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EMERGING TECHNOLOGIES AND JOB SKILLS: CONVERGENCE OF INDICATORS TO ASSESS STAFF PERFORMANCE

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Abstract: The main feature of Industry 4.0 is the integration of emerging technologies that transform work processes in all organizations. This transformation forces human capital to adapt to new work dynamics, which requires an expansion of professional growth models. Faced with automation and the use of advanced technological tools, workers must specialize, adapting to evolving skill requirements. The objective of this study is to design a comprehensive model that allows for a precise and relevant evaluation of the preparation, adaptation and performance of workers in contexts mediated by technology, through relevant indicators to measure work performance in the current context, where the use of emerging technologies is predominant. The exploratory analysis examines the factors used by automation companies to evaluate personnel, with the aim of developing an assessment model that is aligned with contemporary demands and the principles of sustainable development. The methodology follows a mixed approach, combining descriptive and exploratory information management to identify the parameters that link technology with emerging skills. Data collection is carried out from documentary sources and interviews with company staff. Conclusions reveal that the convergence of indicators can minimize the gap, allowing the staff to perform appropriately. A non-linear equation is also proposed that reflects the changes generated by emerging technologies, incorporating psychosocial dimensions that impact work in a constantly evolving environment.

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Introduction

In the current context of digital transformation and process automation, companies are experiencing structural changes driven by the adoption of emerging technologies, such as digital content or database systems, information and communication technologies, robotics, the Internet of Things, virtual and augmented reality, 3D printing, artificial intelligence, big data, and advanced manufacturing. These disruptive technologies have redefined production systems and organizational structures, demanding that human capital acquire new skills and adapt to dynamic, technology-mediated work environments (Brynjolfsson & McAfee, 2017; Pérez, 2024).

Human Resources Management (HRM) is one of the fundamental pillars of organizational growth and sustainability. However, traditional performance evaluation remains anchored in linear approaches that emphasize productivity, technical skills, or observable behaviors, without fully incorporating digital skills or the psychosocial dimensions of work. As a result, evaluation tools are insufficient to capture the complexity of current work performance, where adaptability, continuous learning, and interaction with technological systems are critical (Guartán et al., 2019; WEF, 2023).

This situation reveals a research gap: although several studies have explored competency-based models, 360-degree evaluations, and behavioral scales, few have systematically integrated technological indicators with labor dimensions to design comprehensive models of staff performance evaluation. There is little evidence of methodologies that combine traditional HRM perspectives with the challenges of Industry 4.0 (Alles, 2010; Matosas et al., 2019).

An early attempt to address performance evaluation through mathematical expressions is the linear equation proposed by Martínez (2002), which incorporated elements such as competencies, security, and attitude. While valuable, its linear structure does not adequately capture the complexity of technology-mediated work environments, nor does it integrate emerging digital skills and psychosocial dimensions.

The purpose of this study is to design a model that converges traditional performance indicators with technological and psychosocial skills, providing both a theoretical contribution to the HRM literature and a practical tool for companies transitioning to technology-intensive contexts. In doing so, the article seeks to reduce the gap between business practice and scientific development in performance evaluation. Therefore, the central issue is how the convergence of traditional and technological indicators can be structured to construct a performance evaluation model suited to the demands of contemporary work environments.

Research context

Performance evaluation has historically been a fundamental tool for human resource management, providing information for decisions related to promotions, compensation, and training. Traditional approaches, such as competency-based models, 360-degree evaluations, critical incident techniques, or behavioral rating scales, have been widely used to assess staff effectiveness and organizational contribution. These models focus primarily on observable skills, technical performance, and productivity, often reinforcing the alignment between employee capabilities and organizational profitability (Chiavenato, 2011; Alles, 2010; Chávez, n.d.; Matosas et al., 2019).

Despite their relevance, these approaches are increasingly insufficient in contexts shaped by digital transformation. Organizations today must assess not only productivity or behavioral consistency, but also the capacity of workers to adapt to technological change, acquire digital skills, and collaborate effectively in technology-mediated environments. In practice, many companies still apply homogeneous evaluation formats, overlooking the differentiation required by technological intensity, job profile, or organizational role. This generates inequities and reduces the relevance of evaluation results, as highlighted in recent studies (OECD, 2021; WEF, 2023; Durán, 2020; Guartán et al., 2019).

Some research has acknowledged the importance of integrating new competencies; the literature lacks comprehensive models that formally converge traditional performance dimensions with technological indicators. Existing proposals tend to remain descriptive, or they are limited to linear structures that cannot adequately reflect the dynamic and multidimensional nature of technology-mediated work (Martínez, 2002).

In this context, the present study addresses the need for a more integrated approach. By situating performance evaluation in the framework of Industry 4.0, it emphasizes that emerging technologies are not only transforming organizational processes but also redefining the very dimensions of performance that must be measured. Therefore, this study positions itself at the intersection of traditional HRM practices and the demands of digital transformation, seeking to advance both scientific understanding and business practice.

Literature review

Emerging technologies

Emerging technologies have accelerated a profound reconfiguration of production and organizational processes, generating not only new work tools but also new logics of human and professional interaction. Unlike the technological revolutions of history, in Industry 4.0 or the fourth revolution, the current change is not focused exclusively on machinery or information, but on the intelligent integration of systems, the use of predictive algorithms, automated networks, and real-time data flows that demand different ways of acting, learning, and deciding in the work environment (Arntz, et al., 2016).

This process has led to a redefinition of job profiles, the creation of new positions, and a total cross-cutting transformation that affects all occupations, as they require skills such as computational thinking, digital literacy, technological autonomy, and the ability to collaborate between humans and machines (Autor, 2015). Consequently, performance is no longer recognized as the evaluation of the activities executed, but the concept is expanded to include the adaptive capacity and the willingness of the individual to integrate into work ecosystems mediated by technology, so that the traditional evaluation procedure is already classified as insufficient.

Technological skills

As the axis of contemporary work performance, the skills derived from the rapid incorporation of emerging technology into work environments have transformed processes and business models and have generated a profound conversion in their execution formats. As organizations automate tasks, integrate other tools such as artificial intelligence into decision-making, and digitize operations, traditional competencies become insufficient, generating the prevailing need for human capital to develop the so-called technological skills (Laar et al., 2017).

These skills constitute the set of knowledge, attitudes, and capabilities that allow people to interact effectively with digital tools, solve technological problems, adapt to automated environments, and contribute to the intelligent use of complex systems. They are not reduced to the basic management of devices or software, but range from digital literacy to critical understanding of data, cybersecurity, virtual collaborative work, task automation, and strategic digital communication (Ferrari, 2013; Gallardo et al., 2015).

From the perspective of evaluation, these skills should be recognized as a cross-cutting dimension, as they have become determinants of the performance of organizational tasks. Employees must master specific technologies and simultaneously demonstrate agility to learn new tools, be quick to adapt to frequent technological change, and actively participate in digital innovation processes (Ehlers & Kellermann, 2019).

Performance evaluation models in human resources management

Performance evaluation has historically been considered a key tool to measure the effectiveness and efficiency of people in their job roles, providing information for decision-making related to promotions, training, compensation, or relocations (Chiavenato, 2011).

Traditionally, it has been based on criteria such as productivity, goal fulfillment, and organizational behavior; however, models have evolved from hierarchical and unidirectional approaches to more comprehensive, participatory, and competency-focused proposals. In current contexts, characterized by digital transformation, performance evaluation requires considering more complex dimensions that incorporate technical, digital, cognitive, social, and attitudinal skills, that is, a multidimensional structure that goes beyond observable performance and becomes essential to capture the adaptive potential of the individual in the face of change (OECD, 2021; WEF, 2023).

Understanding competencies as a set of observable behaviors related to good and recognized performance in a specific job, in a specific organization, the competency-based evaluation model is defined as an analysis of the individual's ability to perform their function based on competencies – knowledge, skills, attitudes, behaviors – and where a profile was previously defined by position or area, and the degree of mastery that it includes is evaluated (Pereda et al., 2011; Alles, 2010).

The 360-degree evaluation involves feedback from various sources: superiors, peers, subordinates and customers, it offers a complete vision of the behavior of the evaluated in their work environment; it is a comprehensive method that combines qualitative and quantitative approaches to evaluate performance by identifying strengths, weaknesses and perceptions; it is followed by the delivery of feedback to the evaluator and also generates feedback to the evaluators, creating in everyone a feeling of protagonism, not only in the evaluation, but in the way in which the data they have contributed is processed (Alles, 2022).

For its part, CIT records and conducts evaluations for critical incidents; it is based on the collection of specific behaviors, positive or negative, that significantly influence work performance. The events are documented in detail to analyze and generate specific feedback and to be able to provide solutions and find ways for the worker to grow based on experience, since the emphasis of the situations must be very positive or very negative, not the natural and everyday ones (Chávez, n.d.).

Behavioral rating scales, or BERS, are constructed with behavioral descriptions anchored to different levels of performance for each criterion, allowing the subjectivity of the evaluation to be reduced. Its purpose is to minimize the impact of the interpretations made by the evaluator when performance is defined in behavioral terms. What differentiates this scale is the use of behavioral examples for the representation of each of the anchor points that constitute the scale of each of the categories to be evaluated (Matosas et al., 2019).

Labor dimensions

The division into labor dimensions is pertinent and methodologically valid to evaluate performance, especially in current contexts. The way of evaluating has evolved from models focused on productivity and the fulfillment of quantifiable objectives to more comprehensive approaches that seek to capture the complexity of behavior and the contribution of the individual in their work environment. In this sense, the use of dimensions represents a methodological strategy that allows structuring the performance analysis through specific, measurable categories adapted to the organizational context.

Dividing performance into dimensions allows key areas of behavior and competencies to be observed and evaluated in a more detailed and objective way. This fragmentation facilitates not only measurement, but also feedback, individual development, and decision-making related to training, promotion, or improvement of the work environment (Chiavenato, 2011).

Additionally, when these dimensions are underpinned by emerging competencies and skills frameworks, they are aligned with the real needs of the contemporary work environment (Alles, 2010; WEF, 2023).

Purpose of the study

The purpose of this study is to design a comprehensive performance evaluation model that converges traditional indicators with technological and psychosocial skills. From a scientific perspective, the article addresses a research gap in the human resource management literature, where performance models have not yet fully integrated the demands of technology-mediated work environments. From a practical perspective, it provides organizations with a framework for evaluating employees more effectively in contexts shaped by emerging technologies, ensuring both adaptability and competitiveness.

At the same time, this article should be understood as part of a broader, integral line of research. The findings presented here constitute an exploratory stage and serve as the basis for the development of more advanced methodologies, particularly the formulation of a nonlinear equation capable of capturing complex relationships between labor dimensions and technological indicators.

This research should be understood as a first exploratory approach to analyzing technological skills within organizations, with the specific purpose of corroborating the need to update existing performance evaluation frameworks. The findings highlight the insufficiency of traditional assessment formats to capture the current demands of the digital and technological environment.

Furthermore, the study provides the basis for further research aimed at integrating psychosocial aspects into performance evaluation. This perspective recognizes that technological adaptation and the acquisition of new skills are not only technical processes but are also influenced by personal, family, and mental health factors. In this sense, the results confirm the relevance of developing updated and more comprehensive evaluation models that address both technological competencies and psychosocial dimensions.

Research methodology

This study, with a mixed approach and descriptive information management, is an exploratory stage within comprehensive research. The objective is to determine the convergence of indicators to evaluate the performance of the organizations' employees based on technological skills, to subsequently integrate them into an updated and well-founded non-linear equation, which evaluates performance based on the demands of the work environment within the structure that permeates Industry 4.0 and its technological differentiation.

The descriptive analysis of the models used in organizational practice to evaluate performance – competency-based model, 360°, CIT and rating scale – carried out by Calle et al. (2024) is the conceptual basis taken in this study; practical basis is extracted through information from semi-structured interviews of seven companies

selected for convenience (Hernández, 2018), based on their degree of technological integration in operational and administrative processes. The sample included:

– mining industry, safety and operational context;
– manufacturing and automation firms, with a strong presence of digital tools and industrial systems;
– electrical and motor production companies, applying advanced monitoring and quality control technologies.

The seven companies from the manufacturing and services sector are in San Luis Potosí, Mexico. The sample was selected based on accessibility and voluntary participation, which allowed us to obtain an initial perspective on the adoption of technological skills in real organizational contexts. Respondents included managers, department heads, and operational staff with direct experience in the use and implementation of technological tools. Most of them had more than 20 years of professional experience and educational background in engineering, management, or information technologies.

Data collection was carried out between February and March 2025, ensuring the inclusion of current practices in performance evaluation and the adoption of digital tools in organizational processes. These were collected through semi-structured interviews with operational managers, team supervisors, and HR personnel. The interviews

Through phases of information collection, the convergence between emerging technologies and work skills is structured based on an approximation made by Martínez (2002), subject to linear equations, redefining what is expected of a person in their job in companies with a high degree of technology in their processes, in terms of technological skills.

Results

Phase 1. Analysis of traditional performance evaluation models

In this phase, a descriptive analysis of four performance evaluation models was carried out, in which evaluated indicators and labor dimensions are saved and presented in Table 1, where some advantages and disadvantages that have been observed in the implementation of the models are also specified.

Table 1. Analysis of Performance Evaluation Models

Evaluation Model	Applicable dimensions	Indicators identified	Advantages	Disadvantages
Competency-Based Assessment	Technical, **digital**, attitudinal skills	Technical proficiency level, **digital troubleshooting**	Comprehensive approach, adaptable to different sectors, development aligned to the position	May require complex profile design by area or function

Evaluation Model	Applicable dimensions	Indicators identified	Advantages	Disadvantages
360 – Degree Evaluation	Communication, collaboration, social responsibility	Clarity in communication, effective cooperation, and Team Perception	Complete vision, encourages continuous improvement, and strengthens communication	It can generate biases or resistances if not properly applied
Critical Incidents (CIT)	Security, **innovation**, decision-making	Quantity and quality of responses to critical events, **applied innovation**	Identification of key behaviors, useful in risky environments	High subjective load requires continuous and detailed recording
Behavioral Rating Scales (BARS)	Attitudes, technical performance, observable skills	Frequency of expected behaviors, accuracy in technical tasks	Clarity of criteria, comparability, reduces subjectivity	An elaborate design requires systematic observations

Source: Own study based on (Calle et al., 2024)

Based on this information, it is inferred from the models that denote a clear lack of integration of dimensions and indicators that correspond to the current requirements in reference to technological capabilities, although in the competency-based model, digitalization is referred to, and in the critical incidents model, innovation is enunciated. A formal enunciation is not made, nor do the indicators demonstrate how they are evaluated.

Phase 2. Deploying linear equations to evaluate performance

Next, the linear equations that were used in companies in the mining sector and that turned out to be the basis of bonus programs for productivity concepts are expressed; its application was internal and the administrative strategy was not formally included for transcendental decisions about personnel (Martínez, 2002); Its origin, due to the nature of the operation of the mining sector, is in safety. These equations (1-4) are only demonstrative:

$$\text{Security Grade} = \text{System} + \text{Equipment} + \text{Competence} \quad (1)$$

$$\text{Competence} = \text{Experience} + \text{Attitude} \quad (2)$$

$$\text{Experience} = \text{Knowledge} + \text{Skill} + \text{System} \quad (3)$$

$$\text{Attitude} = \text{Work environment} + \text{Freedom of decision} + \text{Teamwork} + \text{Adaptation} + \text{Familiy harmony} \quad (4)$$

As can be seen, the equations are inclusive, which permeates an extensive equation and its linear structure may not be stable enough in its application; however, it involves elements that can well adapt to current needs and demands and be a reference to lead to a non-linear equation, as argued, and that integrates the modern technological skills.

Phase 3. Fieldwork findings

Seven companies were considered that, in their operational and administrative processes, the use of emerging technologies is common; non-formal interviews were conducted with operational personnel in charge of providing feedback to their teams and personnel who evaluate performance as part of the activities of the Human Resources department. A basic instrument was used for the interviews, specifically looking for information classified as practical and current, and focused on knowing the perception about evaluating performance by integrating contemporary technological skills.

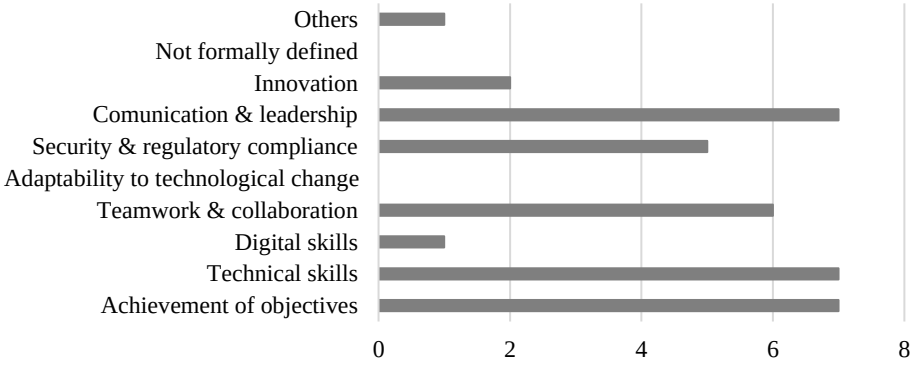

Figure 1. Significant skills for the enterprises

Source: Own elaboration

The results observed in Figure 1 confirm the thesis that emerging technologies are the trigger in companies for changes in processes and, therefore, in the evaluation of the performance of their collaborators, and the coherence with this statement is the evaluation tool through software or digital platforms. The competency-based model is the most widely used, but on the other hand, they state that technological skills are not evaluated, and in addition to this, the responses to the possibility of integrating technological indicators are divided between very and moderately important.

Emphasis is placed on the fact that the evaluations are the same for all personnel regardless of the profiles that occupy the various positions. This should be noted as they are equivalent to 60%, since they are considered strong companies in their field and with significant representation of the use of emerging technologies, which is interpreted as inequitable.

The indicators extracted in this phase are meeting objectives, technical skills, digital skills, teamwork, collaboration, adaptation to technological change, regulatory monitoring, and innovation.

Phase 4. Indicator convergence analysis

First, a graph is constructed that represents the convergence or disparity of the indicators (Figure 2). Indicators or parameters observed from the models (left vertical axis) and those declared by the companies (horizontal axis and the percentage of frequency on the right vertical axis are expressed); this relationship is subjected to a linear equation, assumed to evaluate convergence or disparity. Convergence is the symbol above the bars.

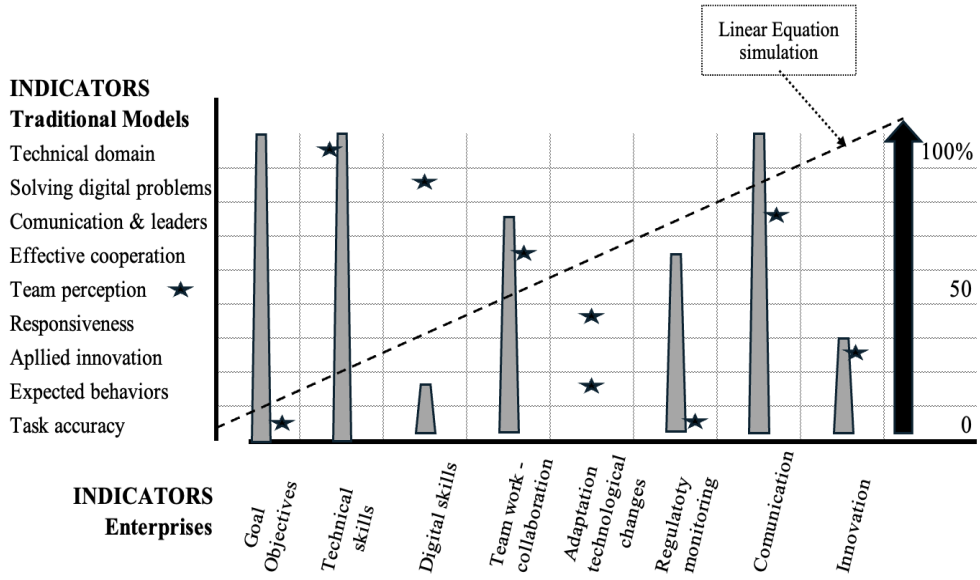

Figure 2. Simple indicator convergence relationship: models vs companies

Source: Own elaboration

Nine indicators that have been extracted from traditional models and eight from companies are considered, and the observations are the following.

a) There is a significant dispersion of the coincidences with respect to the line that simulates a linear equation; this finding allows us to consider that it is possible to create a nonlinear equation to evaluate the performance of the (Carrillo, 2011).
b) As a critical finding, it is observed that there is an indicator that converges, but there is no frequency of measurement: adaptation to technological change.
c) Digital skills and innovation indicators are very rarely used.
d) It is observed that the team perception indicator does not converge with the others.

A basic classification of the indicators shown in dimensions (Table 2) is made to perform a second convergence analysis, but this time it will be the indicators classified in established dimensions versus the linear equation expressions provided by Martínez (2002). Elements such as security are mimicked as technical skills. This analysis is presented in Figure 3.

The labor dimensions in this study are created by convenience in basic terms of skills: transversal and technical, adding the technological ones by the focus of this study.

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Table 2. Reclassification of indicators in labor dimensions

Labor dimension		
Transverse Skills	**Technical Skills**	**New Technological/ Digital Skills**
– Attitude – Communication – Collaboration – Social responsibility – Team Perception – Effective cooperation – Expected behaviors – Achievement of objectives – Teamwork	– Technical performance – Observable abilities – Technical mastery – Precision in technical – Tasks technical skills – Regulatory monitoring	– Digital troubleshooting – Applied innovation – Digital skills: Adapting to technological change – Innovation

Source: Own elaboration

The importance of Figure 3 lies in the fact that, in order to execute the linear equation expressions today, the emerging technology factor (such as automation, digitalization, or any advanced application: AI, Big Data, 3D, IoT, among many others) must be included, and observe how most of the indicators now depend on the formalization of this new dimension of emerging technologies.

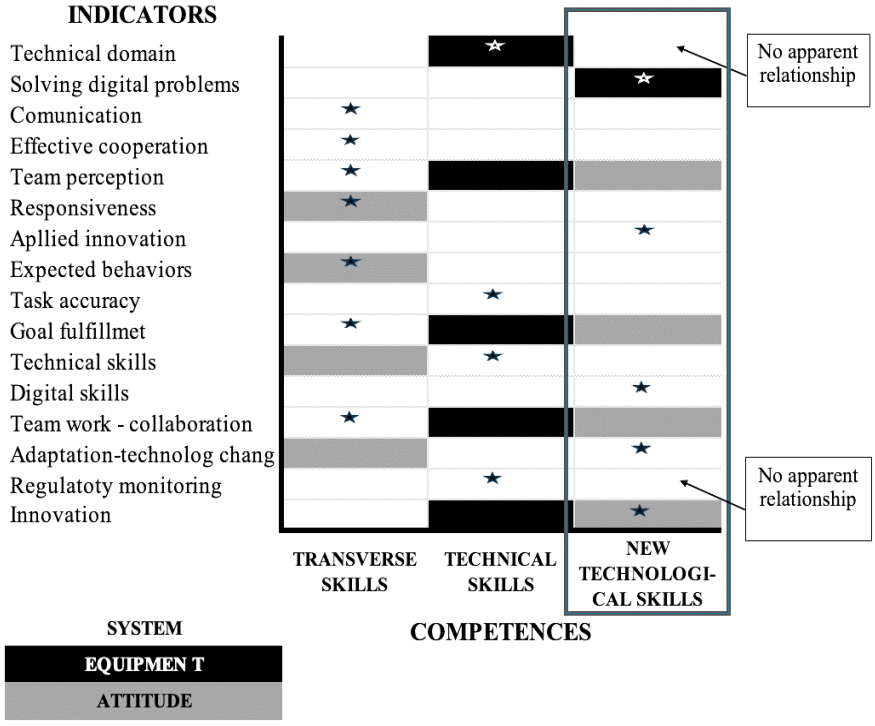

Figure 3. Convergence of indicators within basic labor dimensions

Source: Own elaboration

Thus, the colors show us that:

a) If we automate/digitize the system, the indicators now also fall into the new dimension (light gray).
b) Automating the team leads us to evaluate indicators in the new dimension (black).
c) Not so the natural indicators of technical skills: technical mastery and regulatory monitoring, to which the legend has been placed: ”No apparent relationship”.

Performance evaluation, once the so-called emerging technologies are integrated, must include a new dimension and must also update and strengthen the monitoring of the indicators observed above, since in each dimension, as there is advanced technology, the indicators to be evaluated increase.

As a particular finding, it is observed that transversal skills do not necessarily include psychosocial indicators, as Martínez (2002) did in his set of linear expressions, and may be one more dimension to be evaluated, substantiated, and integrated into the intended evaluation model.

Research limitations

The limitations were presented: the empirical component was conducted with only seven companies, selected through convenience sampling. While this allowed access to organizations with a high level of technological integration, the small sample size restricts the generalizability of the findings. Instrument used to collect data semi-structured and informal interviews, introduces a degree of subjectivity and limits the possibility of establishing causal relationships, and the exploratory scope promotes preliminary research. Moreover:

- the sample size was limited to only seven companies, which restricts the generalizability of the findings, then promoting the first study of this approach;
- the selection of participants was based on convenience sampling, which may introduce bias;
- the data collected is primarily based on self-reported perceptions, which may carry subjective elements;
- the study reflects a specific timeframe and context, so the results might differ in other economic or social conditions;
- therefore, while the study offers relevant insights into the role of technological skills in organizational contexts, the results cannot be translated into the entire population.

Discussion

The results of this study confirm that traditional performance evaluation models, while valuable, are insufficient for organizations operating in technology-mediated environments. Although competency-based assessments and 360° feedback remain widely used, they do not formally incorporate digital or psychosocial indicators, which are now fundamental to organizational performance (Alles, 2010; OECD, 2021).

The finding that most companies apply the same evaluation standards across diverse job profiles illustrates a lack of sensitivity to the differentiated impact of technology on performance. This aligns with Durán (2020), who argued that rigid systems often fail to reflect the realities of organizations in transition. At the same time, the recognition of skills such as teamwork, innovation, and adaptation to technological change echoes the global trends identified by the World Economic Forum (2023), which highlights these competencies as essential for the future of work.

From a scientific perspective, the study contributes by empirically demonstrating the gap between traditional HRM models and the demands of Industry 4.0. Comparative convergence analysis revealed indicators that are critical but absent from current frameworks, such as explicit digital skills and adaptation to technological change. Furthermore, the identification of psychosocial aspects – such as family balance, stress management, and work environment – suggests that evaluation models must move beyond purely technical or behavioral categories to embrace multidimensional structures (Scherer & Pennycook, 2020).

From a practical perspective, the results highlight the limitations faced by companies when applying homogeneous evaluations. By overlooking technological competencies, firms risk undervaluing key capabilities that drive competitiveness in digitalized contexts. The study provides preliminary evidence that organizations must incorporate technological and psychosocial dimensions into their evaluation practices, even in exploratory or simplified forms, to ensure relevance and fairness.

Finally, the reference to the linear equations applied in the mining sector (Martínez, 2002) emphasizes the historical attempt to mathematically formalize performance evaluation. However, the current findings point to the need for nonlinear approaches capable of representing complex interactions among labor dimensions, traditional skills, and technological indicators. This direction supports the argument that evaluation models must evolve not only conceptually but also methodologically to address the realities of digital transformation.

Conclusion

Models focused on technical competencies, operational results, or behaviors observable in isolation fail to reflect the new demands of the work environment, so it is essential to reconstruct the evaluation system under a logic of contemporary labor dimensions, in which indicators associated with technology are integrated as a transversal axis or even as a dimension of its own.

In work environments mediated by emerging technologies, the adoption of dimensions makes it possible to integrate both traditional skills, security, and technical execution, as well as adaptive and digital competencies that have acquired a central role in the transformation of work (OECD, 2021). For example, the World Economic Forum (2023) states that skills related to problem-solving, emotional intelligence, continuous learning, and digital literacy should be part of any comprehensive performance evaluation. Subject to these premises, a differentiation is made through this study.

Scientific contributions

The study provides empirical evidence of the gap between traditional performance evaluation models and the realities of technology-mediated work environments. By comparing indicators from established HRM frameworks with those identified in companies adopting emerging technologies, the research demonstrates that conventional models fail to capture critical aspects such as digital skills, adaptation to technological change, and psychosocial factors.

Additionally, the study contributes conceptually by proposing the convergence of traditional, technological, and psychosocial indicators as the basis for a comprehensive evaluation model. This sets the groundwork for advancing toward nonlinear methodological approaches that can better reflect the complexity and multidimensionality of contemporary labor performance.

Practical contributions

From a managerial perspective, the findings highlight the risks of maintaining homogeneous evaluation systems that disregard the differentiated impact of technological integration across job profiles. Companies that fail to incorporate digital and adaptive competencies into their performance assessments may underestimate essential capabilities for competitiveness, innovation, and resilience.

The study offers organizations a preliminary framework to rethink evaluation processes by integrating technological and psychosocial dimensions into their HR practices. Even at an exploratory stage, these insights can guide adjustments to existing systems, fostering more relevant and future-oriented evaluations.

Future research directions

This study represents an initial stage within a broader research agenda, and its exploratory nature highlights the need for further validation. Future investigations should expand the empirical base, incorporating larger and more diverse samples to test the robustness of the proposed convergence of indicators. By applying quantitative methodologies and extending the analysis to different sectors, it will be possible to assess the applicability beyond the specific companies considered here, ensuring stronger generalization and comparability of the results (Morales et al., 2024).

At the same time, subsequent research should deepen the methodological framework by developing nonlinear formulations capable of capturing the complex interactions between labor dimensions, technological skills, and psychosocial factors. Such advancements would allow performance evaluation to reflect dynamic and multidimensional realities with greater precision. Furthermore, the integration of digital well-being and ethical considerations in the adoption of technology can contribute to more comprehensive evaluation systems that not only measure efficiency and competitiveness but also promote sustainable, human-centered organizational practices.

In summary, this study should be considered a preliminary step in addressing the need to update performance evaluation formats in the context of technological transformation. Although limited in scope, the findings provide evidence that current assessment models do not fully capture the complexity of technological adaptation in organizations.

Most importantly, the study opens the way for further research that integrates a psychosocial perspective into performance evaluation, acknowledging that the development of technological skills is inherently linked to individual, family, and mental health dimensions. This approach establishes a foundation for more comprehensive and contemporary models of employee performance assessment.

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NOWE TECHNOLOGIE I UMIEJĘTNOŚCI ZAWODOWE: KONWERGENCJA WSKAŹNIKÓW SŁUŻĄCYCH DO OCENY WYNIKÓW PRACY PERSONELU

Streszczenie: Główną cechą Przemysłu 4.0 jest integracja nowych technologii, które przekształcają procesy pracy w organizacjach. Transformacja ta wymusza na kapitale ludzkim dostosowanie się do nowej dynamiki pracy, co wymaga rozbudowy modeli rozwoju zawodowego. W obliczu automatyzacji i wykorzystania zaawansowanych narzędzi technologicznych pracownicy muszą się specjalizować, dostosowując się do nowych wymagań dotyczących umiejętności. Celem niniejszego badania jest zaprojektowanie kompleksowego modelu, który umożliwi precyzyjną i trafną ocenę przygotowania, adaptacji i wydajności pracowników w kontekstach zależnych od technologii, za pomocą odpowiednich wskaźników mierzących wydajność pracy w obecnych warunkach, w których dominują nowe technologie. Analiza eksploracyjna odnosi się do czynników, które firmy z branży automatyzacji wykorzystują do oceny personelu, dążąc do ustanowienia modelu oceny dostosowanego do współczesnych wymagań i zrównoważonego rozwoju. Metodologia ta jest mieszanym, opisowym i eksploracyjnym podejściem do zarządzania informacjami, identyfikującym parametry, które łączą technologię z nowymi umiejętnościami. Gromadzenie danych odbywa

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się ze źródeł dokumentacyjnych i wywiadów z personelem firmy. Wnioski pokazują, że konwergencja wskaźników może zminimalizować tę lukę, umożliwiając wydajność personelu w odpowiedni sposób. Zaproponowano również nieliniowe równanie, które odzwierciedla zmiany generowane przez powstające technologie, uwzględniając wymiary psychospołeczne, które wpływają na pracę w stale zmieniającym się środowisku.

Słowa kluczowe: pojawiające się technologie, wymiary stanowiska, ocena wydajności, umiejętności technologiczne