HS, Plattfaut R and more, often incorporated these terms in their work, which appeared in publications like Lecture Notes in Business Information Processing, Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), among others.

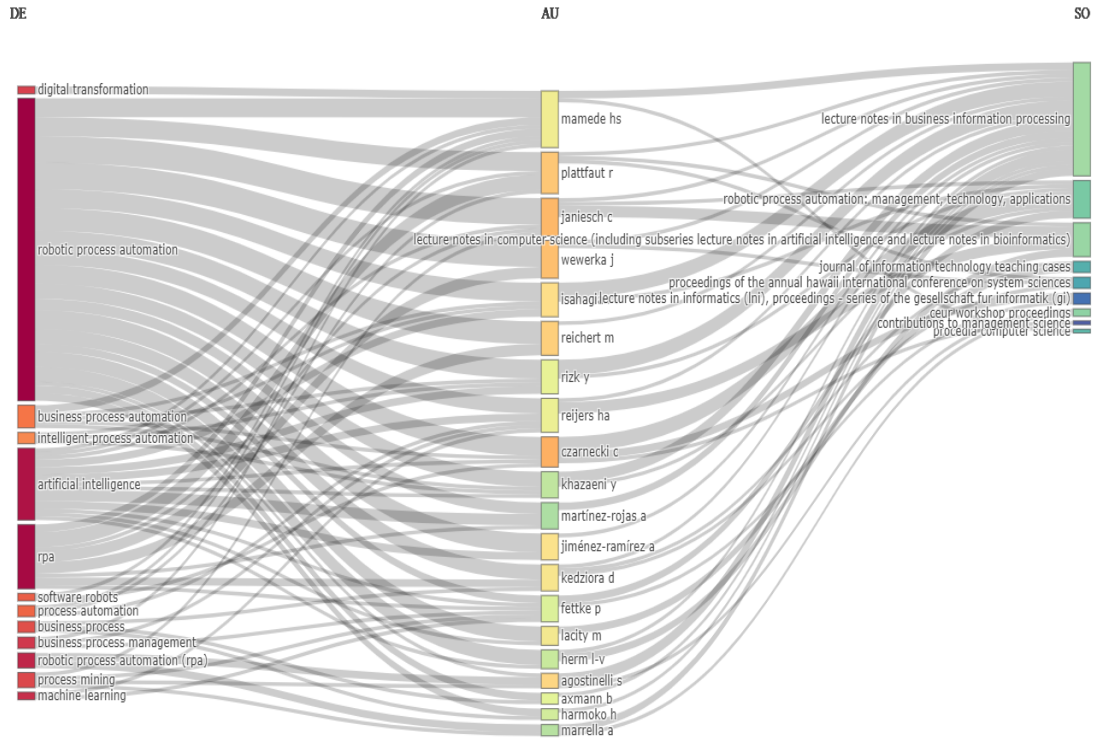

Figure 7. Three Filed Plot of Keywords, Authors and Publications

In the three-field plot, colours are used to differentiate and categorize the elements within each column. Different colour schemes used in the graph are explained in detail.

5.7.1 Left Column (DE) - Topics:

Different shades of red, orange, and pink represent various topics within digital transformation. The colour Dark red is used for the key word "digital transformation" and Maroon is for "robotic process automation". Orange is used for "business process automation" and Light orange is for "artificial intelligence". Finally, the Pink colour represents "machine learning"

5.7.2 Middle Column (AU) - Authors:

The shades of Yellow and Orange distinguish different authors. Each unique colour represents a distinct author. Few examples are: Yellow is for "Mamede" and Light Orange is for "Plattfaut". Darker shades of Orange are used for other authors like "Janiesch," "Reiher," and "Fette" etc.

5.7.3 Right Column (SO) - Sources:

A range of shades in Green and Blue represent various publication sources. Each unique colour signifies a different journal, conference, or publication series. The Light green is for "Lecture notes in business information processing". Dark green indicates "Robotic process

automation - management, technology, applications". The colour code Light blue is for "Journal of Information Technology Teaching Cases". Darker shades of Blue represent other sources like "Proceedings of the annual Hawaii International Conference on System Sciences" and "Lecture notes in Informatics (LNI), Proceedings"

5.8. Country Co-Authorship Analysis

In the field of robotic process automation for business and management studies, a country-based co-authorship analysis visually showcases the collaboration and influence levels of different nations. Figure 8 illustrates this with interconnected nodes and links, shedding light on the extent of global collaborations. The graph represents the likely size of every country's respective node, indicating the volume of research or number of publications the said country is contributing to the mentioned topic. Bigger nodes indicate more work volume. The links show cross-border institutional collaborations, with their closeness and intensity indicating the collaboration's strength. The colors indicate that all the grouped countries belong to some type of cluster. Those countries doing collaboration very frequently and sharing similar patterns in their research are grouped in to clusters of the same colour. Different clusters formed through the associations in research in the area of RPA in business. Red cluster contains close peers such as India, China, and Malaysia. There would be a lot of research output in such clusters for the topic under consideration and they indicate strong collaboration. Green Cluster is clustering with countries such as Germany, Australia, and the Netherlands, indicating again strong research activity or collaboration among them. Blue cluster includes countries like Finland, Switzerland, and Japan. Yellow contains the United States, United Kingdom, and Canada and others. India leads in publication numbers with 101, followed by Germany with 84, and the U.S. with 41. In terms of citations, Germany is at the forefront with 780, followed closely by the U.S. with 734, and India with 396, showcasing their significant contributions. Additionally, the U.S., the U.K., and India have the strongest overall link strength, emphasizing their central roles in this international co-authorship web.

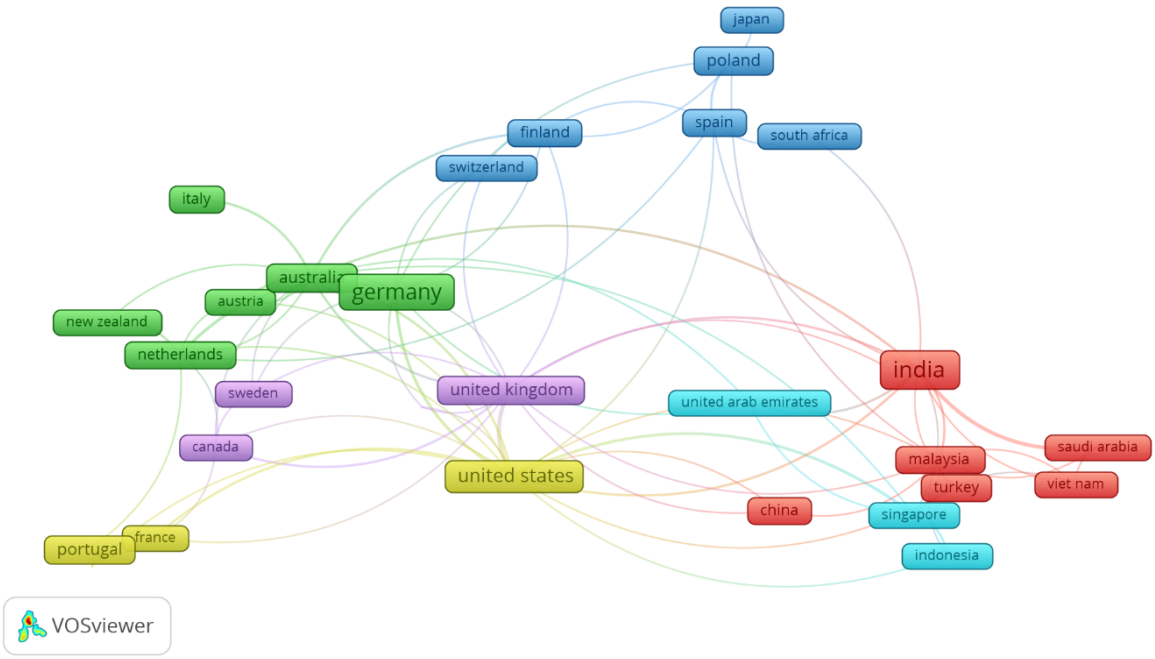

Figure 8. The network visualization of country co-authorship analysis

5.9. Co-occurrence of Keywords

To graphically display groups of commonly used terms connected to robotic process automation, the VOSviewer program was utilized. 146 of the 2770 keywords were chosen for study out of the total since they appeared at least 5 times. Both author kewords and Scopus keywords are used in the analysis. The data and results are visualized in Figure 9. Each node's size and font correspond to the frequency of the term. More common terms are indicated by larger circles and typefaces. This illustration with the inclusion of "robotic process automation," "process automation," and "artificial intelligence" as central nodes, points out those keywords to be at the centre and that there are strong relations among them. They are the most frequently occurring or studied keywords within the set of documents analysed. In the same way, all the adjacent terms to the central nodes of "machine learning" and "AI," which include "finance," "human resource management," "bots," and "supply chain management," would indicate sub-themes or specializations that emanate from the center.

The intensity of the association between the keywords is shown by the thickness of the lines connecting the circles. The keywords may be paired often if the lines are thicker. Notably, the keyword "robotic process automation" was the most frequent, showing up 284 times, followed by "process automation" (271 times), and "process control" (206 times). The colour coding represents different clusters or groups of keywords, which have much closer ties with their neighboring keywords, among themselves compared to other clusters. The visualization captures a complex network of interconnected themes within automation and AI. The Robotic Process Automation (RPA) cluster, marked in blue, is a hub for terms such as "bots," "automation technology," and "user interfaces," reflecting the technological underpinnings of RPA where software robots streamline repetitive tasks. Adjacent to this is the green-colored Process Automation cluster, where "workflows," "productivity," and "supply chain management" denote the use of automation to enhance business efficiency.

The red Artificial Intelligence cluster delves into the realms of "machine learning" and "intelligent robotics," illustrating AI's role in equipping machines with decision-making capabilities. Meanwhile, the orange Technology and Innovation cluster gathers terms like "blockchain" and "innovation," signifying the cutting-edge technological advances across RPA and AI sectors. The light blue Business and Management cluster focuses on how RPA and AI intersect with "finance" and "human resource management," pointing to automation's transformative impact on business operations. Lastly, the yellow cluster underscores the importance of "data processing" and "user interfaces," emphasizing the user-centric aspect of automation technology in facilitating human-computer interaction. Collectively, these clusters represent the multifaceted landscape of RPA and AI as they converge on the modernization of business, technology, and data management practices.

It was also pointed out by visualization that a strong interdisciplinary relationship holds between fields such as artificial intelligence, business processes, optimization, and technology implementation

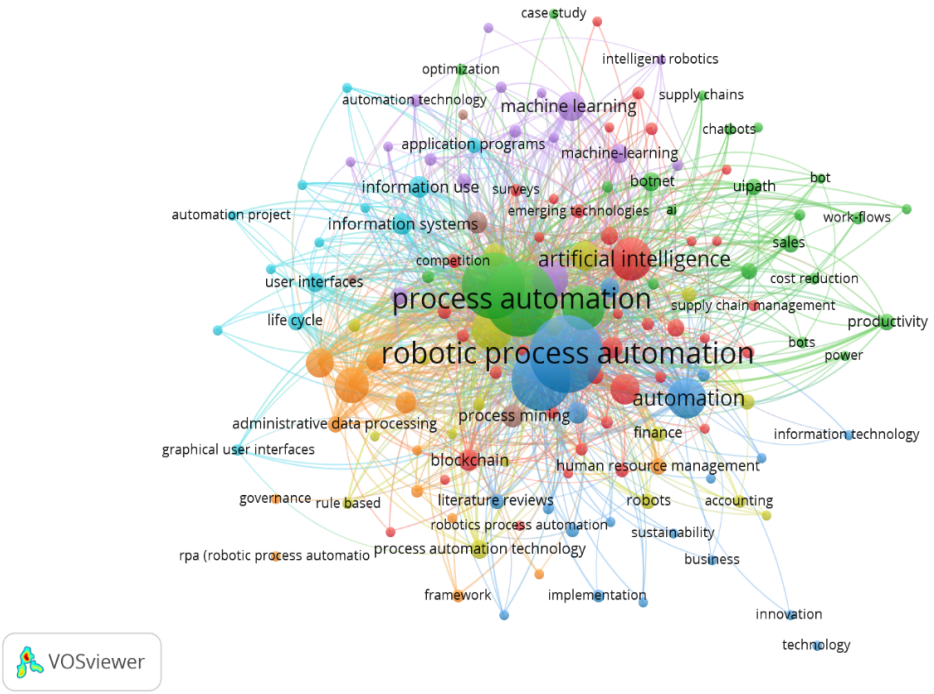

Figure 9. The network visualization of keyword co-occurrence

6. Discussion

This bibliometric research utilized a comprehensive and meticulous methodology to gather and analyze data from the Scopus database, focusing on the intersection of "Robotic Process Automation," "Business," and "Management" within the timeframe of 2016 to 2023.

The study outlines a distribution of research documents across various academic disciplines, revealing a notable emphasis on Computer Science, which leads to 386 documents. This is followed by other technical and applied sciences like Engineering, and Business-related fields. While there is a substantial representation from these areas, the distribution also underscores a considerable diversity in research areas, including but not limited to Economics, Social Sciences, and Energy-related research. However, there is a significant disparity in the volume of documents across the disciplines, with some areas like Medicine, Physics, and various sciences having notably fewer documents. Moreover, several fields, encompassing Arts, Chemistry, and various biological and health sciences, have minimal contributions, ranging from 1 to 5 documents. This distribution may reflect a predominant focus on technological and applied sciences in the dataset, while also maintaining a broad, albeit less substantial, representation across a myriad of other research areas.

The papers mentioned, particularly "Automation of a Business Process using Robotic Process Automation (RPA): A Case Study" by Aguirre S. and Rodriguez A. and "Turning Robotic Process Automation into commercial success - Case OpusCapita" by Asatiani A. and Penttinen E., are likely to be pioneering works in the field given their high citation counts, suggesting that they have been widely recognized and referenced in subsequent research and studies. Since the top-cited papers are case studies, it implies that practical applications and real-world examples of RPA are highly valued by researchers and professionals in the field, possibly because they provide tangible insights and applicable knowledge. The frequent citations and focus on these papers underscore the significant contributions and advancements they have brought to the domain of RPA, potentially shaping the trajectory of research and application in the field. The papers from 2016 and 2017 leading the citation list indicate that the field has been active and evolving for several years. It also indicates that the research foundations layed by these papers paved the way for further researcin this area. The fact that these papers discuss both the automation of a business process and turning RPA into com-

mercial success suggests that the field has a diverse range of applications and is relevant both in terms of technological development and business application.

The field of Robotic Process Automation (RPA) has experienced a significant increase in research and development activities in recent years, as evidenced by the upward trend in the number of scientific articles published from 2016 to 2023. Particularly, the years 2021 and 2022 have been pivotal, each witnessing a peak in production with 137 articles, highlighting that RPA has gained substantial attention and is considered an area of increasing significance within the scientific community. This suggests that RPA is likely to continue being a focal point of research and technological advancements in the foreseeable future.

From the provided information, it can be concluded that "Lecture Notes in Business Information Processing" and "Lecture Notes in Computer Science" (along with its subseries "Lecture Notes in Artificial Intelligence" and "Lecture Notes in Bioinformatics") are significant contributors to the field of robotic process automation through their scholarly publications. The former leads with a substantial number of 42 articles, while the latter has also made a commendable contribution with 27 articles. This suggests that these journals are pivotal in disseminating knowledge and advancements in the domain of robotic process automation.

From the provided information and considering the early stages of research in this promising area, we can conclude that CZARNECKI C is the most prolific author in the field of robotic process automation, with a total of 8 publications. JANIESCH C and WEWERKA J are also substantial contributors, each having authored 7 publications, making them the second most prolific authors in this field. PLATTFAUT R and REICHERT M have also made notable contributions, each authoring 6 publications. This data highlights that these individuals have significantly influenced and advanced the field of robotic process automation research through their scholarly contributions.

From the provided information, it can be concluded that IBM Research AI is the leading institution in the realm of robotic process automation, with the highest number of affiliations, which is 19. Sapienza Università di Roma and the University of Seville also emerge as significant players in this domain, each having 11 affiliations. Furthermore, Bannari Amman Institute of Technology, Queensland University of Technology, and the University of São Paulo are notable contributors, each with 10 affiliations. This indicates that these institutions are pivotal in driving advancements and innovations in the field of robotic process automation, showcasing a blend of contributions from both corporate research (IBM Research AI) and academic institutions.

The three-field plot explores the interplay between keywords, authors, and publications within the field of RPA. Notable keywords such as "robotic process automation," "RPA," and "artificial intelligence" are frequently by authors in their articles, indicating a strong focus on these topics in the domain. Authors like Mamede HS and Plattfaut R have notably incorporated these key terms into their work, which has been published in various journals and publications, including "Lecture Notes in Business Information Processing" and "Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)." This highlights that there is a substantial emphasis on the incorporation and analysis of RPA and artificial intelligence within the academic and research scenario.

In this emerging area of technology, India has the highest number of publications with 101 papers, then Germany with 84 and the U.S. with 41. When citations are considered, which can be an indicator of the quality of the research, Germany is on the top with 780 citations. The U.S. is very near to this with 734 citations, India also has 396 citations. This leads to the conclusion that though India has the highest publication count, Germany and the U.S. have made more significant contributions in terms of citations. Furthermore, the U.S., the U.K., and India are central figures in this international collaboration network, as evidenced by their strong link strength in the cluster. This underscores their pivotal roles in fostering interna-

tional collaborations in the field of robotic process automation for business and management studies.

The study utilized the VOSviewer program to visually represent key terms Among all the keywords, "robotic process automation" was the most prevalent, appearing 284 times, followed closely by "process automation" and "process control". This suggests a significant focus on automation processes in the context of robotic process automation.

7. Conclusion

The wide and dynamic research landscape surrounding the business applications of robotic process automation (RPA) in business has been highlighted by this bibliometric analysis. We have discovered current trends, significant authors, and important research themes within the business applications of of RPA. The findings suggest that RPA is an area of interest that is fast developing in both academia and business, with a rising corpus of research reflecting its growing importance in streamlining corporate processes, promoting efficiency, and spurring innovation. There is a growing research interest in the multifaceted nature of this domain, encompassing areas like automation, artificial intelligence, and business transformation. This bibliometric analysis serves as a valuable resource for researchers, practitioners, and policymakers seeking to navigate the vast landscape of RPA research. It provides a solid foundation for future studies and offers a roadmap for further exploration of emerging trends and untapped opportunities in the business applications of Robotic Process Automation.

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