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Human Talent Management in Higher Education Institutions: Facing Challenges and Taking Advantage of Opportunities in the 4.0 Era

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Abstract

The article identifies the challenges faced by human talent management in higher education due to the adoption of Industry 4.0 technologies. It outlines the main strategies these areas should implement to address the institutions' needs adequately. A qualitative methodology was used, which included a literary component based on analyzing documents published in scientific databases. This comprehensive approach enabled the identification of various characteristics that human talent in educational institutions should possess, defining the four most recurrent to be managed. Additionally, a field exploration was conducted through semi-structured interviews with Human Talent Management experts from the Educational Sector. This allowed us to propose a set of transformation strategies that are not only theoretical but also practical and actionable, to be implemented in these areas and provide solutions to the challenges of Industry 4.0. Using Atlas.ti, the findings obtained from the interviews confirm the theoretical elements identified in the documentary analysis. This analysis identified the primary challenges in ethics of care and good living, collaborative team management, technological and digital skills, and data science. Finally, the strategies to be applied were defined based on the recommendations provided by the experts.

Keywords

Higher education, industry 4.0, human resources, industrial revolution

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Gestión del Talento Humano en Instituciones de Educación Superior: Afrontando Retos y Aprovechando Oportunidades en la Era 4.0

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Resumen

El artículo identifica los desafíos que enfrenta la gestión del talento humano en la educación superior debido a la adopción de las tecnologías de la Industria 4.0. Describe las principales estrategias a implementar para abordar adecuadamente las necesidades de las instituciones. Se usó una metodología cualitativa, que incluyó un componente literario basado en el análisis de documentos publicados en bases de datos científicas. Este enfoque integral permitió identificar diversas características que el talento humano debería tener en las instituciones educativas, definiendo las cuatro más recurrentes en la gestión. Se realizó también una exploración de campo mediante entrevistas semiestructuradas con expertos en Gestión del Talento Humano del Sector Educativo. Esto nos permitió proponer un conjunto de estrategias de transformación no solo teóricas, sino también prácticas y viables, para implementar en estas áreas y brindar soluciones a los desafíos de la Industria 4.0. Utilizando Atlas.ti, los hallazgos obtenidos en las entrevistas confirman los elementos teóricos identificados asociados a la ética del cuidado y la buena vida, la gestión colaborativa de equipos, las habilidades tecnológicas y digitales, y la ciencia de datos. Finalmente, se definieron las estrategias a aplicar con base en las recomendaciones de los expertos.

Palabras clave

Educación superior, industria 4.0, recursos humanos, revolución industrial

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We are currently in industry 4.0, which will have a significant impact on humanity; as stated by the president of the World Economic Forum, Schwab (2016), “The fourth industrial revolution will be in every detail as powerful, impactful and historically important as the previous three.” (p. 14). According to Rodríguez et al. (2021), a notable gap exists concerning Industry 4.0 in the medium- and short-term perspectives within the public and private sectors of various countries. This highlights the need to design and implement public policies that support digital advancement across the board. These global shifts have a profound impact on organizations, prompting them to adapt to new realities and circumstances. Mora & Guerrero (2020) noted that companies must recalibrate and restructure their management practices in key areas such as I4.0 projects, operations, strategy, human resources, energy management, and sustainability.

Due to the above, professions, in general, must be rethought. Their competencies have adjusted to the new realities, as indicated by García (2019), who notes that the transformation of job nature due to technological advances has made it necessary to intervene in human capital, enabling workers to acquire the skills required by the labor market. Remember that the fourth industrial revolution requires the “development of specific hard or cognitive skills, which vary according to each sector or activity, but also other soft or socio-emotional skills, necessary to produce knowledge throughout life” (Basco et al., 2020).

Regardless the new profiles, skills, and knowledge that professionals must develop to meet organizational needs, higher education institutions must adapt in order to train professionals who align with workplace expectations., "who manage to solve problems ethically", with critical thinking and analysis of the consequences of their decisions, strengthening its disciplinary pillars to involve different perspectives that can complement the proposed solutions by working in an interdisciplinary way” (Castellanos et al., 2020). Likewise, digital development, characterized by technological acceleration, the availability of knowledge, and access to information, means that higher education institutions must rethink training and training methodologies for the development of attitudes and competencies; this is supported by Sandia & Montilva (2020), who specify the new educational approach from predominant learning in citizen education, promoting the competencies that are basic and necessary in digital aspects and civic skills.

Considering the situation we discussed earlier, the Human Talent departments in Higher Education Institutions (HEIs) play a vital role in supporting institutional directives. They ensure that the workforce adapts to and aligns with the policies of the institutions, assuming the commitment to “preparation in processes of creating profiles, selection and permanence of personnel and, in addition, studies around change management, which prepare people in new lines of management and work for the adoption of competencies.” (H et al., 2020).

At this point, two key questions arise that drive this research: First, what are the primary challenges that the Human Talent areas of HEIs must address within the framework of Industry 4.0? Second, what strategies should they implement to face the difficulties identified?

Theoretical Framework

The impact of the Fourth Industrial Revolution is evident in the findings presented by Basco et al. (2020), who note that approximately 60% of the population has adopted digital platform technologies, mobile services, and cloud computing. Furthermore, with the anticipated growth of emerging technologies, these innovations are expected to play a crucial role in this revolution, particularly through essential tools such as artificial intelligence, big data, cybersecurity, virtual environment simulation, and automation.

Concerning the technology-human relationship, the new information technologies developed today can generate changes comparable to those that have occurred in previous technological revolutions, where these have substantially impacted the labor market, mainly in aspects such as efficiency and indispensability of people, so that human capital being the most valuable asset of companies, it deserves special handling, dedication, and appropriate management, so that it does not end up abruptly displaced, but instead receives the relevance it deserves, by integrating it to the transformation process, recognizing that the latter will not be achieved with the continuous use of traditional strategies and without updating personnel skills.

For authors such as Arroyo & Hermoso (2019), the 4.0 revolution in technology is increasingly playing a role in managing human capital by simplifying processes, enhancing data processing, and streamlining reporting. This is confirmed in a review about how automation technologies affect employment, which presents significant challenges for organizations in terms of training and educating their employees (Filippi et al., 2023).

These training processes are fundamental for the transition demanded by the new 4.0 era, according to Martínez (2018), who affirms that “education is the most powerful weapon that can be used to respond to the unavoidable need to update and improve skills throughout the lives of a greater number of people, and thus confront a VUCA environment” (p. 1) For this reason, author such as Martínez (2019) states that “Updating and reviewing the direction of education does not mean reducing it, impoverishing it, but rather the ability to harmonize with this moment in history without canceling its identity” (p. 7), this, supported by the strategic alignment of the human capital management of the institutions.

While the previous discussion highlights the importance of effective human talent management for higher education institutions (HEIs) to thrive in environments increasingly dominated by new technologies, it is also crucial to identify the key priorities for aligning human talent with current digital trends. A thorough theoretical review has identified at least five essential skills that the human talent within HEIs should prioritize.

To strengthen this analysis, it is important to distinguish between the general challenges of Industry 4.0 and those specific to higher education institutions (HEIs). While Industry 4.0 affects all sectors, higher education institutions (HEIs) face unique challenges, such as outdated curricular structures, limited faculty training in digital competencies, and administrative inertia (Crespo et al., 2022). For instance, some universities have begun implementing interdisciplinary programs that include data science and ethics, while others have established digital learning centers to upskill their academic staff.

Murphy et al. (2019) highlight a significant concern shared by many corporate leaders globally: the ethical use of technology. This concern is particularly pronounced in

organizations experiencing rapid growth, underscoring the importance of these issues in the context of technological expansion. Such growth also highlights the vulnerabilities associated with the information that organizations manage and control.

Secondly, the strategy of care and good living, as González-López (2019) indicates, must focus on the needs of each individual and the responsibility towards them, which should subsequently transcend the care of others as social entities. This is why, from a human capital management perspective, the well-being of the collaborator must be focused on both the individual and the group, without losing sight of the ethical environment as a broader system. An example of this is evidenced by Esquirol (2015), cited in Echeverría & Martínez (2018), who states that the permanent connection with technology and social networks deprives human beings of the most precious asset they possess: time to rest, engage in conversations, and reflect.

Thirdly, the management of collaborative teams is another skill that human talent areas should develop, given that, according to research such as that conducted by Borrero & Alcalá (2020), professionals currently face a significant challenge. It faces the new digital era because this phenomenon affects people's initiative and ability to generate innovative proposals that lead to better organizational results, which is why adopting agile and collaborative work methodologies becomes increasingly relevant. This enables the unification of comprehensive processes and technologies, as well as the management of new knowledge, to promote new teamwork skills through multidisciplinary and comprehensive interaction.

Zambon et al. 2019 cited in Amaya (2019), also consider that "the Industry 4.0 approach allows the creation of an environment in which all elements come together continuously." Moreover, effortlessly highlighting that all devices and their functionalities constantly communicate allows for a high level of coordination between the various components of the work teams. In this way, it is possible to increase the ability to coordinate activities, which is essential for developing continuous improvement in organizational areas where it is required.

One of the primary challenges to address is the development of technological and digital skills, which are essential for enhancing the human capital of higher education institutions. This enhancement is crucial for meeting the demands of the 4.0 era, particularly in light of the increased emphasis on virtual and remote education following the COVID-19 pandemic. According to Aya et al. (2020), this new landscape requires higher education institutions to recruit teachers better equipped to teach, guide, and support students in utilizing digital teaching tools and developing skills in information and communication technologies.

The points discussed encompass the use of digital tools and the critical elements of effective teaching and learning. According to Rambay & De la Cruz (2021), the teachers' competencies must be developed and focused on pedagogical methodologies. Based on ICT, planning, and learning expertise, ICT requires digital skills and their application to pedagogical aspects. Likewise, according to Burgos 2016, cited in Aya et al. (2020), "teaching in virtual environments implies the effective use of digital mediations as a starting point, assuming a facilitating and energizing role that guides the student" (p. 159). To achieve this, research and continuous updates are necessary to meet the requirements of the virtual educational environment and develop learning guidelines and models based on ICT.

The fifth skill identified refers to data science, which becomes relevant given that every day, information takes on greater importance in the development and evolution of society, which

positions it as a critical factor for economic growth and well-being as a consequence of its usefulness, since where there is an increase in activities associated with digital tools, there is also more significant data traffic, which in turn demands the development of human capital and its intellectual level (González et al., 2020).

The above highlights the need for HEI collaborators to possess skills in data science, particularly when considering topics such as privacy, where González (2019) emphasizes the importance of utilizing data. Privately managed information to enhance the market, data analytics, and programming that, integrated with the sciences of human behavior, allow defining fundamental aspects for the management of human capital from the different areas of human talent since people can produce data in a permanent and timely manner, which is stored and can be processed for the development of organizational management that is more adjusted to reality. The latter is also supported by extensive data, which, according to Aguado 2018, cited by Amaya (2019), has led to a significant shift in the way things are done in organizations, primarily affecting how they make decisions to achieve the organizational mission in the most efficient manner possible.

Method

The research conducted aims to identify the primary challenges encountered by the Human Talent Management departments within Higher Education Institutions and their main strategies to address their needs in a timely and efficient manner has a qualitative approach, which, according to Hernández (2018), “its purpose is to explore how certain individuals perceive and experience the phenomena that surround them, delving into their points of view, interpretations and meanings” (p. 390).

The acquisition and analysis of the information were conducted through two essential moments. The first moment corresponds to a documentary-type component from an analytical literature review that allowed us to understand the problem in detail. This analytical and descriptive review of the literature is a phase before data processing that “consists of preparing and analyzing historical data to identify patterns and trends” (Martel, 2019), which is why this methodology was considered the most suitable for identifying the most recurring challenges for the areas of Human Talent Management about industry 4.0.

The second moment was developed through field research and semi-structured interviews with experts in the human management of higher education institutions to obtain data related to the topic. According to Pomposo (2015), this type of interview generates a space for flexibility in terms of information and development with the interviewee; in this way, it was possible to obtain data that helped validate the information analyzed and propose some strategies that can implement these areas of facing the new challenges of industry 4.0. A sample of five experts with over 20 years of experience in Human Talent Management in higher education institutions in Bogotá, Colombia, is described in Table 1.

Table 1
Expert Profiles

Expert	Education	Current Position	Experience
Expert 1	Journalist and Social Communicator (Univ. de la Sabana); Master in University Management (Univ. de Los Andes); PhD in Higher Education (Univ. Benito Juárez García)	Director of the 'Observatory of the Colombian University'	30+ years in management, teaching, and leadership in over 70 HEIs
Expert 2	Industrial Engineer (Catholic Univ. of Colombia); Specialist in Labor Law (Sergio Arboleda Univ.)	Manager at 'Contexto Consultores SAS'	30+ years in human development and salary strategy; former head of talent at top universities
Expert 3	Business Administrator (Univ. de Los Andes)	Director at 'Business Life Colombia'	10+ years in higher ed projects, consulting, and talent culture development
Expert 4	Business Administrator (Externado Univ.)	Consultant for HEIs	45+ years in human talent and leadership in banking, education, and consulting
Expert 5	Psychologist (Catholic Univ. of Colombia); Specialist in Human Resources (Externado Univ.)	Director of Human Resources at the 'Colombo British Gymnasium'	25+ years in HR leadership in HEIs and international schools

The semi-structured interview format comprises two components: in the first section, questions are formulated to characterize the professional profile of the experts, and in the second section, ten questions focus on the challenges in the area of human talent. In higher education institutions, strategies and recommendations to face Industry 4.0. Inductive analysis was employed to analyze the data, which, according to Herrera (2018), aims to establish categories derived from previous theoretical references. The data were processed using the Atlas.ti tool, which consisted of two categories and four subcategories.

The analysis integrated findings from the literature review and interview insights to strengthen data validity. Coding was conducted using ATLAS.ti, with categories being compared to theoretical expectations. This approach enabled us to verify consistency and pinpoint discrepancies between academic discourse and practitioners' perspectives, thereby enhancing the interpretive rigor of the study.

Results and Discussion

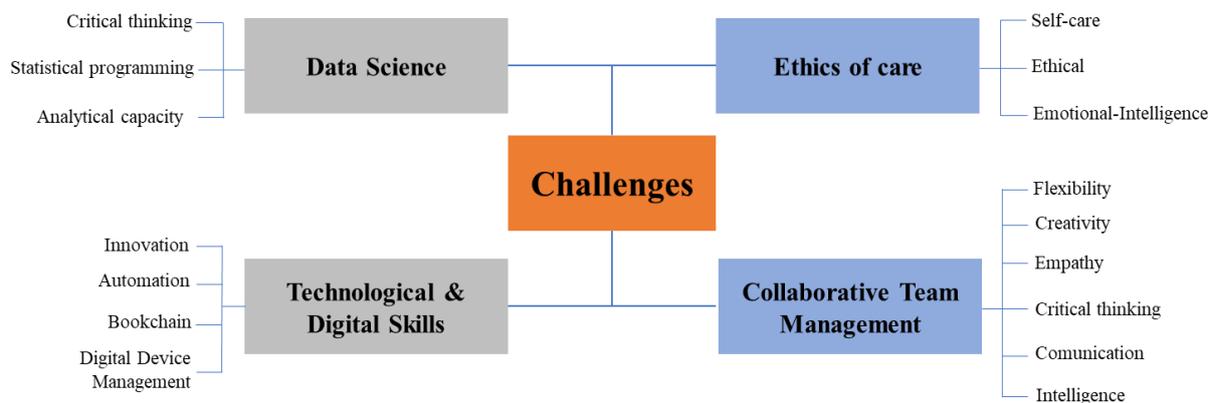
The results obtained during the literature review and field exploration processes are compared against the previous contributions made by other authors on this topic. Thus, to identify the main challenges faced by human talent management in higher education institutions in the face of the 4.0 revolution, the four main concepts repeatedly mentioned in the literature consulted

were selected. These, as seen in Fig. 1, correspond to ethics of care and good living, management of collaborative teams, technological and digital skills, and data science.

Figure 1 highlights the key elements essential for tackling each challenge. These include care ethics, good living, self-care, ethical criteria, and emotional intelligence. When managing collaborative teams, the necessary skills encompass flexibility, creativity, empathy, critical thinking, communication, and, akin to the previous challenge, emotional intelligence. In terms of technological and digital skills, important aspects include managing digital devices, blockchain, automation, and innovation. Finally, critical thinking, statistical programming, and analytical skills are crucial for data science.

Figure 1

Challenges of 4.0 in the Areas of Human Talent Management.



Some key quotations from interviews with experts are:

- Ethics of care and good living require promoting a workplace culture centered on empathy, fairness, and well-being. One expert emphasized, 'We are moving from control to trust, procedure to presence.'
- Collaborative team management implies a shift towards horizontal leadership models. One interviewee shared, 'Teams must learn to build consensus and lead without hierarchy.'
- Technological and digital skills demand technical training and mindset transformation. 'The biggest challenge is not tools, it is people's resistance to change,' stated another expert.
- Data science goes beyond technical use -it includes understanding the ethical use of information. 'We must train leaders who are not only data-literate but data-responsible,' remarked an expert.

The above allows us to see the need for the human talent department of higher education institutions to prepare both technically and humanly to face the new reality that, as mentioned by Floridi 2015, cited by Castellanos et al. (2020), "When the environment changes, the individual must transform and thus preserve humanity, using the resources available to understand the new environment in which they live and survive in it" (p. 248). On the other hand, concerning field research, the Atlas TI software categorizes skills using the 4.0 Revolution classification. This indicates that experts' focus is related to human talent management challenges, including developing collaborative teams, the ethics of care and good

living among employees, technological and digital skills, and the efficient use and management of information.

The result allows us to see that despite the apparent importance of the development of collaborative teams, with a total of 30 mentions equivalent to 31%, the proportions between the four categories are very similar since the ethics of care and good living in employees and technological and digital skills have 26% and 23%, respectively. In contrast, the efficient use of information management, which has the lowest percentage at 20%, remains very close to the other three categories.

The importance reflected in the percentage obtained by collaborative work supports what was expressed by Master & Restrepo (2017), who affirm that the absence of general skills is one of the limitations when it comes to obtaining personnel for different positions, which is why, these have become increasingly important in the development of human talent, even more so with the arrival of the fourth industrial revolution and within which teamwork is considered one of the primary skills for different positions in an organization.

The analysis of semi-structured interviews with experts, conducted using the ATLAS.ti tool, revealed that providing collective recognition is an effective strategy for managing collaborative teams. This practice helps establish productivity indicators based on interpersonal relationships within the team. This finding aligns with the research by Master & Restrepo (2017) and statements from the World Economic Forum (2016), both of which highlight the importance of fostering team management that prioritizes collective satisfaction. They emphasize identifying key elements such as attitude, aptitude, and judgment. Additionally, this approach can help identify innate leaders who have a significant impact on their teams.

For the challenge of ethics of care and good living, experts postulate three elements to work on; the first is the organizational climate, which focuses on identifying opportunities for well-being and quality of life and managing people from diversity and from be; The second is to define an organizational culture that seeks alignment of the employee with it, developing leaders to prioritize people and manage teams from trust and not from control; The third is the development of skills that allow a balance of personal and work life, thus giving relevance to what was expressed by González-López (2019), who represents that people's well-being is not only based on autonomy and justice but also in care as an essential element to lead a good quality of life.

The challenges associated with technological and digital skills necessitate strategies that focus on integrating technology into services, investing in technological advancements, and training employees to enhance response times and overall efficiency. This aligns with the insights of authors like Master & Restrepo (2017), who assert that each individual, organization, and nation's relationship with the digital ecosystem will significantly influence its sustainability and growth potential. This perspective resonates with observations made by experts in the field. Moreover, for practical information use and management in Human Talent areas related to data science, leaders must access relevant data for self-management purposes, conduct regular assessments to inform decision-making, and seek to strengthen internal processes, always emphasizing productivity that aligns with overarching strategies.

Conclusions

Industry 4.0 has created significant challenges in human talent management, primarily revolving around four fundamental areas: the ethics of care and well-being, the management of collaborative teams, and the development of technological, digital, and data science skills. While the existing literature identifies these areas as key challenges for human talent management, interviews with experts have revealed that current priorities in addressing Industry 4.0 challenges should focus first on the development of collaborative teams; second, on the ethics of care; third, on technological skills; and finally, on the effective use of data. This approach emphasizes the importance of developing interpersonal or soft skills before focusing on technical or complex skills, all while leveraging information for effective internal management.

The research concludes that experts advocate for implementing strategies to enhance employees' skills, particularly those of leaders, in decision-making, personal development, diversity, and promoting creativity and collaboration. Furthermore, it highlights the importance of utilizing technological tools that yield medium- and long-term benefits, striking a balance between productivity and employees' personal and professional lives.

The 4.0 revolution has ushered in significant changes that higher education institutions must prioritize and adapt to. Their human talent management departments must adjust to the evolving demands of the environment in order to remain relevant. We must prevent obsolescence by ensuring that management integrates digital tools effectively into educational activities.

Human Talent Management within higher education institutions undeniably plays a crucial role in addressing the challenges of the 4.0 era. It acts as a transformative axis for human capital by implementing strategies that enhance the various dimensions of individual development. This approach strongly emphasizes ethical considerations and holistic integrity, prioritizing the human aspect in all its facets. With the analyses carried out, it is clear that the challenges faced are not only at the level of academic training, but also, and perhaps more relevant, the importance of the attitudinal and relational strengths that the capital must possess. Humans perform adequately in the new global environment, characterized by permanent dynamism, uncertainty, and competitiveness.

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