Review

Intellectual capital and human resources: A 26-year thematic systematic review

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Abstract: Intellectual capital is the sum of whatever organization resources that contribute to value and competitiveness of a company. Though some metrics have been developed for measuring individual and collective capabilities, from Human Resources point of view, it is difficult to translate the concept of “intellectual capital” into, for example, financial terms. To better understand the field, the aim this study is to draw a thematic analysis on the relations between Intellectual Capital and Human Resources. We provide an overview of publications and their course in this subject. We accessed two widely used databases (Scopus and Web of Science) to produce the review. We set a period of 26 years marked by the subject’s theme entry. In order to handle duplicates, we used RStudio Software and to manage the data we used Bibliometrix package tools, said: biblioshiny and thematic map. Our analysis revealed how intellectual capital and human resources are important for generating value in organizations. Some results explores innovative ways of managing these resources, such as integrating technological, commercial, organizational and cultural aspects, using dynamic systems modeling, investing in long-term strategies and in education and training, and studying the relationship between green intellectual capital and green human resources management.

Keywords: intellectual capital; human resources; systematic review

1. Introduction

Intellectual Capital (IC) shapes the results of companies (Adelman, 2010; Ahuja et al., 2013; Olander et al., 2015; Liu et al., 2022). Its conceptualized as the total stock of intangible assets, knowledge, capabilities and relationships associated with organizational valuation (Nahapiet and Ghoshal, 1998; Rehman et al., 2020). Some authors order IC through its dimensions, such as structural capital, innovation capital and process capital. These dimensions are considered alongside traditional production resources, said: capital, labour and land (Cappellin, 2003; Ţefănescu-Mihăilă, 2015). On top of that, IC plays a crucial role to human resource management. Human resources (HR) deal with a large amount of resources, with different measuring tools to convey as many facets as possible in understanding and setting IC (Tinelli et al., 2016).

According to Adelman (2010), an essential and strategic role of Human Resources management is to capture the IC and the organizational insights that derive from it. The author suggests that IC involves different types of knowledge, such as data definitions, business processes and rules, specialized technical procedures, fit with the organizational culture, management styles, relationship history with customers and suppliers, and information flow in the organization. So, to further explore this relationship between IC and HR through a chronological and thematic
approach, we take Donthu et al. (2021) contributions to propose a thematic analysis of a systematic review carried out on two databases. We accessed Scopus for emphasis on research papers specific to management field and Web of Science for a broader approach that encompasses the human and social sciences in general. We used a group management method proposed by Cobo et al. (2011) in which we created a graphical representation that displays thematic elements based on the density of the network’s strength in terms of keywords or themes, and centrality of the level of interaction between the networks. This enabled “core themes” identification, which includes the most studied themes and the ones which generated more scientific output.

Our aim is to draw a thematic analysis on the relations between Intellectual Capital (IC) and Human Resources (HR), by which we can provide an overview of publications and their course in the last 26 years. This review contributes to highlight and delineate a growing field of research, which involves the challenges and possibilities to the understanding and management of IC through HR practices.

In the following Methods section, we describe the processes of data gathering, filtering and thematic analysis. We also describe the tools used to operate the data. The Results section is divided into two parts. We start by presenting an overview of the research field, its main contributors and most cited papers. Then we engage in a thematic and chronological analysis of the research papers which make the cut for our aim at the intersection between IC and HR. The final section summarizes the findings, highlighting the value generation ability of the theme.

2. Method

Scopus and WoS (Web Of Science) databases are frequently used in bibliometrical studies (e.g., del Barrio-García and Prados-Peña, 2019; Rojas-Lamorena et al., 2022). Scopus is a reliable source for research in the field of Management, while Web of Science approaches more broadly the human and social sciences field. By this, we understand the bibliometric research involving both these databases provide an interesting combination for the purpose of this review. We were able to reach the theme in its specific relation to management and further, in its appraisal by a more general approach in human and social sciences. We used a survey overview query in the main collection of WoS and Scopus considering the database entire reference period. For this, the WoS “ALL” field and the Scopus “TITLE-ABS-KEY” field were used. And through the existing literature on the subject, we defined the following boolean argument:

(“intellectual capital”) AND (“human resource*”)

We used an ‘asterisk’ to include both singular and plural mentions to “human resources”, also for disambiguation and broadening of the results. Our goal is to work with “intellectual capital” and “human resources” intersection points. The results shows that the first publication enlisted in the query dates from 1997. With that, we established the period for the analysis from 1997 to 2023, the last 26 years. We filtered the results to show only peer reviewed journal papers. We believe the journal papers represent the most up-to-date source of information in the academy (del Barrio-García and Prados-Peña, 2019). The obtained data consists of 284 articles on WoS and 329 articles on Scopus. To check for duplicates in the merging of the WoS and Scopus
bases we used the R language through RStudio interface. Doing so, we removed 94 articles and the remaining articles were exported into a single XLSX containing 480 documents. As scanning may not be fully efficient, the spreadsheet was manually checked using the DOI link. The final selection consisted of 475 scientific articles with 1170 authors and 1026 keywords, both refined results and individual per database are available for readers (https://osf.io/h8ewv/?view_only=a291fb78bc28495792db7736b2c331fc).

**Analysis tools**

The bibliometrics research brings together a variety of studies that address a specific topic within the limits of more than one domain of knowledge. When it comes to big data, the bibliometrics technique is best for making quotation analyses, exploring the intellectual structure of domains and providing a subjective and objective analysis (Donthu et al., 2021). We used biblioShiny through Bibliometrix on R Studio software to create the list of analytic items.

After reviewing the field’s chronological and descriptive perspectives, we used the thematic mapping to generate a thematic structure. We then applied a group management method suggested by Cobo et al. (2011). The methodology consisted in creating a graphical scheme that shows the thematic elements based on density (quantity of articles), disposed vertically and, horizontally, centrality (quantity of quotes). Density shows the strength of the network in terms of keywords or themes, while centrality shows the amount of interaction between the networks. This allows for capturing “motor themes”, which sets, in the high density and high centrality quadrant, both the most researched and the ones which attracts more scientific production, and, in the low density and low centrality quadrants it presents the emerging problems and less frequent issues. The upper left quadrant has high density and low centrality. It presents problems developed internally, but isolated, or without connection to other networks. Core themes covering multiple areas of knowledge are also represented in the lower right quadrant, which is central and low density.

In addition, we also applied a co-word analysis, a tool capable of identifying, describing and visually illustrating the interactions between keywords in a scientific field. This tool enables evaluation of the frequency in which two keywords are viewed together. It calculates the amount of documents, like our articles, in which these words are associated.

**3. Results**

**3.1. Course of the scientific production**

From its first entry in 1997, according to the gathered data, the subject of IC in relation to HR remained active throughout the years, with overall growth, specially in the last five years. **Figure 1** confirms what was mentioned above.
Five authors published the most over the period. The list, hierarchically starting with the one who contributed the most, in volume, consists of (1) Nick Bontis of the De Groote School of Business, McMaster University, Hamilton, Ontario, Canada; (2) Yusliza Mohd, of Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia; (3) Tanya Bondarouk from Universiteit Twente, Enschede, Netherlands; (4) Nadeem Akhtar Khan of the University of Kashmir, India. Finally; (5) Eric Kong from the School of Management and Enterprise, Faculty of Business, Education, Law and Arts and University of Southern Queensland, Toowoomba, Queensland, Australia.

Among the five most quoted articles (Table 1), only Nick Bontis is listed. He is the second, third and fourth most cited. Bontis studies intellectual capital, knowledge management, human capital measurement, disruptive technology and knowledge worker productivity. Among the most cited papers, his contributions lean toward management field, mainly on intellectual capital. The first most cited study approach an investment and return perspective, while the fifth discusses human resources management and intellectual capital through ambidexterity learning approach.

Table 1. 5 most cited works (2002–2022).

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<th>Document</th>
<th>Title</th>
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<tr>
<td>Youndt MA, 2004, J MANAGE STUD</td>
<td>Intellectual Capital Profiles: An Examination of Investments and Returns</td>
<td>770</td>
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<td>Bontis N, 1999, INT J TECHNOL MANAGE</td>
<td>Managing organisational knowledge by diagnosing intellectual capital: framing and advancing the state of the field</td>
<td>612</td>
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<tr>
<td>Bontis N, 1999, EUR MANAGE J</td>
<td>The knowledge toolbox: A review of the tools available to measure and manage intangible resources</td>
<td>569</td>
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<tr>
<td>Bontis N, 2002, J INTELLECT CAP</td>
<td>Intellectual capital ROI: a causal map of human capital antecedents and consequents</td>
<td>480</td>
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The co-occurrence of thematic terms (Figure 2) provides a comprehensive overview of the possible areas and most researched topics. In this case, three thematic groupings have been identified over twenty-six years. Although “human resources” appears in the three groups, blue cluster (top-left) focuses on companies; while the
green cluster (middle-left) focuses on issues related to human capital. The red cluster (bottom-right) focuses, mainly, on educational issues.

Figure 2. Co-occurrence of thematic terms.

3.2. Thematic analysis

We used the visual information provided by Biblioshiny tool to present a timeline of the topics throughout the period, as illustrated in Figure 3.

Figure 3. Thematic map of the total period (1997–2023).

The pink cluster located in the “Niche themes” quadrant, top left, indicates that the intersection between IC and HR is still an isolated subject, as it deals with two very specific themes. However, the cluster is also well placed in terms of density, indicating a good audience for the topics (Cobo et al., 2011). Its position in the scheme highlights a strong debate, more noticeable when associated with human resources management. Since the aim of this paper is to investigate the relation between IC and HR, the pink cluster represents the basis for the thematic analysis. Out of the 475 articles, 45 are associated with this cluster. We filtered and read all the content of 23 articles, including title and summary, specifically directed to theme of the present review.

We opted for a chronological analysis to verify the thematic fluctuations and the innovations throughout the years. We assume that if the interest upon a topic presented in the initial years reappears in recent years, it could indicate a development to attend
new demands. Also, if a topic shows only in recent years, it indicates innovation on the field. From 1999, there are papers on the relation between IC and HR scattered along the years, with a peak of three articles in 2021. During the specified years of 2000, 2001, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2013, and 2019, the topic remained unexplored in the literature.

The 1999 article analyzed is titled “Managing organizational knowledge by diagnosing intellectual capital: framing and advancing the state of the field”. This research shows intellectual capital as a diverse field encompassing several perspectives, including balance sheet measurement, system coding, power balance, mental development, ROI calculation and construction through training and development. According to this study, human capital is a crucial component of intellectual capital as it contributes to innovation and strategic renewal. The authors also show that human resources are an important component of intellectual capital, contributing to innovation and strategic renewal. Human capital, represented by intelligence, skills and experience of the organization members, is a fundamental aspect of human resources. It is difficult to measure and codify human capital, but in return it provides sustained competitive advantage for it adds value, uniqueness and cannot be easily imitated or replaced by concurrent companies. Human capital is considered a source of strategic innovation and renewal, and it plays a crucial role in organizational success. The article also highlights the contributions of human capital to individual learning, which is a prerequisite for organizational learning and human resource management (Bontis, 1999).

In 2002, the article titled “Practical Aspects of Knowledge Management” take a more specific emphasis on intellectual capital and human resources and its contributions to knowledge management. The authors suggest that organizations in the “Internet age” should take advantage of their highly qualified, skilled and experienced employees to enhance intellectual capital. The authors argue that next-generation business solutions should focus on adding knowledge-rich components to the workflow to create value. The paper also emphasize the need for strong human resource management practices to integrate technological and commercial sides, and tackle organizational and cultural issues.

“Dynamics of human resource and knowledge management” is a 2003 article which discusses the importance of intellectual capital and human resources to knowledge economy. It shows that intellectual capital is identified as a valuable resource for knowledge economy, contributing significantly to organization evaluation. According to this paper, companies are recognizing their employees as the most valuable asset and are finding ways to measure and manage the intangibles of skills, knowledge and information. The study proposes an Analytical Hierarchical Process (AHP) method to help companies identify their key capabilities using financial and non-financial measures, such as learning and innovation. The dynamics of recruitment, training and management of skills and knowledge are illustrated in a form of causal cycle, and strategies for human resources management are developed using dynamic systems modeling. The article suggests that understanding the dynamics of recruitment and training is essential to developing an effective strategy for managing intellectual capital, then, modeling system dynamics can help organizations develop efficient human resource management strategies.
Another research published in 2003 titled “Territorial knowledge management: towards a metrics of the cognitive dimension of agglomeration economies” discusses intellectual capital as knowledge and information within the organization, but outside the individual employees. It is also closely linked to organizational capital and external to individual companies, but internal to a cluster or region. The authors apply a three-dimensional categorization differentiating structural capital, innovation capital and process capital. These dimensions are considered alongside traditional resources of production, such as capital, labour and land. In this paper, intellectual capital is mainly produced by companies for their internal use and its value is measured based on the cost of replacement or in the additional contribution it brings to the company returns. In this sense, human capital, which refers to the knowledge and skills of each employee, is an important component of intellectual capital leading to innovation gain. In conclusion, efforts to strengthen human resource through transferring and learning can be an effective way to stimulate knowledge and innovation (Cappellin, 2003).

Published in 2011, the article “The effect of intellectual capital on employees’ satisfaction and retention” examines the effect of intellectual capital on employee job satisfaction, then it identifies two human resource management practices that have a positive influence on intellectual capital. The research conducted a survey involving 1117 employees within a Italian corporation operating in the food market. The structural equation modeling results showed that intellectual capital positively affects employee professional attitudes, although differences have been observed between the three dimensions. Specifically, human capital and relational capital did not directly affect employee satisfaction and retention in the work, according to the hypothesis; these relationships were entirely mediated by structural capital. The study also identified two measures of human resources management practices, communication and alignment, which positively influenced intellectual capital and contributed to improved employee satisfaction and retention in work. The study provides understanding for managing design and implementing intervention programs and policies to intellectual capital effective management (Longo and Mura, 2011).

“Prioritization of intellectual capital indicators in knowledge-based industries: Evidence from pharmaceutical industry” published in 2012 deals with intellect capital and human resources in knowledge-based industries. The discussion proposed states that intellect-based capital (IC) and intangible assets are considered critical tools for successful business in know-how industries. It highlights the importance of prioritizing intellectual capital indicators in knowledge-based industries and that human capital is a key component of intellective capital, playing a crucial role in innovation, organizational competitiveness and economic performance in knowledge-based environments. In the paper we also find that human capital includes knowledge, skills, innovation and ability to perform tasks. The authors suggest that organizations need to recruit, cultivate and retain talent to expand their knowledge base and improve overall productivity. They mention there is a need for reliable indicators to measure and report information on human capital, and effective management of human capital creates and sustains the wealth and competitive advantage of a company. In conclusion, the paper suggests that the development of a robust human capital indicator can provide value for a company and its stakeholders and encourage greater private
investment, contributing generally also to human resource management (Mehralian et al., 2012).

Also from 2012, “Cloud computing and human resources in the knowledge era” states that intellectual capital refers to the sum of the knowledge, skills and experience of employees, which contribute to the achievement of competitive advantage, being considered an asset when employees use their specific knowledge to create economic value for organizations. The study proposes a conceptual framework that combines cloud-based HRMS, knowledge management (KM), intellectual capital (IC), innovation and performance. This structure aims to enhance organizational innovation and increase intellectual capital by leveraging cloud computing in HRMS. The author points out that cloud computing, as a new trend in information technology, offers innovative solutions to help companies significant savings in managing human resources, however, this also creates challenges for human resources professionals, requiring them to change their skill sets and tasks. The article emphasizes the importance of knowledge networks and IT-supported interaction to increase intellectual capital and promote innovation (Yeh, 2012).

In 2014, “A multi criteria method for environmental management system selection: an intellectual capital approach” introduces a decision-making approach that integrates and quantifies financial and non-financial value creation criteria. The goal is to identify the alternative that maximizes the total market value of a company. The evaluation method combines four sources of value creation inherent to profit-oriented firms. It draws upon the tripartite dimensions of intellectual capital value—human, structural, and relational. The objective is to prioritize the array of alternatives within the environmental management system. This prioritization is based on the market value each alternative generates. In this paper, Intellectual capital (IC) includes all non-monetary and non-physical resources that are fully or partially controlled by the organization and contribute to the its value creation. These intangible assets related to knowledge have a positive impact on competitiveness, business performance and market value. Because of that, human resources are considered a key component of intellectual capital and are recognized as a crucial indicator for future financial performance (Guerrero-Baena et al., 2014).

The article “Social Investment, Economic Growth and Labor Market Performance: Case Study—Romania” published in 2015 states that intellectual capital includes three elements: human capital, structural capital and relational capital. It claims that human capital is a component of intellectual capital and it is defined as “knowledge existing in an organization that can be a competitive advantage” or “known that may be converted into value”. The research also highlights the importance of human resources to production processes and to the success of a company. It emphasizes that modern organizations need to rethink their strategies, make long-term investments and invest in people. This suggests that success and survival in the market depends heavily on understanding the importance of human resources and that managers should be aware of this. Furthermore, the article mentions that education is considered as means for accumulating human capital, and a higher level of training can increase the flexibility of the workforce and a better adaptation to the conditions of the labour market (Ștefănescu-Mihăilă, 2015).
Also published in 2015, “Prioritizing (ranking) of indexes for measuring intellectual capital using FAHP and fuzzy TOPSIS techniques” states that human resources are considered strategic competitive resources, invested in similar tangible assets, being an essential component of intellective capital, covering knowledge, skills, intellect, relationship, attitude, talent and behavior of employees. Human resources brings that human capital is the main body of intellectual capital and includes the knowledge, experience and special skills of the staff employed in a commercial entity to create economic value and that it is a holistic concept that represents the resources and assets related to the people of a company. In the context of measuring intellectual capital, the paper brings that human resources are categorized into several sub-scales, such as staff competence and communication values and skills. The authors suggest the priority of human resources is important, and that different studies have identified various factors, such as knowledge and competence, experience, teaching, leadership ability, problem-solving ability and more.

Published in 2016, “Embedding semantics in human resources management automation via SQL” shows that intellectual capital plays a crucial role in human resource management. Human resources management processes deal with a large amount of resources, amongst them the peculiarities of intellectual capital require expressive representation languages to convey as many facets as possible. The approach presented in the article combines the representation power of a logical language with the efficiency of a DBMS information processing to deal with human resources management tasks. With the information available, it can be inferred that intellectual capital is an important asset in human resources management, and the approach proposed by the authors aims to effectively manage and use intellectual capital in human resources processes (Tinelli et al., 2016).

The 2017 “Impact of the Educational Attainment of the Knowledge Management Process in Serbian Textile Enterprises” research paper discusses that intellectual capital, including knowledge and information, is considered crucial for economic development and national progress. In fact, this research defends intellectual capital as more important than tangible assets, such as capital or labour. The authors state that human resources play a significative role in the development and application of knowledge management in Serbian textile companies. Furthermore, they mention that the educational level of employees have significant impact in dimensions such as organizational culture, knowledge acquisition process and competitive advantage. It also shows that inadequate knowledge and skills among employees are identified as common problems in the Serbian textile industry. In addition, they emphasize that the proper management of staff characteristics, including their educational level, is important for the development and application of knowledge management, leading to increased productivity and competitiveness. According to the paper, organizational culture is a key factor in supporting cooperative innovation and knowledge sharing. They also suggest that overcoming cultural barriers is essential for effective knowledge management, and organizational culture is considered a significant obstacle to this (Zakin et al., 2017).

In 2018, the article titled “Developing a measurement instrument of knowledge management implementation in the Iranian oil industry” also discusses that intellectual capital is an important component of the implementation of the knowledge
management, but this paper aimed at an Iran’s oil industry instead of the textile market. According to Ghasemi and Valmohammadi (2018), intellectual capital consists of human capital, market capital, structural capital and social capital for the organization. That is, for the authors, human capital is considered unique in each organization and depends on educational level, experiences, professional skills, attitudes, values and ability to learn and to adapt to change. The article states that human resource management is identified as one of the critical success factors in implementing knowledge management in the Iranian oil industry, with the success of it depending on the constituent elements of intellectual capital, including human capital. Therefore, the proposed measurement instrument for the implementation of KM in the Iranian oil industry includes factors such as human resource management, indicating the importance of human resources in the context of knowledge management (Ghasemi, and Valmohammadi, 2018).

Also published in 2018, “Nexus Between Green Intellectual Capital and Green Human Resource Management” examines the relationship between green intellectual capital and green human resource management. The paper uses a quantitative research approach and a mailing survey to gather information from 112 large manufacturing companies in Malaysia. The results indicate that green human capital and green relational capital have a significant influence on green human resource management. However, green structural capital is not significantly related to green human resource management. The article identifies three dimensions of green intellectual capital: green human capital, green structural capital and green relational capital. This suggests that these dimensions have an impact on green human resource management. The study uses the Intellectual Capital-Based Vision Theory as a theoretical basis to explore the link between green intellectual capital and green human resource management (Yong et al., 2018).

In 2020 we have another pair of papers, the first one titled “Analyzing the relationship between green innovation and environmental performance in large manufacturing firms” deals with green intellectual capital and green human resources management. The study suggests that the green intellectual capital is described as the total stock of intangible assets, knowledge, capabilities and relationships associated with environmental protection or green innovation observed at the individual and organizational levels of a company. It is expected to be positively related to green innovation and environmental performance in enterprises. On the matters of green human resources management, the authors state that advanced practices can motivate an organization to develop and leverage its green intellectual capital and enhance its green innovation. Thus, green human resources management includes practices such as post analysis, recruitment, selection, training, rewards and performance evaluation. Therefore, they conclude that the relationship between the constructs and environmental performance is more complex than previously suggested, with green innovation mediating the relationships between green intellectual knowledge, green human resources management and ambient performance (Rehman et al., 2020).

The other research published in 2020 is “Managing employee engagement in the strategy implementation process: The case from the natural gas industry” states that intellectual capital is a set of non-monetary and intangible resources that directly influence the growth of the value of an organization. It includes elements such as
human capital, structural capital, relations capital and organizational culture. Chadam and Turkyilmaz (2020) suggests that the development of all intellectual capital elements—including human resources—is strongly associated with a high level of employee engagement in the business of the company. The article emphasizes the importance of employee engagement to the company’s goals, including the effective implementation of a new investment strategy and plan, and that positive changes in employee involvement are translated into excellent financial results and opportunities for further development. The analysis of the results of the survey in the present case concludes that the implementation of innovative projects, such as the company strategy, would not have been possible without a significant increase in employee engagement in the organization. This highlights the crucial role of human resources in achieving organizational goals. Therefore, the article suggests that future projects should consider employee diversity, mainly in terms of age and gender, to identify appropriate human resources practices and further increase employee engagement.

Moving to 2021, the research paper “An inclusive systematic investigation of human resource management practice in harnessing human capital” reports that intellectual capital is identified as one of the main business problems that companies are currently facing, along with technology, globalization, profitability through expansion and change. It suggests that human resources management is responsible for solving these business problems and collaborating with companies to create new skills. The study states that the new human resource management involves bringing together the management of the organization and the workers, merging their knowledge reservoirs for joint success. Thus, it is seen that human resources experts aim to influence the business world and to take on a proactive role in addressing globalization challenges. The study aims to understand the role of human resource management in the development of national talents for global success, indicating the importance of human resources in the exploitation of intellectual capital (Rajput et al., 2021).

The study “Green human resource management practices and environmental performance in Malaysian green hotels: The role of green intellectual capital and pro-environmental behavior”, published in 2021, discusses green human resource management practices such as ecological training and development and ecological disciplinary management. According to the authors, these are significant predictors of green intellectual capital and pro-environmental behavior in Malaysian green hotels. The study suggests that ecological training and development are a key practice for building intellectual capital and promoting pro-environmental behavior. It also cites that green intellectual capital plays a significant role in mediating the relationship between green discipline management and pro-environmental behavior, as well as between green recruitment and environmental behavior. In addition, it mentions that pro-environmental behaviors are significantly related to hotel environmental performance and also mediate the relationship between green intellectual capital and environmental performances. Overall, the article highlights the importance of integrating green human resource management practices with green intellectual capital and pro-environmental behaviors to improve hotel environmental performance (Nisar et al., 2021).
The 2021 article is titled “A study on the intellectual capital management over cloud computing using analytic hierarchy process and partial least squares”. Wang (2021) discusses that intellectual capital as the overlap of all assets, intangible resources and non-physical resources of an organization, including processes, innovation capacity and implicit and explicit knowledge of its members and network of partners, and that is considered a vital resource for the competitive advantage of organizations. The author suggests that human capital is a component of intellectual capital and refers to the organization employee knowledge and skills; this includes the competence, attitude and intelligent thinking of employees. It also states that competence reflects the knowledge, skills, talents and mastery of employees, while attitude is the value created by the behavior of employees in the workplace and that intelligent thinking involves personal innovation and adaptability. In conclusion, Wang (2021) proposes human capital as the source of innovation for strategic revitalization of the organization that contributes to a good management of human resources.

Published in 2022, “Impact of Knowledge-Based HRM Practices on Organizational Performance: Mediating Effect of Intellectual Capital” proposes intellectual capital (IC) as a mediator variable between knowledge-based HRM practices and organizational performance in the context of the Indian service sector. This means that HRH practices lead to the creation of intellectual capital, and the relationship between HRH and performance is positively mediated by IC components, and thus, organizational capital is considered the most contributing component of IC, followed by human and relational capital. Gupta (2022) states that knowledge-based HRM practices positively affect human capital, which is a component of intellectual capital, and that HRM practice promotes the implementation of knowledge systems, IT structures and cultural change strategies, which are linked to the potential of companies to acquire, store and record knowledge. The study reports that human capital is an important aspect of organizational capital, which includes innovation, advancement, knowledge management, systems and other processes, and that human resources (HR) are recognized as tangible and intangible assets that can promote organizational performance. The article discusses that organizations use various evaluation techniques and adopt different human resource management practices to motivate employees, increase confidence, engagement and motivation, as well as that human Resource Management practices are also associated with high-performance work programs that enhance employees’ knowledge of the organization’s products or services, customers, and workplace culture (Gupta, 2022).

The 2022 article “Relationship Between Enterprise Talent Management and Performance Based on the Structural Equation Model Method” states that intellectual capital has a significant positive effect on the company innovation performance, as human capital plays a significant role in driving innovation performance only at the most mature stage of business development. The research also addresses the relationship between talent management and corporate performance, using the structural equation model to quantify the human resource management factors that affect logistical performance. The results highlight the positive impact of intellectual capital on innovation performance and the economic benefits of staff training and good customer service. In short, the article focuses on the importance of human resources,
especially intellectual capital and staff training, to boost performance and innovation in organizations (Liu et al., 2022).

“Connecting information literacy and social capital to better utilize knowledge resources in the workplace” is a 2023 study that discusses the relationship between intellectual capital and human resources within the context of knowledge processes at work. It explores the connection between information literacy and social capital, which represent the individual and social contexts that affect organizational knowledge processes. The results suggest that information literacy supports all three dimensions of social capital in the workplace, indicating that strong information handling skills allow better access to knowledge beyond the resources of an individual, which is social capital. The paper emphasizes that investing in information literacy is an investment in social capital, and managing employee information processing skills is a concrete step towards using organizational social capital and achieving positive results. It is also mentioned that knowledge management, which involves creating, sharing, using and managing organizational knowledge and information, is closely related to information skills and the development of social capital (Widen et al., 2023).

Also published in 2023, “Investing in green intellectual capital to enhance green corporate image under the Influence of green innovation climate: A Case of Chinese Entrepreneurial SMEs”, also discusses green intellectual capital and green human resources. The study states that green intellectual capital is a corporate resource composed of wisdom, skills and capabilities of an individual to carry out environmental conservation efforts efficiently, which can be cultivated through training and development programs, organizational knowledge dissemination capacities, etc. The authors propose that green human resource is a component of green intellectual capital and refers to the knowledge, skills and experiences of employees related to environmental conservation. Employees with simultaneous knowledge of the external environment tend to pay more attention to their contribution to a sustainable business environment, making their wisdom an additional skill of their green intellectual capital. The study concludes that green intellectual capital, measured through green human resources, relations capital and structural capital, positively influences green central competence, which in turn positively impacts the green corporate image (environmental performance and green innovation practices). The study also found that green central competence mediates the relationship between green intellectual capital and green corporate image. The paper highlights that the innovative green climate moderates the relationship between green central competence and green corporate image. In doing so, the research provides empirical evidence for the multidimensional construction of green intellectual capital and its role in estimating green central competence and green corporate image. The findings suggest that investing in green intellectual capital can be a viable solution for small and medium-sized entrepreneurial enterprises to improve their green corporate image (Khan et al., 2023).

Thus, as a complementary analysis, we can verify that no articles were obtained for the years 2000, 2001, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2013 and 2019. The year 2021 had the most articles, having a total of 3 articles, as shown in Figure 4.
Throughout the years, we see the idea of dividing IC into dimensions being adopted and enriched by other studies. An interesting mark to this is the relation between IC dimensions in green HR. We also highlight green human management as an recent innovation, mentioned only after 2018. Another notable point is that elements related to training appear in the initial articles and are then revisited in the articles from the final years, indicating that it is an issue that was used and has returned to prominence in the current scenario; although it is a concept linked to general training, innovative elements emerge from new training practices, which are more current and can also be considered innovative.

4. Conclusion

In the following topics we organized some contributions to be highlighted through the analysis. We grouped these observations in three domains: (1) innovation; (2) future prospects and; (3) key conclusions.

Innovative content:
- The integration of technological, commercial, organizational and cultural aspects in intellectual capital and human resources management is an innovative approach to creating value in organizations.
- Investing in long-term strategies and human capital, encompassing education and training, is regarded as an innovative method to enhance the workforce’s flexibility and adaptability in response to market conditions.
- Exploring the link between green intellectual capital and green human resources management is an innovative area of research that focuses on the impact of environmental sustainability on human resource management practices.

Future of human resources and intellectual capital:
- The future path of human resources (HR) and intellectual capital involves the integration of technological, commercial, organizational and cultural aspects to manage and effectively use intellectual capital in HR processes. This approach
recognizes the importance of harnessing highly qualified and experienced employees to create value in organizations.

- Human resources management needs to focus on adding knowledge-rich components to work processes, emphasizing the role of intellectual capital in organizational success. Integrated approaches that consider technological and commercial aspects, as well as organizational and cultural factors, are crucial for effective human resources management.

Key conclusions:

- Intellectual capital plays a crucial role in human resource management (HRM) and knowledge management, significantly contributing to organizational value. It is recognized as a valuable resource in the knowledge economy and can be a competitive advantage for organizations.

- Human resource management needs to consider the integration of technological, commercial, organizational and cultural aspects to manage intellectual capital and human resources effectively. Integrated approaches that focus on adding knowledge-rich components to work processes are essential to creating value.

- Understanding the dynamics of recruitment, training and knowledge management is vital for the development of efficient human resources management strategies. Dynamic systems modeling can help organizations formulate effective strategies for managing intellectual capital and human resources.

- Education and training are considered important for accumulating human capital and increasing the flexibility and adaptability of the labour force to market conditions. Investing in long-term strategies and people is crucial to the success and survival of organizations in the market.

- Green intellectual capital, including green human capital and green relational capital, have significant influence on green human resource management (GRH). The dimensions of green intellectual capital impact green human resource management practices.

According to the analysis, intellectual capital and human resources management is crucial for organizations in the knowledge economy. The recognition of intellectual capital value and the need to use it effectively in HRM processes are emphasized in several sources. The integration of technological, commercial, organizational and cultural aspects is seen as an innovative approach to creating value and ensuring organizational success. Long-term strategies, investments in education, training and the development of flexible and adaptable workforce are considered important for future human resource management. In addition, exploring the link between green intellectual capital and green human resources management is an emerging area of research that focuses on the impact of environmental sustainability on human resource management practices. Overall, the future path of HR and intellectual capital involves a holistic approach that integrates multiple aspects and recognizes the importance of leveraging human capital to drive innovation, competitiveness and sustainable practices in organizations. As propositions for further research we suggest the investigation of artificial intelligence role in intellectual capital and in human resource management. Artificial intelligence heralds a new era in the future of work, promising unparalleled efficiency and the transformation of job landscapes across industries.
Because of that we understand its understanding is valuable to discuss the relations between intellectual capital and human resources.

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References


