

What did We Miss? A Bibliometric Review of Electronic Human Resource Management and Research Agenda

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ABSTRACT

This study identifies the literature gap that will guide academics and researchers in their future research initiatives in electronic human resource management (e-HRM) practices globally. For this, a comprehensive bibliometric analysis is conducted on 148 documents published in the Scopus database from 2004 to 2019. The use of bibliometrix package in R software and VOSviewer software has revealed that tech advanced countries like Germany, USA and China have been examining this topic and as such authors of those countries appear as the top authors considering total citations and number of publications. From

the results of the thematic map, trend topics, bibliometric coupling, three-field plot and co-occurrence network, potential research areas are found. Furthermore, the examination of the theories and methods highlighted in literature pointed at the future research agenda.

ملخص

تحدد هذه الدراسة الفجوة القائمة على مستوى الأدبيات التي ستوجه الأكاديميين والباحثين في مبادراتهم البحثية المستقبلية في ممارسات إدارة الموارد البشرية الإلكترونية (e-HRM) على مستوى

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العالم. ولهذا الغرض، تم إجراء تحليل بيبليومتري شامل على 148 وثيقة منشورة في قاعدة بيانات Scopus من 2004 إلى 2019. وأظهر استخدام حزمة بيبليومتريكس في برنامج R و VOSviewer أن البلدان المتقدمة في مجال التكنولوجيا مثل ألمانيا والولايات المتحدة الأمريكية والصين كانت تدرس هذا الموضوع، وبهذا يظهر مؤلفو تلك البلدان كأفضل المؤلفين الذين يأخذون في الاعتبار إجمالي الاستشهادات وعدد المنشورات. ومن خلال نتائج الخريطة الموضوعية، ومواضيع الاتجاهات، والاقتران البيبليومتري، ورقعة ثلاثية الميادين وشبكة التواجد المشترك، تم العثور على مجالات البحث المحتملة. وعلاوة على ذلك، أشار فحص النظريات والأساليب التي تم إبرازها في الأدبيات إلى أجندة الأبحاث المستقبلية.

ABSTRAITE

Cette étude identifie les lacunes de la littérature qui guideront les universitaires et les chercheurs dans leurs futures initiatives de recherche sur les pratiques de gestion électronique des ressources humaines (e-HRM) au niveau mondial. Pour cela, une analyse bibliométrique complète est menée sur 148 documents publiés dans la base de données Scopus de 2004 à 2019. L'utilisation du paquet bibliometrix dans le logiciel R et du logiciel VOSviewer a révélé que les pays avancés sur le plan technologique, comme l'Allemagne, les États-Unis et la Chine, se sont penchés sur ce sujet et que les auteurs de ces pays apparaissent comme les principaux auteurs au regard du nombre total de citations et du nombre de publications. Les résultats de la carte thématique, des sujets de tendance, du couplage bibliométrique, du diagramme à trois champs et du réseau de cooccurrence permettent de trouver des domaines de recherche potentiels. En outre, l'examen des théories et des méthodes mises en évidence dans la littérature a permis de définir le futur programme de recherche.

Keywords: Electronic Human Resource Management; bibliometric; Human Resource Information Systems.

JEL Classification: C23, R41 (up to 5 codes)

1. Introduction

Human resources management (HRM) and its strategic application in organizations have been respected as the underlying factor for organizational effectiveness (T. Bondarouk & Ruël, 2013; Khashman, 2019; Janet H Marler & Emma Parry, 2016). However, in recent days, immense technological advancements in the fast-changing world have reshaped HRM into electronic HRM (e-HRM). A holistic definition given by Janet H Marler and Emma Parry (2016) is enough to explain e-

HRM. According to them, e-HRM is a combination of computer hardware, software and electronic networking tools that aids in performing actual HR functions of an organization like policies, process and services by synchronization and sharing of information at the individual and societal level within the organization. As such, today's organizations are too much inclined towards e-HRM for various reasons.

The reason why organizations have been increasingly adopting e-HRM for more than four decades is the hope of attaining administrative and strategic benefit (Tanya Bondarouk, Emma Parry, & Elfi Furtmueller, 2017; Kovach, Hughes, Fagan, & Maggitti, 2002; Stefan Strohmeier, 2009). After researching in five large organizations based on a case study, Ruël, Bondarouk, and Van Der Velde (2007) identified the goals of the organization for stepping towards e-HRM and classified this into four types namely cost reduction/gain of efficiency, improvement of client service, developing strategic orientation of HRM and integrating HR functions of different units of the organization or the whole organization (Tanya Bondarouk, Huub Ruël, & Beatrice van der Heijden, 2009). Besides, by identifying the factors affecting adoption of e-HRM namely technology ,organization and people a framework has been developed referred as 'TOP' framework (Tanya Bondarouk et al., 2017). E-HRM is a vast concept and it covers all the activities of HRM in an organization and as such the whole organizational activities covered by e-HRM has been classified into 3: operational HRM, transformational HRM and relational HRM (Lepak & Snell, 1998). Further Wright and Dyer (2000) distinguished areas based on face-to-face or electronic means of giving HR services as transactional HRM, traditional HRM, and transformational HRM (Tanya Bondarouk & Ruël, 2005).

By the welfare of e-HRM the activities of the organization previously performed by HR professionals physically consuming a lot of time can now be performed online.(Tanya Bondarouk & Ruël, 2005). On one hand, employees have exposure to whatever they need to know and change like personal files, development plans, processing financial documents and new job applications on the other hand manager has control of everything sitting on his desktop. They make performance appraisals, generate the report for turnover and absenteeism, calculate employee costs, manage their training and what not (Roehling et al., 2005). Considering the digitization of corporate culture, it can be presumed that e-HRM has come

a long way and is being used very generously amongst all organizations specially in the western world (Siam & Alhaderi, 2019).

This study examines a bibliometric literature review to find an overall summary of electronic human resource management or e-HRM in organizations over years. The contribution of different prolific authors, journals and countries showing interest in this research topic can also be identified from the research findings. Statistics reveal that Tanya Bondarouk is the most productive author in this field but Stefan Strohmeier tops the list in terms of total citations. International journal of human resource management having the highest publication and Human Resource Management Review having the highest citations serve as the primary directory for this research. Stefan Strohmeier's Research on e-HRM: Review and implications is the highest cited document in this topic so far making it the milestone for future research in this field. Country-wise analysis reveals that Germany is the leading country in e-HRM research.

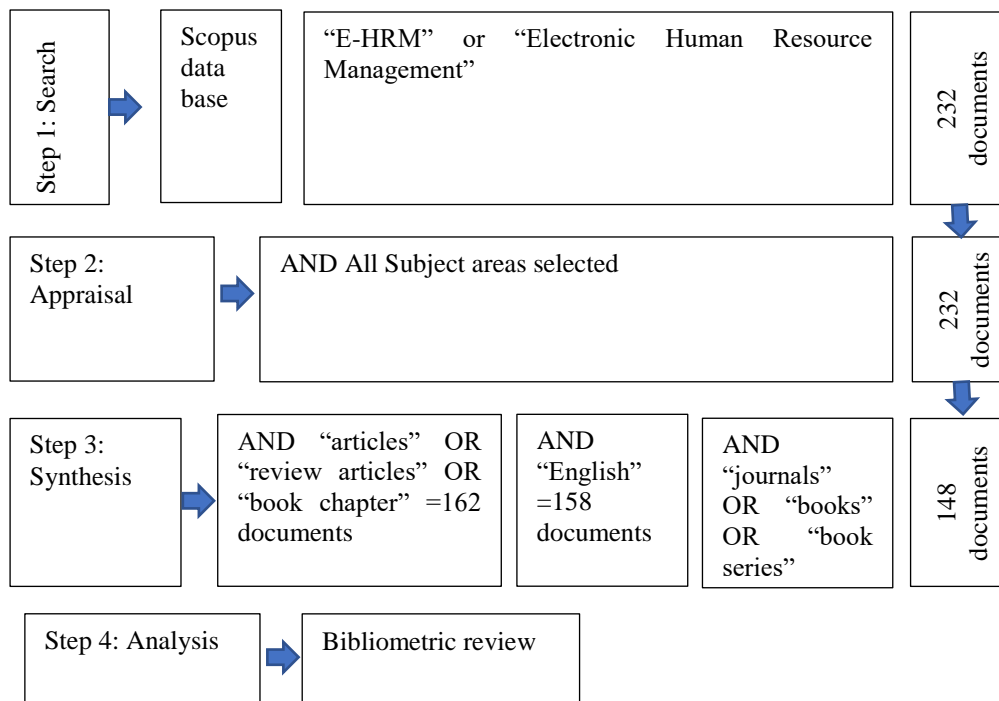
The rest of this paper is organized into additional five chapters. Chapter 2 mentions the methodology used in this study followed by the analysis of the results from bibliometric analysis in chapter 3. Chapter 4 describes the implications and conclusions of this study.

2. Methodology and data

Over the years, several review techniques have been applied such as structured review (Rosado-Serrano, Paul, & Dikova, 2018), review for model/framework development (Paul & Mas, 2019), meta-analysis (Knoll & Matthes, 2017), review based on theory (Paul & Rosado-Serrano, 2019), hybrid-future research (Kumar, Paul, & Unnithan, 2019), framework-based (Paul & Benito, 2018), bibliometric review (Randhawa, Wilden, & Hohberger, 2016), and systematic review (Chang & Chen, 2020), (Tranfield, Denyer, & Smart, 2003). Among these techniques, the bibliometric and systematic review techniques are applied in this study. The widely used SALSA method has been put into practice to address the research goals and establish an impartial data analysis. (Papaioannou, Sutton, Carroll, Booth, & Wong, 2010). Search, Appraisal, Synthesis, and Analysis stand for SALSA. Firstly, nearly every possible source and keyword is used in the search (data collection), ensuring that any valid data is not missed. Using the search words "E-HRM" or "Electronic

Human Resource Management" resulting in 232 articles, the search has been expanded to document titles, abstracts and keywords of the entire Scopus dataset. Second, the searched data in the first stage are scrutinized in the appraisal stage. But as our study topic, e-HRM covers all subject areas, filtering using subject area was not done. Then, only 162 records existed for analysis by limiting the collected data collection to articles, review articles and book chapters. Finally, restricting this dataset to English only resulted in a total of 158 published articles and 148 articles for the research were found restricted to sources such as journals, books and book series. Third, the study applied bibliometrix package in R programming language and VOSviewer software as a bibliometric tool for the synthesis stage relevant to the development of an analytical system using the dataset (Aria & Cuccurullo, 2017). Finally, for the detection of possible literature gaps, a systematic literature review has been implemented. The SALSA method and procedural steps in the selection process are illustrated in Figure 1.

Figure 1: Data Selection and Analysis Procedure Steps of SALSA



3. Bibliometric results and discussions

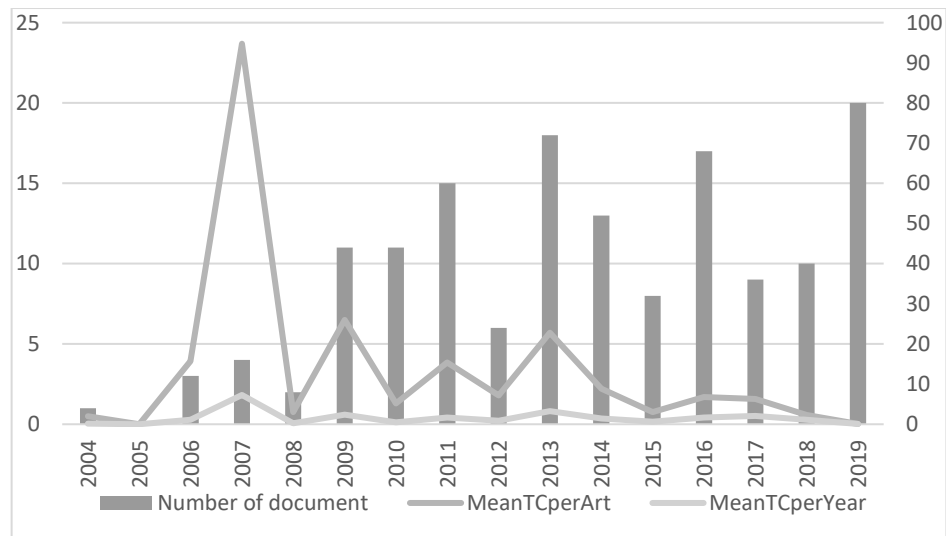
The importance of e-HRM has seen to rise for quite a long time along with a hope and promise of increasing HRM administrative effectiveness (T. Bondarouk, Schilling, & Ruël, 2016; Heikal, Ciptaningsih, Nguyen, Laxmi Lydia, & Shankar, 2019; Rushit Gnana Roy & Jegan, 2019; Zareena, 2018). Considering the significance of this topic and increasing interest among authors, a bibliometric search on 148 documents published in Scopus database from 2004 to 2019 is performed. Among these documents, it is observed that total 251 authors have contributed in production of these documents. The newness and scope of this topic may have motivated authors to participate in publishing these articles. Collaboration among the specialists of different fields is the key for exploring and understanding of this topic which can be presumed observing only 31 (20.94%) documents written by 25 (9.97%) authors. Detailed information regarding the significant influence of this research topic and increasing interest of authors in this trending issue over the years can be found from the following subsections.

3.1. Publication and citation trend

An analysis of yearly publication and citation trend of about 148 articles from the year 2004 to 2019 is shown in Figure 2. Number of documents published is depicted through bar graph while mean total citation per article and mean total citation per year are depicted using line graphs. The bars that is the number of documents published shows a growing tendency having the largest number of documents published in 2019. Meanwhile, a steady rise has been observed in the mean total citation per article and mean total citation per year since the beginning and a sudden sharp rise during the year 2007. Afterwards, these graphs have been showing both upward and downward tendencies. It is obvious that the recent publications have not gained many citations as it can also be seen from the graph because time is needed for creating impact after publication. The year 2019 being the most productive year, the main topics of research has been cloud computing and information system relating to e-HRM followed by the year 2013 most research has been conducted concerning the adaptation and impact of e-HRM in organization. Since the beginning the interest of research in this field seemed to remain intact and in the recent year it is more on rise as e-HRM is being increasingly accepted by

organizations globally due to growing awareness and advancement of information technology (Zareena, 2018)

Figure 2: Publication and citation trend

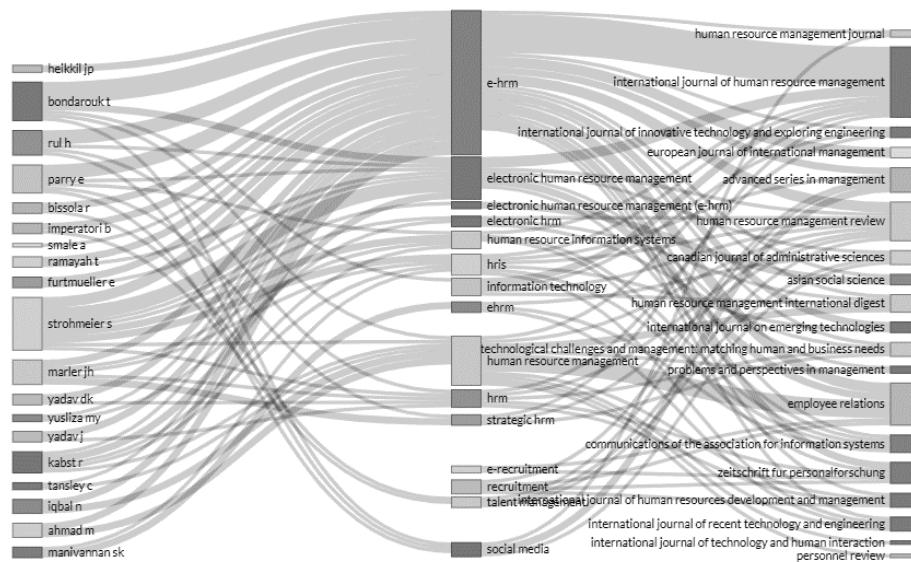


3.2. Three-fields plot

Figure 3 visualizes the three items of this study and how they are interrelated. The left field displays authors, keywords in the middle field and sources in the right field are presented. From the top authors' list, it is seen that Tanya Bondarouk is the most dominant author because she seems to be contributed in major keywords and published in major journals. Among the keywords, e-HRM is the most used keyword and International Journal of Human Resource Management is the most cited source from source perspective. For convenience, the keywords field has been classified into four categories. The first part contains all keywords that are relevant to electronic human resource. The second is traditional HRM followed by recruitment and the last one is about social media. The first category is the largest one containing all the keywords synonymous to e-HRM or human resource information system. For the second category words like human resource management, HRM and strategic HRM are used. Among all the documents in e-HRM, authors and journals have primarily focused on recruitment as it seen from third category of keywords. Lastly, the word social media, a completely different from the other categories has been used in journals like Advance Series in

Management and Human Resource Management Journal. The application of social media was linked to studies that explored the potential of information sharing for employer branding through social media and the future envisioned by HR professionals. (Tatiana Bondarouk, Huub Ruël, Elena Axinia, & Roxana Arama, 2013) Be it recruitment or branding, the whole of HR activities has, nowadays, been associated with social media and, as a result, studies concerning this key word has been on the rise.

Figure 3: Three-fields plot



3.2. Source impact

The most influential journals are listed in Table 1 highlighting their h_index , g_index , m_index , total citations and total number of publications. The h -index is an author level grading system that helps to measure citation impacts of publications and productivity, the g -index is a calculation based on the distribution of citations received by a given researcher's publications whereas the m index is the h -index divided by the number of years that a researcher has been active. The data indicates that the International Journal of Human Resource Management is the most productive journal considering number of publications, h -index, g -index and m -index whereas *Human Resource Management Review* is the most influential having highest total citations. With only 6 publications, the

Human Resource Management Review has 6 h-index, 0.429 m-index with total 488 citations. All of the 6 articles of the journal have high citation indexes but two articles, Research in e-HRM: Review and implications (195) and The psychology of talent management: A review and research agenda (163) together encompass the most citations. While h-index is mostly used for calculating the cumulative impact of research output, g-index is proposed to boost the h-index by giving frequently cited papers more weight. However, the g-index is equal to h-index meaning that the publications were able to fulfill the targeted h index. In some cases, citations are zero like *International Journal of Innovative Technology and Engineering*, *International Journal of Recent Technology and Engineering* and *International Journal of Emerging Technologies* as these are the newest in publications from the years 2018 and 2019 but their rate of publications seems high which is an indication of the apparent growth of the research. During the initial years, it is found that the pioneer journal is *International Journal of Human Resources Development and Management* with negligible publications and citations but have been the basis of this research topic.

Table 1: Most influential Journals

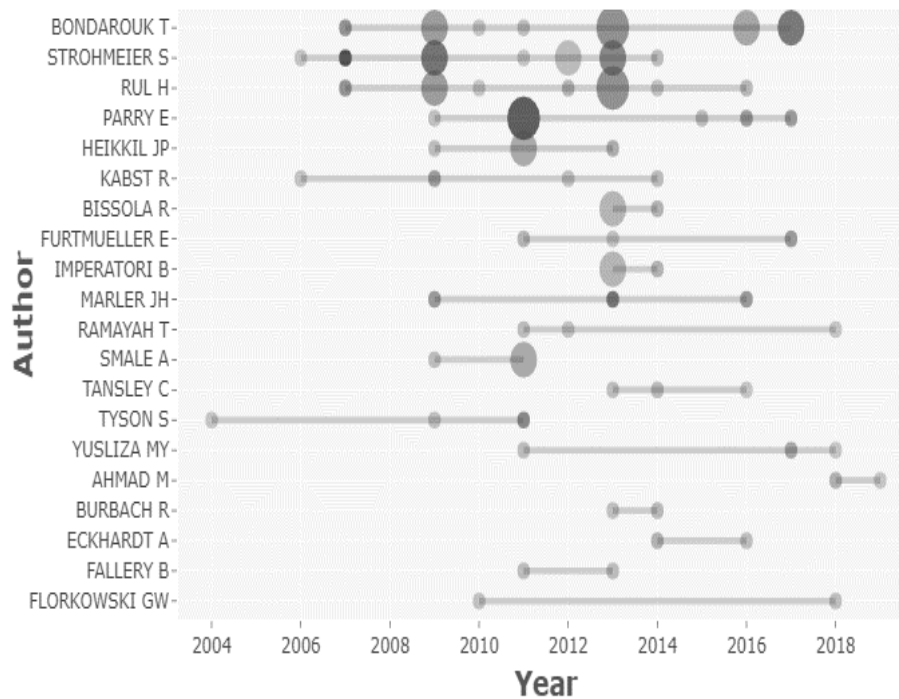
Source	h_index	g_index	m_index	TC	NP
International Journal of Human Resource Management	9	14	0.750	357	14
Advanced Series in Management	5	6	0.500	44	10
Employee Relations	7	8	0.500	152	8
Human Resource Management Review	6	6	0.429	488	6
European Journal of International Management	4	5	0.364	26	5
Handbook of Research on E-Transformation and Human Resources Management Technologies: Organizational Outcomes and Challenges	3	5	0.250	25	5
Asian Social Science	2	3	0.250	9	3
Canadian Journal of Administrative Sciences	3	3	0.600	22	3
Human Resource Management International Digest	1	1	0.077	1	3
Human Resource Management Journal	3	3	0.300	83	3
International Journal of Technology and Human Interaction	2	2	0.182	7	3
Zeitschrift Fur Personal forschung	3	3	0.333	36	3

Source	h_index	g_index	m_index	TC	NP
Communications of The Association for Information Systems	2	2	0.400	21	2
International Journal of Business Information Systems	2	2	0.182	9	2
International Journal of Human Resources Development and Management	2	2	0.118	4	2
International Journal of Innovative Technology and Exploring Engineering	0	0	0.000	0	2
International Journal of Recent Technology and Engineering	0	0	0.000	0	2
International Journal of Training and Development	2	2	0.167	20	2
International Journal on Emerging Technologies	0	0	0.000	0	2
Journal of Strategic Information Systems	2	2	0.250	27	2

This table presents the annual citations during our study period that is from 2004-2019. Here TC=Total citations, NP=Number of publications and 3 indexes h, g and m are seen.

3.4. Most influential authors

Figure 4 outlines the top contributing authors identifying their total citation, total citations per year and frequency of writing. Results reveal that Tanya Bondarouk is the most productive author in all three of the categories. Her frequency of writing remained apparently unchanged from 2007 until 2018 whereas her total citations surprisingly doubled in a span of one year and total citations per years also changed accordingly from 3.4 to 8.5. Tanya Bondarouk produces 11 articles followed by Stefan Strohmeier having 10 articles. While it is seen that the work of Stefan Strohmeier may be clarified by the flexibility of methodologies and theories he has used, Tanya Bondarouk uses more descriptive case studies and empirical approaches. It can be seen from the figure that new authors like Mansoor Ahmad, Gary Florkowski, T. Ramayah have been gaining special attention and the fact that these authors are residents of different parts of the world conveys that the research topic has been in rise all over the world. Mansoor Ahmed from Pakistan, Gary Florkowski of USA, T. Ramayah of Malaysia are some emerging authors working and gaining popularity in this research topic.

Figure 4: Most influential author

While figure 4 ranks authors based on their number of publications and total citations throughout the years, table 2 gives the idea about author impact considering h _index, g _index and m _index. Considering h _index which is an author level grading system to measure citations, Tanya Bandarouk occupies the first place while second place is occupied by Stefan Strohmeier, Van den Rul H, Emma Parry simultaneously having equal h _index of 6 which means their cumulative impact of research output is the same. But when g _index and m _index are considered there is slight change in the ranking. Tanya Bondarouk still tops the list with g _index greater than h _index meaning that she not only fulfilled her targeted citations rather did better. The second, third and fourth place are occupied by Stefan Strohmeier, Van den Rul H, Emma Parry but the new researchers like Mansoor Ahmed, Gary Florkowski lagged in this consideration. By comparing this figure4 with that of table 2 an interesting fact is found that being new, Mansoor Ahmed was ahead of Stefan Strohmeier, Van den Rul H and Emma Parry in terms of frequency and total citations but he is in 16th place out of 20 authors because of having only 2 documents. Any how it is fascinating that these new researchers

like Mansoor Ahmed, Gary Florkowski who have been indulged in research from the recent times are showing much interest in this research area.

Table 2: Author impact

Author	h_index	g_index	m_index	TC	NP
Bondarouk T	8	11	0.667	158	11
Strohmeier S	6	10	0.4	373	10
Rul H	6	8	0.5	125	8
Parry E	6	7	0.5	172	7
Heikkil JP	3	4	0.25	60	4
Kabst R	3	4	0.2	69	4
Bissola R	3	3	0.375	27	3
Furtmueller E	2	3	0.2	38	3
Imperator B	3	3	0.375	27	3
Marler JH	3	3	0.25	154	3
Ramayah T	2	3	0.2	11	3
Smale A	2	3	0.167	39	3
Tansley C	2	3	0.25	15	3
Tyson S	2	3	0.118	75	3
Yusliza MY	2	3	0.2	23	3
Ahmad M	1	2	0.333	7	2
Burbach R	2	2	0.25	14	2
Eckhardt A	2	2	0.286	19	2
Fallery B	2	2	0.2	16	2
Florkowski GW	2	2	0.182	7	2

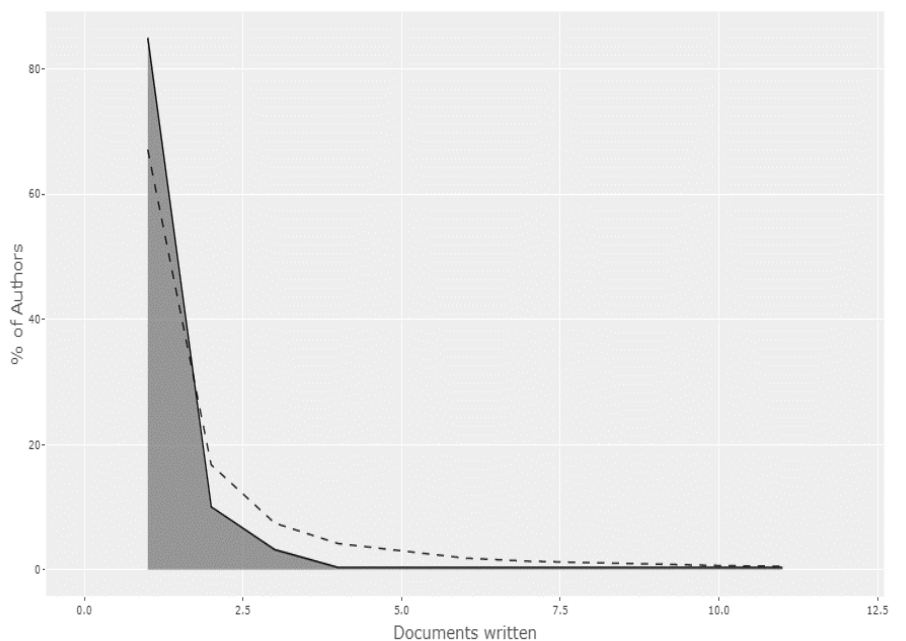
TC=Total citations, NP=Number of publications

3.5. Lotka's Law

It is very important to know the impact of scientific productivity for any researcher or academics in each period of time which can be visualized using the Lotka's law. Figure 5 depicts that 83.7% (210 authors) contributed to only one paper, 10.4% or 26 authors produced two papers

and only 3.6% contributed to more than two papers between 2004 to 2019. That means the number of authors contributing only one paper is dominant considering authorship productivity pattern. It is observable that the percentage of authors contributing to single paper is higher than Lotka's expected percentage but in case of more than one paper the expected percentage has not been fulfilled. In fine, the Lotka's law will be beneficial for the later researchers interested in research concerning e-HRM as they will have an idea about the behavioral pattern of the publishers. Moreover, the expected contribution by the researchers would only be possible, as per Lotka's law, if more authors contribute in more than one document in e-HRM literature.

Figure 5: The frequency distribution of scientific productivity



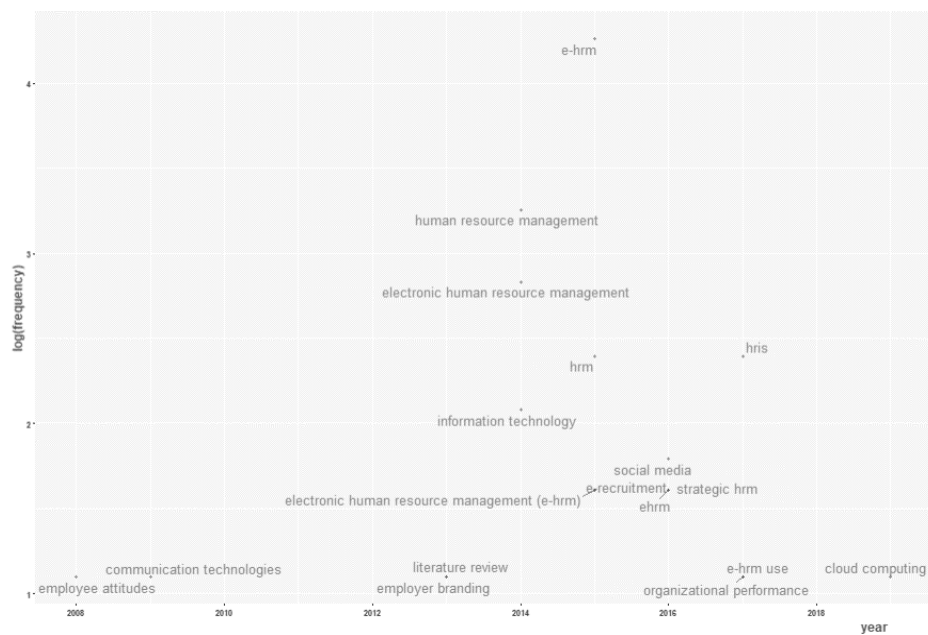
3.6. Most influential documents

From a period of 2004 to 2019 on the basis of total citations, Stefan Strohmeier's Research in e-HRM: Review and implications (2007) tops the list of most influential documents. The contribution of Stefan Strohmeier who is a Professor at Saarland University in Saarbruecken, Germany is noteworthy in this area of research. His other dominant articles include Concepts of E-HRM consequences: A categorization,

review and suggestion (2009), Organizational adoption of e-HRM in Europe: An empirical exploration of major adoption factors (2009), Domain driven data mining in human resource management: A review of current research (2013). Stefan Strohmeier's top cited article summarizes recent empirical work on electronic human resources management (e-HRM) and addresses some implications for future research. His other papers are mainly about general understanding of e-HRM consequences. The psychology of talent management: A review and research agenda of Nicky Dries holds the top position in terms of total citations per year and the second position on the basis of total citations. Tanya Bondarouk is another productive author in this area of research. She is regarded as a co-founder of the Electronic/Digital Human Resource Management interdisciplinary academic area and her articles such as e-HRM efficacy in a public sector organization: a multi-stakeholder perspective is the product of a qualitative analysis undertaken in a public sector organization. The strategic value of e-HRM: findings from an exploratory study in a government organization represent results from an exploratory study on the strategic value of electronic human resource management in a government organization (e-HRM). It is seen that the same author's articles are mostly in the leading position having greater citations revealing their interest in this field and all the articles addresses the key issues and necessary explanatory analysis regarding our topic of interest that is e-HRM.

3.7. Trend topic

The buzz topics in e-HRM literature from 2008 to 2018 are presented in the figure 6. During the initial periods, major studies were concerning employee attitude and communication technologies whereas the latest studies focuses mostly on cloud computing, HRIS etc. Overall during these 10 years, most research has been conducted on the condition of human resource management in organization and the gradual advancement of it with the progress of information technology and involvement of social media for e-recruitment, branding and other purposes. The main theme that could be found from the figure was the gradual change in trend topics from traditional to technical concerning human resource management.

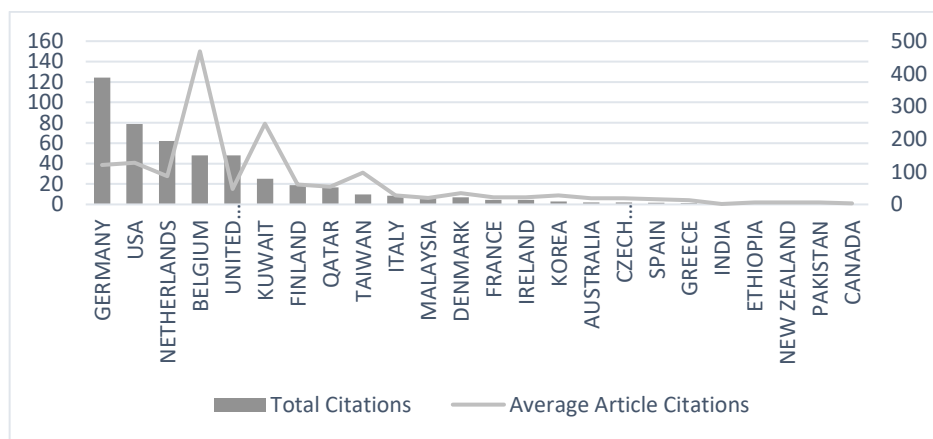
Figure 6: Trend topic

3.8. Country-wise analysis

Countries have been in competition in identifying problems and development of solutions by research and publications. Research being an important element in the advancement of knowledge and growth of any country, most countries try to focus and invest on research and as such a competition is observed which can be analyzed from the figure 7. The figure gives a pictorial view of the countries involved in this research field on the basis of total citations and average article citations. While considering total citations, Germany is seen to be the most influential country but Belgium tops the list if average article citations are considered. Among the 15 articles published in Germany found in Scopus, Research in e-HRM: Review and implications by Stefan Strohmeir itself has the highest total citation of 195 among 388 total citations of Germany. It is noteworthy that the most influential author in this research field, Stefan Strohmeir is a professor of Saarland University in Saarbruecken, Germany. On the otherhand though only 1 article, The psychology of talent management: A review and research agenda by Nicky Dries is found in Scopus to be published in Belgium, it has helped Belgium top

the list receiving highest average article citations. The second place has been occupied by USA in terms of total citations and Kuwait in terms of average article citations. Here a captivating fact is that though the first world countries are inclining towards this research and reaching the pinnacle, Canada is at the nadir both in terms of total citations and average article citations.

Figure 7: Country wise analysis

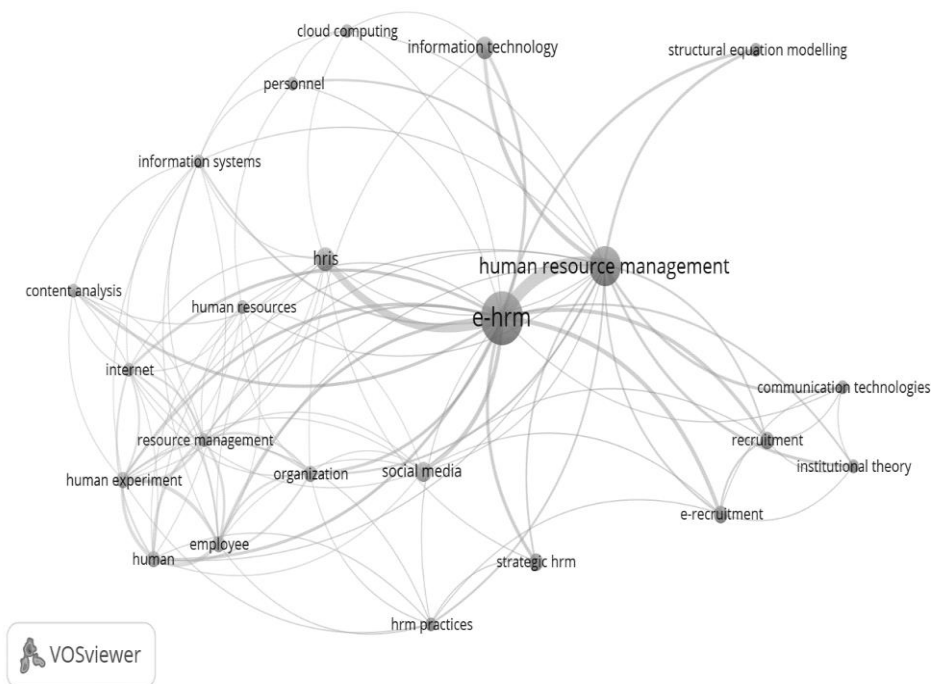


3.9. Conceptual Structure

Keywords provide information about the core contents of any document. The main keywords used in e-HRM research is presented in figure 8 considering a threshold of 3 occurrences from which the most used topics of this research can be identified. The main keyword is e-HRM in cluster 2 and has occurred 78 times. The keywords positioned in the center, human resource management, e-HRM etc. are firmly connected to the rest of the keywords. The red lines that is the cluster 1 shows the keywords which are newly generated and have high strength connection like internet, social media, content analysis, human experiment etc. Among the newly generated high strength words, social media is the mostly used having been occurred 7 times and fully connected with the keywords of cluster 1. As the power of information sharing has been identified by the HR professionals the application of the keyword social media is escalating. (T. Bondarouk, H. Ruël, E. Axinia, & R. Arama, 2013). The widely used theory and method both having occurrence of 3 has been revealed in the cluster 2. Institutional theory is one of the most used

theories (Heikkilä, 2013) and structural equation modelling used for structural relationship analysis is one of the most used methods in the e-HRM research (Al-Ajlouni, Nawafleh, & Alsari, 2019 {Iqbal, 2018 #36}). Lastly cluster 3 contains technology related keywords and shows how they are linked with e-HRM. Cloud computing is mainly connected with the word of its own cluster but information technology is connected with organization of cluster 1 depicting its increasing use in organizations and HRIS being mostly connected with the words of cluster 2 shows that it is associated with the newly generated, high strength words and is in trend. (T. Bondarouk & Ruël, 2013). Thus the findings from the co-occurrence networks of keywords will help in gaining deeper information and the explanation of issues under study.

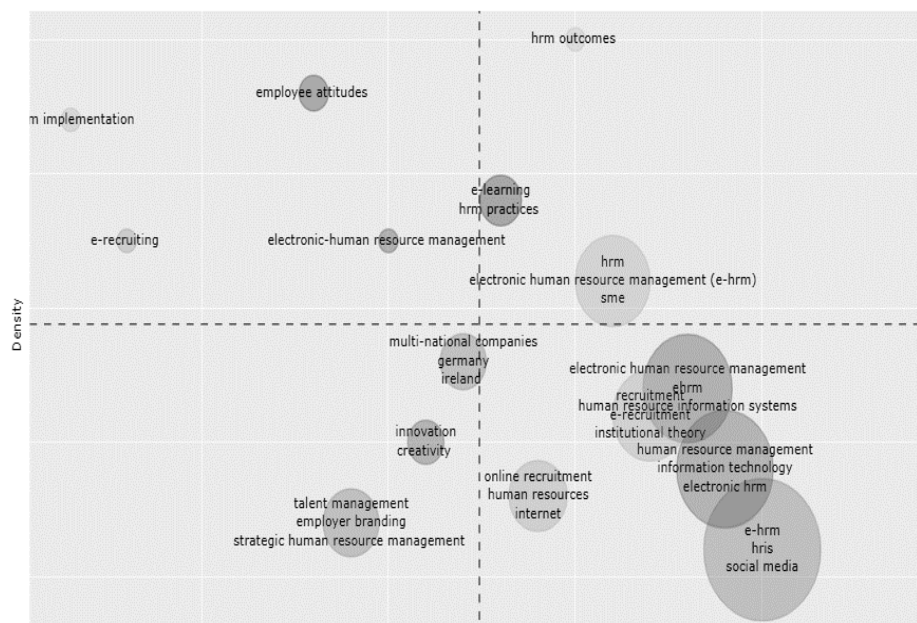
Figure 8: Co-occurrence network of keywords



3.10. Thematic map analysis

The thematic map provides the visualization of 4 distinct typologies of bibliometric analysis based on two dimensions, namely density and centrality. Density is the strength of internal links between all the keywords used to define the theme of the research and centrality is the impact of external links to other themes by leveraging the area of keywords of the authors as shown in the figure. Here the upper right quadrant that is the motor theme which is high in density and has strong centrality is mostly vacant having only 3 small clusters containing keywords like HRM outcomes, HRM practices, Small and medium enterprises (SME) etc. As this quadrant shows the most developed themes, the presence of the keyword SME is an indication of how developed research of e-HRM has been in the SMEs sector.(Bissola & Imperatori, 2013; T. Bondarouk, ter Horst, & Engbers, 2009; Carvalho & Machado, 2016; Hooi, 2006) . The upper-left quadrant shows themes of high density but unimportant external links that suggest its limited relevance to the e-HRM field. The keywords present in this quadrant are employee attitude, e-recruiting etc that is the general keywords used by the authors while analyzing e-HRM.(Mishra & Pavan Kumar, 2019; Ramkumar, 2018; Waheed, Xiaoming, Waheed, & Ahmad, 2019). The lower left quadrant with both low density and weak centrality contains some important keywords including name of some countries like Germany and Ireland which are among the most productive countries for research and talent management, employer branding, innovation etc which are few trending topics in this field. However, being placed in the lower left quadrant recommends that these areas should be prioritized more. It is observable that e-HRM research has focused more on topic specific efficiency rather than country specific ones. Finally, basic and transversal themes are shown in the lower-right quadrant. This arena has the highest and most trending themes as can be seen like online recruitment. HRIS, social media, information technology etc. It is surprising that despite the significance of these keywords in the recent times in e-HRM, these have been positioned in the last quadrant. So, focus should be given in this quadrant for eliminating this literature gap and for improving the quality of research.

Figure 9: Thematic map

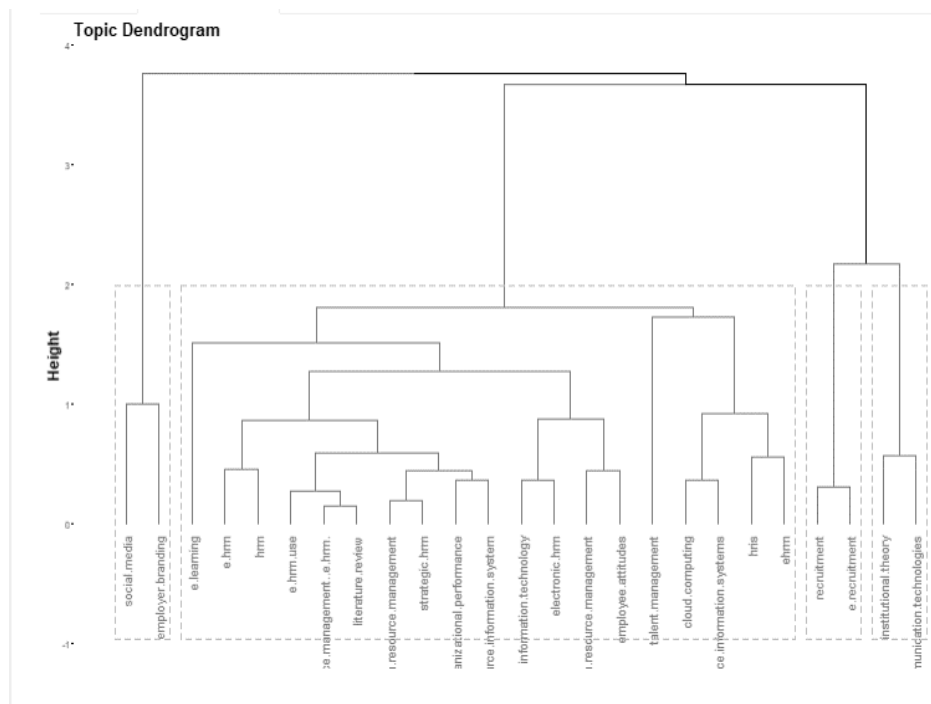


3.11. Conceptual structure analysis

The dendrogram in figure 10 shows the hierarchical relationship between keywords generated as an output from hierarchical clustering. Three relatively small clusters and one large cluster has been demonstrated in the figure with four different colors. The clusters have been formed for illustrating the keywords used together by researchers while describing e-HRM. Cluster 1 or the blue cluster contains words like recruitment, e-recruitment, the most talked about topic of e-HRM as a way to improving communication between job seekers and employers (Sek Khin, Poorangi, & Zahiruddin, 2011). This cluster has joined with the cluster 4 that is the red cluster which accommodates two words. One is institutional theory, a dominant theory in e-HRM research concerning the institutional dimensions affecting e-HRM practices in organizations (Heikkilä, 2013; S. Strohmeier, 2007) and other is communication technology without whose advancement the whole concept of e-HRM would go in vain. These two clusters made a larger cluster joining with cluster 3 having the keywords social media and employer branding. Keywords like social media and employer branding are related in the same way as the words from cluster 1 and 4 are related with the words in cluster 3. This type of

connection is found as social media is not only encouraging communication among employee- employers but also helping in recruiting the right personnel.(Martin, Parry, & Flowers, 2015; Waheed et al., 2019). Lastly the largest cluster that is cluster 2 appears to be discriminant enough to form different clusters within itself. This indicates that the researchers were able to form different clusters among those keywords and the other 3 clusters joining cluster 2 indicates how all these keywords are related.

Figure 10: Conceptual structure map (Topic dendrogram)

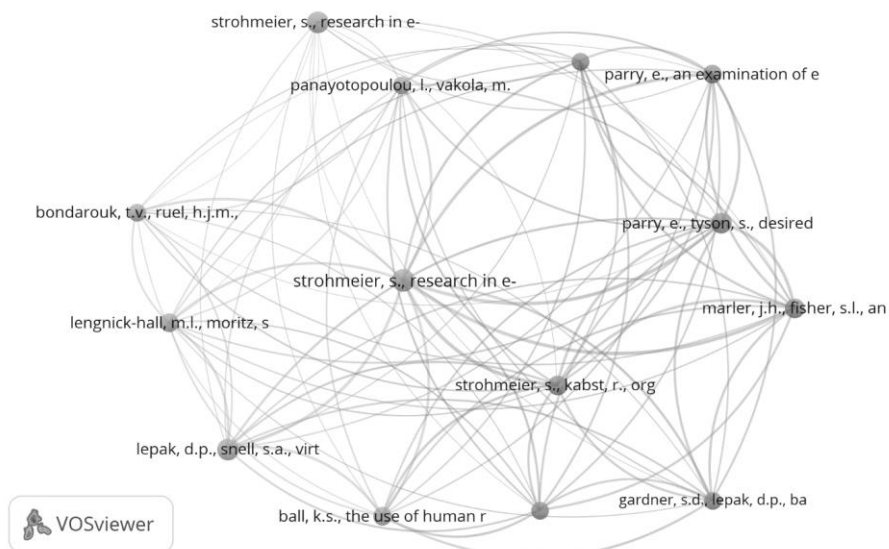


3.12. Intellectual structure

Co-citation is commonly defined as the frequency by which other documents cite two documents together. The more co-citations obtained by two documents, the greater their intensity and the more likely they are to be semantically related. In the figure 11, a co citation network has been shown where out of 8080 references, 14 references have met the criteria for minimum 10 citations of a reference. Two clusters having different colors with a total of 14 nodes representing references having link

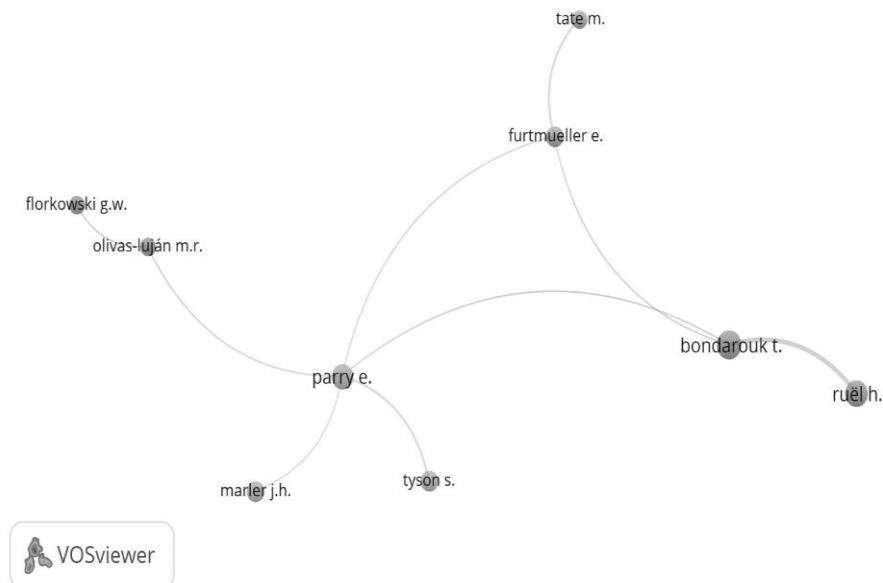
between each other has depicted the co citation among the references. All the nodes are linked with each other revealing that all the documents are co-cited with each other. The biggest node in cluster 1 containing Stefan Strohmeir's Research in e-HRM: Review and implication having the highest citations (30) is considered as the stepping stone for research in this field (Tanya Bondarouk et al., 2017). It has been found that the papers which have been published earlier and served as path finder for future research have been placed in cluster 1 like Virtual HR: Strategic human resource management in the 21st century of David P. Lepak and Scott A. Snell published in 1998, The impact of e-HR on the human resource management function by Mark L. Legnick and Steve Moritz published in 2003 etc. (S. Strohmeier, 2007) . And the papers present in cluster2 are mostly the aftermath of those in cluster1 like An evidence-based review of e-HRM and strategic human resource management by Janet H. Marler and Sandra L. Fisher published in 2013 (T. Bondarouk, E. Parry, & E. Furtmueller, 2017). It can be noticed that most paper of cluster 1 have higher citations but those of cluster 2 has higher total link strength which is evident because the papers of cluster 2 are the outcomes of cluster 1. Thus, the co-citation network gives the idea about how the papers are connected and the advancement of research in this field.

Figure 11: Co citation network of references



3.13. Social structure

Co-authorship analysis shows the collaborative network and is an efficient way to investigate authors' relationships that lead to knowledge development. reveals the collaboration network and is an effective method for exploring relationships among authors that helps in knowledge development (Hu & Racherla, 2008). Geographical and institutional proximity has a major influence on the collaboration network (Ponds, Van Oort, & Frenken, 2007). Figure 12 shows a collaboration network of 9 authors meeting the minimum threshold of 2 documents out of 251 authors. It is found that most authors who have collaborated are either working from the same institutions or are the residents of the same country. Collaboration is found among Tanya Bondarouk and Huub Ruël publishing 8 documents together from University of Twente, Netherlands. Such collaboration is also found between Emma Parry and Shaun Tyson as they are from the same institution, Cranfield School of Management and published 3 documents together. In the figure, 4 clusters can be seen and each cluster deals with the collaboration of an individual author with the others. The cluster 1 shows the collaboration between Emma Parry and other authors like Jannet H. Marler, Shaun Tyson, Tanya Bondarouk and Miguel R. Olivas-Luján. Emma Parry on average has 3 documents with each of them and most of them were published between 2011 to 2013. Diverse documents were published by her while working with different authors, some dealing with the cause while others with the outcomes relating to e-HRM (T. Bondarouk et al., 2017; J. H. Marler & E. Parry, 2016; Parry & Olivas-Luján, 2011; Parry & Tyson, 2011). The second cluster is all about the collaboration of authors with Tanya Bondarouk. Most collaboration is found with Huub Ruel as they are from the same institution as mentioned earlier and their average publication year was 2011 to 2012. Besides many multi authored documents are found to be published by Tanya Bondarouk along with Elfi Furtmueller, Emma Parry, Huub Ruel etc. (T. Bondarouk et al., 2017; T. Bondarouk, H. Ruël, & B. van der Heijden, 2009; T. Bondarouk et al., 2016; Ruël et al., 2007). Lastly, cluster 3 depicts the collaboration of authors with Elfi Furtmueller and cluster 4 with Miguel R. Olivas-Luján. While the average publication year of cluster 3 is 2013-2014, it is 2010-2011 for cluster 4. It is evident that with the passage of time the collaboration among the authors are increasing but the dominance of geographical and institutional proximity is still visible.

Figure 12: Collaboration network

4. Conclusion

The administration's perspective on its representatives began to shift, with companies paying noteworthy attention to human resources along with money-related capital and anticipating that they need workers capable of giving other organizations a decisive competitive advantage. This improvement in the HR practice paradigm is an outcome of e-HRM (Yadav, Yadav, & Malik, 2019). This study focuses on a bibliometric literature review to investigate the status of research in e-HRM review performed on 148 research papers covering almost all subject areas considering the diversification of HRM in all fields. Identifying the literature gap that guides academics and researchers in their prospective research initiatives is the key contribution of this research study. The results primarily provide a diverse analysis of citations and a framework for co-citation and publication patterns from 2004-2019. Along with a temporal analysis and author affiliations, a conceptual structure map and correspondence analysis help to summarize important research findings. From the findings of this report, the contributions of numerous prolific scholars, journals identifying the importance of this topic and a country-

wise participation in pursuing a solution can also be detected. Thus, this study will act as a guideline for researchers and others for figuring out the future research gaps in this field and enable them to work on those.

Like any other studies, this study is also not immune to limitations. Using only Scopus database for searching papers is one of the main limitations. As only a single database has been used it is likely to miss few potential and significant papers relevant to this research. In addition, the studies listed for this research are extensive, but not exhaustive, since they were chosen from the journals mentioned. Therefore, future studies can keep these limitations into mind and can explore further for research in this topic. Analyses of data obtained from the Scopus database offer observations that will contribute to the identification of more clear and vibrant ways of gaining an understanding of e-HRM and its organizational effectiveness. In addition, practitioners are required to learn further about new and emerging sectors involved in this literature and to perform empirical research to provide more precise findings of the proposed context. Besides practitioners will be able to figure out the purpose for using the methods and theories and why those were preferred by researchers. They will be able to contribute more by working on the potential research gaps. Therefore, our research paper will serve as a guide for summarizing all the previous literature in this field and will enable the future researchers to do more tests and analyses for identifying the gaps and findings and contribute to development of society and the country at large.

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