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Analytics Integration in Performance Management: A Bibliometric Analysis

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ABSTRACT: Performance management enables measurement, identification, prediction and retention of resources which are critical to the success of the organization. Literature shows that traditional performance management systems suffer from subjectivity, lack of continuity and ineffective use of data. Application of analytics in performance management function is one variation which has been receiving increased interest in the recent years due to this. This paper explores the integration of HR Analytics (HRA) in performance management function. The study relies on bibliometric analysis to understand the publication pattern, dominating themes and upcoming research trends in this area. Bibliometric data from SCOPUS database is subjected to analysis using VOSviewer. Findings reveal an increase in research activity in this area over the years. Application of analytics in performance management, employee engagement, evaluating training needs and predicting attrition are observed to be the significant topics in the recent years.

KEYWORDS: HR Analytics; HRA; performance management; bibliometrics.

I. INTRODUCTION

Performance management is a core HR function which aids in improving organizational performance by developing the performance of individuals and teams. Still literature shows that traditional approaches to manage performance face challenges like subjectivity, lack of continuity and ineffective use of data. In order to alleviate the shortcomings of traditional performance management systems, a growing number of organizations integrate analytics in this function these days. Along with providing an evidence-based approach to decision making, analytics also helps to make the best use of HR data. This paper adopts a bibliometric approach to explore the works in this area. The data extracted from SCOPUS database is subjected to analysis using VOSviewer to answer the research questions.

II. RESEARCH QUESTIONS

This study aims for an overview of research works in the area of integration of analytics in performance management. The following research questions are attempted to be answered.

RQ1: What is the publication pattern in the research area: analytics in performance management?
RQ2: Which are the prominent themes in this area (areas with maximum research activity)?
RQ3: What are the future areas of research in this theme?

III. METHODOLOGY

Integration of analytics in performance management has been receiving growing interest in research in recent years. This study adopts a bibliometric approach to explore the research works in this field.

According to Pritchard (1969) bibliometric analysis is the quantitative analysis of bibliographic data. It is the statistical analysis of a set of connected documents using several bibliometric indicators which provides a general informative overview of any research area and demonstrates summaries of the trends (Rialp et al., 2017). According to Mariani et al(2022) a growing

number of literature review articles employ bibliometric analysis to measure and map (multidisciplinary) research, to identify leading authors and seminal work (Donthu et al., 2021), and to map novel research trends (Mariani and Borghi, 2019). Recently, this technique has been passed down to diverse disciplines such as management, finance, economics, operations, marketing and psychology, among others. (Merig_o and Yang, 2017; Cheng, 2016; Podsakoff et al., 2008; Tur-Porcar et al., 2018; Laengle et al., 2017; Mart_ınez-L_opez et al., 2018).

The bibliographic data used in this study were collected from the Scopus database. This is because Scopus is the largest abstract and citation database of peer-reviewed academic research literature in the world (Kataria et al., 2020; Norris and Oppenheim, 2007; Zhao and Strotmann, 2015). Scopus is also accepted as an effective database dealing with academic documents worldwide (Kataria et al., 2020; Valenzuela-Fernandez et al., 2019).

IV. SEARCH TERMS AND ANALYTICS SOFTWARE

The SCOPUS database was searched using the terms below as title, abstract and keyword for the period 2011-2023. The language was limited to English. Document types selected were articles, review, book chapter, conference papers, notes.

Table I. Search Terms in SCOPUS

Search term	No. of results
“HR” AND “analytics” AND “performance” AND “management”	127
“HR Analytics” AND “performance AND “management”	67
“HR Analytics” AND “performance management”	9
“HR” AND “analytics” AND “performance management”	16
“Performance” AND “HR Analytics”	105
“Performance analytics” AND “HR”	4

The results were exported as .csv files to MS Excel. After manual cleaning, it was ensured there were no duplicates. The final result had 218 documents. This metadata has been subjected to analysis using VOSviewer software. VOSviewer is an open free software that enables researchers to conduct bibliometric data analysis easily. The use of free software contributes to the transparency, reliability and replicability of the research (Mariani et al.,2022; Antons et al., 2020).

V. RESULTS

A. Publication Trend

To understand the research activity in this area an analysis of publication trend has been done. The following depicts the details of publications, citations, leading authors and contributing countries over the period of analysis.

1).Publications and citations

A total of 218 articles has been published in SCOPUS from the time period 2011 to 2023. Figure 1 shows an increasing trend indicating the growing research activity in this area over the years. A steady increase can be observed from 2020 to 2023. 150 articles are published in this 4-year period. This makes 68% of the total publications. Maximum number of publications (48) is in 2023 making it 22% of the total number of publications. The lowest productivity is in 2014 (0 publications).

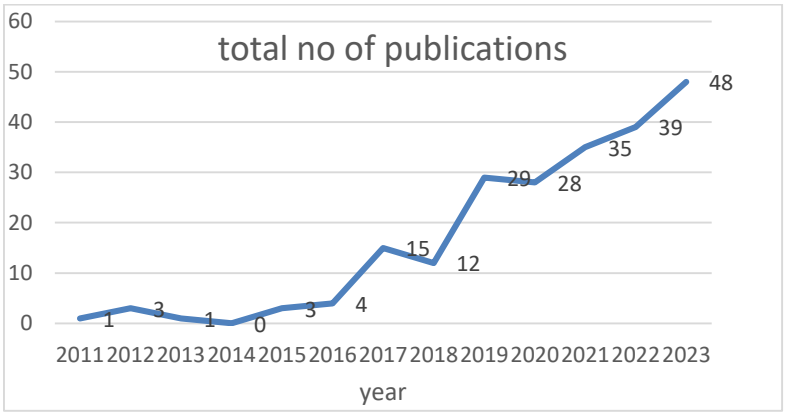

Figure 1. Number of Publications by Year

Table II. Number of Publications and Citations by Year

Year	No. of publications	Percentage	Number of citations	Percentage
2011	1	0.46%	68	2.91%
2012	3	1.38%	181	7.75%
2013	1	0.46%	0	0.00%
2014	0	0.00%	0	0.00%
2015	3	1.38%	10	0.43%
2016	4	1.83%	276	11.82%
2017	15	6.88%	490	20.98%
2018	12	5.50%	140	5.99%
2019	29	13.30%	236	10.10%
2020	28	12.84%	490	20.98%
2021	35	16.06%	309	13.23%
2022	39	17.89%	104	4.45%
2023	48	22.02%	32	1.37%
Total	218	100.00%	2336	100.00%

Table 2 shows 2017 and 2020 report maximum number of citations (490). This is 20.98% of the total citations in the overall period analysed. 2021 has the second highest citation (309) which is 13.23% of the total. 2013 and 2014 have the lowest number of citations (0).

Table III. Information Related to Publications and Citations by Year

Year	No. of publications	No. of citations	No. of publications	Avg citation per publication	Avg citation per cited publication
2011	1	68	1	68	68
2012	3	181	2	60.33	90.5
2013	1	0	0	0	0
2014	0	0	0	0	0
2015	3	10	1	3.33	10
2016	4	276	3	69	92
2017	15	490	12	32.67	40.83
2018	12	140	11	11.67	12.73
2019	29	236	28	8.14	8.43
2020	28	490	27	17.5	18.15
2021	35	309	30	8.83	10.3
2022	39	104	25	2.67	4.16
2023	48	32	12	0.67	2.67

2).Top 10 authors and citations

Table 4 shows the leading authors in this field. Angrave et al (2016) is the most cited author backed by Marler and Boudreau (2016). These two articles contribute to 44.29% of the total citations in the top 10 list.

Table IV. Top 10 Authors and Citations

Sl No.	Title	Authors	Citedby
1	HR and analytics: why HR is set to fail the big data challenge	Angrave, D., Charlwood, A., Kirkpatrick, I., Lawrence,M. & Stuart M.(2016)	266
2	An evidence-based review of HR Analytics	Marler, J. H., & Boudreau, J. W. (2016)	250

3	Three-Way Complementarities: Performance Pay, Human Resource Analytics, and Information Technology	Aral, S., Brynjolfsson, E., & Wu, L. (2012)	177
4	When eliminating bias isn't fair: Algorithmic reductionism and procedural justice in human resource decisions.	Newman, D. T., Fast, N. J., & Harmon, D. J. (2020).	122
5	The questions we ask: Opportunities and challenges for using big data analytics to strategically manage human capital resources	Hamilton, R.H. & Sodeman, W. A. (2020)	83
6	Talent and analytics: new approaches, higher ROI	Harris, J.G. , Craig, E. & Light,D.A. (2011)	68
7	Learning pulse: a machine learning approach for predicting performance in self-regulated learning using multimodal data	Di Mitri,D.,Scheffel, M.,Drachsler,H.,Börner,D.,Ternier,S. & Specht,M. (2017)	61
8	Leveraging technology for talent management: Foresight for organizational performance	Sivathanu B. & Pillai R .(2019)	47
9	Analytical abilities and the performance of HR professionals	Kryscynski, D., Reeves, C., Stice-Lusvardi, R., Ulrich, M. & Russell, G. (2017).	46
10	Organizational capabilities that enable big data and predictive analytics diffusion and organizational performance: A resource-based perspective	Mishra, D., Luo, Z., Hazen, B., Hassini, E. & Foropon, C. (2019)	45

3).Top countries contributing to this field

Table 5 shows top 10 countries contributing to this field of research. India tops the list with 79 publications which accounts to 37% of the total publication. Indian articles also have the third highest number of citations (278). This is 11% of the total citations. United States seconds the list in number of publications (35, 16%) and contributes to the maximum number of citations (972, 38%).

Figure 2 is the map visualization of the top countries contributing to this field. There are eight groups of countries that collaborate. Clusters represent the group of nations that generally collaborate among each other. The size of the node for any country indicates the number of research papers it has produced.

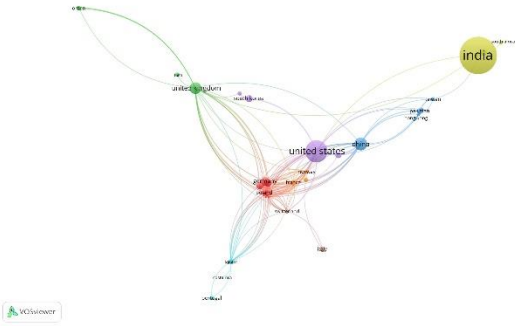

Figure 2. Map Visualization of Top Countries Contributing to This Area

Table V. Top 10 Countries Contributing to this Area

B. Keyword Co-Occurrence Analysis

Sl No	Country	Number of publications	Percentage	Number of citations	Percentage
1	India	79	43.65%	278	13.18%
2	United States	35	19.34%	972	46.09%
3	China	15	8.29%	118	5.60%
4	United Kingdom	13	7.18%	443	21.01%
5	Germany	8	4.42%	29	1.38%
6	Japan	7	3.87%	42	1.99%

7	Australia	6	3.31%	51	2.42%
8	Netherlands	6	3.31%	132	6.26%
9	South Korea	6	3.31%	24	1.14%
10	UAE	6	3.31%	20	0.95%

This analysis was done to understand the existing relationship between topics in the area. Keyword co-occurrence analysis is based on the assumption that the words appearing together are linked to each other by a thematic relationship (Mariani et al., 2022). Co-occurrence analysis including all keywords on VOSviewer produced the visualization in Figure 3. The map visualization helps to understand how keywords and concepts evolved over time. Five groups of research activity were found. Cluster blue has the biggest impact in the map. As the map shows research is most active in the areas of application of analytics in performance, and talent management. Cluster red has the second highest impact. This area is rich with studies that focus on the application of analytics in predicting attrition, training needs and employee performance. Followed by cluster green which deals with studies keen on the application of analytics to understand job satisfaction, employee engagement and retention.

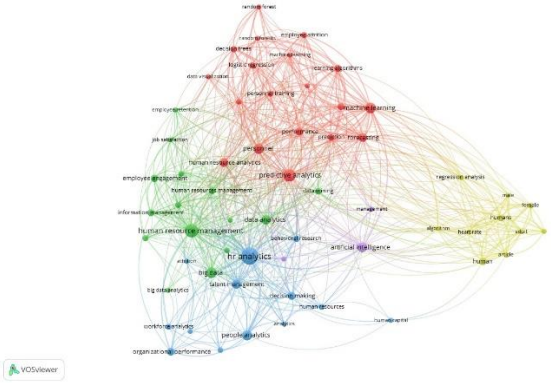

Figure 3. Clusters Identified Through Co-Occurrence Analysis

Cluster 1 (Blue) – HR Analytics, talent management, people analytics, organizational performance, human resources, decision making
Cluster 2 (Red) – human resource analytics, professionals training, employee attrition, performance, predictive analytics, prediction, forecasting, data visualization, learning algorithms
Cluster 3 (Green) – human resource analytics, big data, data analytics, attrition, data mining, employee engagement, job satisfaction, employee retention, information management
Cluster 4 (Purple) – artificial intelligence, management
Cluster 5 (Yellow) – regression analysis, algorithms.

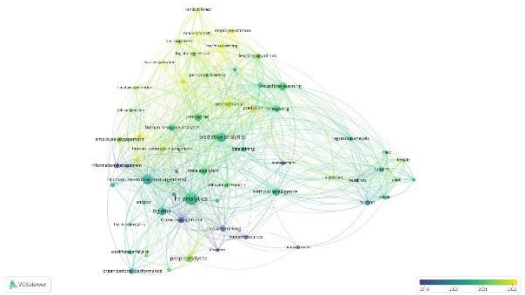

Figure 4. Overlay Visualization of Co-Oocurence Analysis

Figure 4 shows the overlay visualization of the co-occurrence analysis. It can be observed that in the beginning of the period of analysis, more generic studies dominated the research in this area. The research in this period had a focus on HR Analytics as an approach, its benefits to talent management. Other topics include human capital and information management. Later on, studies concentrated on predictive capabilities of analytics especially in organizational performance, employee engagement, training and retention. The transition of nodes from green to yellow demonstrate this very clearly. Recent years show research activity with a focus on predictive analytics and its application in employee performance and attrition.

C .Bibliographic Coupling Network Analysis

To observe the thematic structure of documents, Bibliometric coupling analysis was carried out. A bibliographic couple is a set of two documents sharing one or more common references (Kessler, 1963). Documents forming a bibliographic couple exhibit similar intellectual content (Weinberg, 1974). By bibliographic coupling analysis we can assume thematic similarity, allowing to illustrate the intellectual structure of a research field (Donthu et al., 2021). This analysis also helps to identify the leading researchers and most influential publications. VOSviewer visualized six clusters as shown in Figure 5 which included a total of 76 documents which met the threshold of authors having minimum 5 citations.

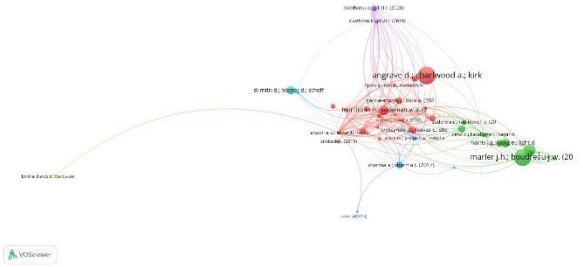

Figure 5. Clusters Identified Through Bibliographic Coupling Analysis

Table 6 describes each cluster and core theme of each. Cluster red consists of 22 articles which constitutes 717 citations, 48% of total citations. The leading themes in this cluster are challenges in integration of analytics, analytics and its impact in HR functions. Cluster green has 11 constituting 588 of citations which is 39% of the total. The main themes include HR Analytics and its impact in HR functions like employee performance management, performance monitoring and talent management. Cluster blue has 5 articles. In this cluster constituting 72 of citations, key themes include application of HR Analytics in performance appraisal, application of HRA in Indian organizations and AI in HR. Cluster yellow has 2 articles constituting 12 citations. Clusters purple and cyan consist of 2 documents each with 31 and 73 citations. The clusters yellow, purple and cyan include works that focus on predicting performance using analytics, machine learning and talent management. The most cited works over the period of analysis revolve around challenges to integration of analytics and the impact of analytics in performance management, performance monitoring and performance appraisal.

Table VI. Clusters and Dominating Themes

Cluster	Core themes	Author	Total citations
1	HR analytics and impact in HR functions, HRanalytics in predicting turnover.	Angrave et al (2016)	266
		Billot and King (2017)	22
		Cayrat and Boxall (2022)	6
		Dahlbom et al (2020)	38
		Garcia and Osca (2021)	37
2	HR analytics and impact in organizational performance, employee performance monitoring, procedural justice and talent analytics	Marler and Boudreau (2017)	250
		Newman et al (2020)	122
		Harris and Light (2011)	68
		Levenson and Fink (2017)	43

		Nocker and Sena (2019)	35
3	HR analytics and performance appraisal, application of HRA in Indian organizations, AI in HR	Sharma and Sharma (2017)	41
		Arora et al (2021)	14
		Patre (2016)	7
		Saraswathy et al (2017)	5
		Rana et al (2018)	5
4		Bonilla and Palos (2023)	6
		Palácios et al (2021)	6
5		Di mitri et al (2017)	61
6		Sivathanu and Pillai (2020)	31
		Yuan et al (2021)	12

D. Co-Citation Analysis

This analysis was done to identify the relationships among cited publications to understand the evolution of fundamental themes. Co-citation analysis is a reliable technique to make sense of the connections among documents in the reference lists across publications in a literature base (Zupic and Cater, 2015). As Figure 6 shows VOSviewer visualized five clusters.

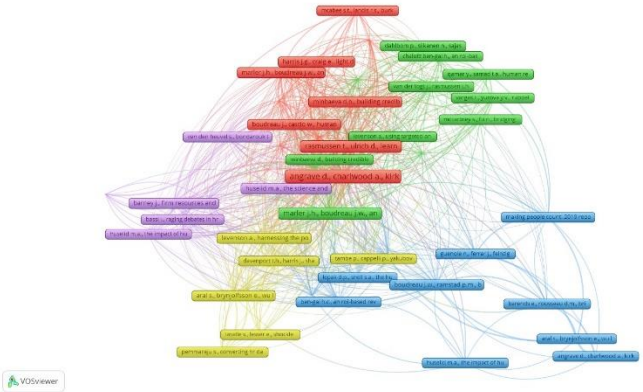

Figure 6. Clusters Identified Through Co-Citation Analysis

Cluster 1 – (Red) This cluster has 14 articles. The core themes revolve around how HR Analytics can be implemented to enhance decision making and the challenges in its implementation. It can be observed that research focus here is a general understanding of what HR Analytics is, the benefits of its implementation and challenges in its integration.

Cluster 2 – (Green) This cluster has 12 articles. The core theme in this cluster is practical implementation/adoption of analytics. This extends to application of analytics in areas like organizational performance, performance management, performance appraisal and talent management.

Cluster 3 - (Blue) This group has 11 articles. The focus here is impact of analytical implementation in HR, in areas like turnover, productivity, performance and pay.

Cluster 4 – (Yellow) This group has 8 articles. Predictive analytics, talent analytics and application of AI to enhance decision making are the key themes here.

Cluster 5 – (Purple) Includes 8 articles mostly into futuristic perspectives on HR Analytics.
The thematic evolution in this area started from defining what analytics is and what are the benefits of using analytics. Over time the focus moved to integration of analytics, challenges to integration, application of analytics in performance management and performance appraisal. Emerging themes in this area is found to be application of predictive analytics and AI to maximize the benefits of analytics-based decision making.

VI. MAJOR FINDINGS AND DISCUSSION

An increasing trend can be observed in the area of integration of analytics in performance management over the period 2011 – 2023. A total of 218 publications were published in this period. 68% of the publications were published in the year range 2020 to 2023. Co-occurrence analysis of keywords and their overlay reveals an evolution of topics from generic HRA studies to the application of analytics in specific HR functions including its predictive capabilities. At the beginning of the period of analysis, more generic studies dominated the research in this area. Later on, studies concentrated on the predictive capabilities of analytics especially in organizational performance, employee engagement, training, and retention. Recent research activity has a focus on predictive analytics and its application in employee performance, and attrition. Bibliographic coupling analysis shows the most influential works over the period analysed. The leading themes addressed in these papers include the impact of analytics in specific HR functions, challenges to the integration of analytics, application of analytics in performance management, performance monitoring, performance appraisal, and talent management. A co-citation analysis was also conducted which reveals the evolution of themes in the area of analytics integration in performance management. The various themes evolved from defining what analytics is and what are the benefits of using analytics. Subsequently, the focus moved to the integration of analytics, integration challenges, and application of analytics in performance management and performance appraisal. Emerging themes in this area are found to be the application of predictive analytics and AI to maximize the benefits of analytics-based decision-making.

Even though the period analysed marks an increasing research activity in the area of integration of analytics in performance management, various challenges to this integration have also been pointed out by studies. Lack of skillset in HR professionals has been one challenging factor emphasized throughout the period of analysis (Cayrat and Boxall,2022; Visier, 2021; Angrave et al, 2016; CIPD,2013). This includes poor statistical and technical skills. A frequently studied variable in analytics adoption is 'fear appeals' and many times it was found to be a challenging factor. The fear of losing their jobs due to less analytical competence negatively affects the attitude of HR professionals in integrating analytics in the first place. The dearth of business acumen of HR professionals (Marler and Boudreau, 2016) also leads to a low understanding of pragmatic nuances of analytics. These factors contribute to a decreased trust in analytics-based findings and drive managers to rely on their intuitions for decision-making. Also, low proficiency in analytics creates a handicap in asking the right questions even when there is a lot of data at the disposal of the HR team.

The unavailability of centralized data is the second most prominent challenge that came up from the studies (Ramachandran et al, 2023; Hamilton and Sodeman, 2019; McIver et al., 2018; Roberts, 2016; Angrave et al, 2016). Silos mentality, insufficient support from top management, and lack of collaboration from line managers are found to be the key reasons for this. Employee data is not just what is captured by the HR department. It is also captured by other departments like marketing, sales, operations, and customer feedback. HR Analytics by itself is cross-functional in nature. The inability to collate data from various departments limits proper analytical integration. In recent years, the absence of a data-driven culture in organizations has been a significant challenge emphasized by studies (Ramachandran et al, 2023; Ekka and Singh,2022). A strong data-driven culture is characterized by data sharing, adoption of technology, and having more change champions (Ramachandran et al, 2023). An organizational culture that is weak in the data-driven context negatively affects the integration of analytics.

A.Practical Implications

Since lack of analytics-related competencies among HR professionals are found to be the prominent challenge, upskilling and training programmes in statistics, technology and analytics have to be designed and delivered as a priority. The need and significance for analytical integration have to be conveyed to HR professionals in such a way that it doesn't trigger job insecurities. To nurture a data-driven culture in the organization, stakeholder collaboration has to be made possible. All stakeholders – top management, middle-level management, line management, employees and HR professionals must be convinced of the value of analytics in enhancing their respective jobs. One of the options in this regard is ensuring better access to data by these stakeholders. Though many organizations use data management platforms, it is realized that the access and integration of data remain to be improved. Finally, for smooth integration of analytics, HR has to be able to design and implement change strategies and manage resistance to change. Another option is encouraging organizations to document their analytics-related practices more rigorously.

B.Recommendations for Future Research

It was found that studies that empirically measure the impact of analytics in performance management function are limited in number. Future research can address this gap. There is also a need for studies that design and recommend change strategies for the effective implementation of analytics. This will help make analytical integration agreeable to a larger number of stakeholders. The application of predictive capability of analytics is a topic which is receiving growing interest in recent years. Future research can also explore the impact of predictive and prescriptive analytics in various HR functions including performance management.

VII. CONCLUSION

This study explored the application of HR Analytics in performance management. It was found that research activity in this area is increasing. The focus of the studies has evolved from exploring the benefits and impact of analytics to the application of the same in performance management. Recent studies are keen on the application of predictive analytics in employee performance, attrition, training and retention. Undoubtedly analytics as a domain continues to expand in terms of stakeholders, methods, and outcomes. However, various challenging factors have also been present which have been slowing down its integration to the expected levels. As Oracle (2021) reports only 15% of the firms are analytically mature (uses predictive and prescriptive analytics) while 68% of organizations are still using descriptive analytics. For a strategic function like performance management to be effective, descriptive, predictive and prescriptive analytics should be utilized. Overcoming these challenges will help more organizations to address this 'capability gap' (Deloitte, 2014) and pave the way for HR to be ultimately strategic.

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