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Indicators of Socio-Economic Efficiency of Personnel Development in the Context of Digitalization

Abstract

In the context of rapid digital transformation, the issue of assessing the socio-economic efficiency of personnel development is gaining strategic importance. This article proposes a system of indicators that reflects both quantitative and qualitative changes in employee development under digitalization. The study identifies key performance criteria, such as productivity, adaptability, digital skills, and return on training investment, which can serve as tools for evaluating human capital efficiency in modern organizations. The proposed indicator framework allows for a more accurate alignment of HR development strategies with organizational goals in the digital era. *The purpose* of this article is to develop and substantiate a system of socio-economic indicators that can be used to evaluate the efficiency of personnel development in the conditions of digital transformation. *Methodology.* The study is based on a combination of theoretical analysis and expert evaluation methods. A review of scientific literature and international reports was conducted to identify existing approaches to performance measurement. The final system of indicators was structured through comparative analysis and validated using expert assessments and relevance criteria. Both quantitative (e.g., digital ROI) and qualitative (e.g., employee adaptability) indicators were included. *Results.* The article presents a two-level system of indicators for assessing the socio-economic efficiency of personnel development. The indicators are divided into quantitative (productivity, training cost efficiency, retention rates) and qualitative (digital adaptability, innovation capacity, employee satisfaction with digital tools). These indicators reflect not only the economic outcomes of HR development but also the social and behavioral changes in a digital environment. *Practical implications.* The proposed indicator system can be applied by HR departments, consultants, and policymakers to assess the effectiveness of personnel development programs. It can serve as a foundation for performance monitoring, benchmarking, and strategic decision-making in the sphere of human resource management under digital transformation. *Value / Originality.* The originality of the article lies in its attempt to integrate traditional socio-economic evaluation methods with digital-specific indicators. The proposed model responds to the urgent need for updated tools of measurement in personnel development, offering a structured and adaptable framework applicable in both public and private sectors.

Keywords

personnel development, socio-economic efficiency, digitalization, human capital, performance indicators, HRM

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1 Introduction

In the context of rapid digital transformation, the strategic importance of human capital development is intensifying across all sectors of the economy. Technologies such as automation, artificial intelligence, and advanced data analytics are reshaping the way organizations operate and deliver value. Consequently, workforce competencies must evolve continuously to meet the demands of digitalization.

Personnel development now encompasses not only technical and professional training but also digital fluency, adaptability, and innovation capacity.

Despite increasing investment in training and upskilling initiatives, organizations still lack reliable tools to evaluate the socio-economic efficiency of these efforts. Traditional indicators – such as the number of training hours or post-training assessments – tend to focus on immediate, measurable outputs while ignoring broader organizational and social impacts. These include long-term productivity, employee engagement with digital tools, readiness for change, and innovation performance.

This study aims to address this gap by developing and validating a set of indicators that reflect both the economic and social outcomes of personnel development in the digital era. The main research objective is to construct an integrated framework of indicators that captures the complexity of human capital development under digital transformation. The framework incorporates both quantitative measures (e.g., productivity growth, return on training investment, digital skills attainment) and qualitative measures (e.g., adaptability, behavioral changes, and motivation to innovate).

The structure of the article follows a coherent research logic: it begins with a review of theoretical foundations and current literature on socio-economic efficiency and digital competencies in human resource management (Section 2), followed by a detailed presentation of the research methodology and the principles underlying the design of relevant indicators (Section 3). The next part (Section 4) is dedicated to the development of the socio-economic indicator framework and its conceptual justification. Section 5 presents the key findings from the empirical validation of the proposed indicators, while the final section (Section 6) offers conclusions and highlights the practical implications of the results for organizational strategy and HR policy. Overall, the article provides a conceptual and methodological foundation for a more comprehensive evaluation of how personnel development in the digital era contributes to long-term organizational sustainability and the enhancement of human capital potential.

2 Theoretical Background and Literature Review

The accelerating digital transformation has fundamentally altered skill requirements and performance metrics in modern organizations. Global reports underscore an urgent need for new approaches to workforce development: the World Economic Forum projects that 50% of all employees will require significant reskilling by 2025 (World Economic Forum, 2023). New digital competencies – as outlined in frameworks like the EU's Digital Competence Framework (DigComp) – have become essential across job roles (European Commission, 2022). These trends highlight the importance of systematic personnel development and the challenge of quantifying its socio-economic efficiency in the digital era. In essence, organizations must ensure that investments in employee upskilling yield tangible economic benefits (e.g., productivity, innovation) and positive social outcomes (e.g., higher skill levels, employability), yet traditional HR metrics are ill-equipped to capture these multifaceted returns.

Human capital theory provides a foundation for linking employee development to organizational performance. Becker's seminal work on human capital demonstrated that investments in education and training raise the marginal productivity of workers (Becker, 1964), establishing a clear economic rationale for developing employee skills. This idea laid the groundwork for viewing training not merely as a cost but as a value-creating investment. Subsequent HR scholarship has built on this premise to emphasize strategic alignment of human capital development with business goals. For example, Ulrich et al. argue that HR professionals must evolve into strategic "capability builders" and "technology advocates" who champion workforce skill development in the context of technological change (Ulrich, Younger, Brockbank, & Ulrich, 2012). Aligning HR with strategy in this way is crucial for demonstrating value – otherwise senior management may regard HR initiatives as a "financial loss" rather than a driver of competitiveness. This evolution in theory calls for new indicators that can capture the value created by upskilling and reskilling efforts, linking personnel development to both economic performance and social well-being.

Despite these theoretical advances, existing HR measurement models lag behind the realities of digital transformation. Traditional indicators (e.g., training hours, training costs or simple ROI on training) often fail to reflect the quality of skills acquired or their broader impact on innovation and agility. Contemporary policy frameworks point to the need for more nuanced metrics. The OECD Skills Strategy, for instance, advocates measuring individuals' skill levels and training outcomes – not just inputs – to ensure workforce development meets labor market needs (OECD, 2019). Likewise, the Future of Jobs reports by the WEF highlight that continuous learning and re-skilling are now central to economic survival, implying that firms need ways to track the effectiveness of their upskilling initiatives (World Economic Forum, 2023). However, much of this guidance remains at a macro level. At the enterprise level – especially in Eastern Europe – a notable gap exists in translating digital upskilling imperatives into concrete performance indicators. Studies indicate that Central and Eastern European enterprises still exhibit relatively low digital maturity on average (Bondarouk &

Brewster, 2016), which suggests that many firms in the region are only beginning to grapple with how to measure and drive digital skill development. Moreover, the literature offers limited insight into enterprise-specific models for evaluating HR development in such contexts. Margherita and Bua highlight, for example, a "lack of study" on how organizations practically develop and assess new digital competencies (Margherita & Bua, 2021). This points to a broader shortcoming of current HR metrics: they have yet to fully account for the qualitative shifts in workforce capabilities required by Industry 4.0 and digitalization.

The convergence of human capital theory and digital transformation trends reveals a pressing need for refined indicators of personnel development efficiency. Such indicators should integrate socio-economic dimensions – capturing both the economic returns (productivity, innovation, competitive advantage) and social benefits (skill growth, adaptability, employee retention) of developing human capital in the digital age. By addressing the noted gaps in existing models, especially for enterprise-level application in Eastern Europe, new metrics can provide organizations with a clearer rationale and tools for investing in their people. This study, therefore, is grounded in the imperative to develop and validate indicators that holistically assess the efficiency of personnel development in the context of digitalization, thereby contributing to both the academic literature and practical management frameworks.

3 Research Methodology and Indicator Design

This study develops a theoretical framework for evaluating the socio-economic efficiency of personnel development in the digital economy. The proposed system of indicators was constructed through a multi-step process that integrates conceptual analysis, expert reasoning, and methodological tools widely recognized in human resource management and performance evaluation. The research is conceptual in nature and does not involve empirical testing. Nevertheless, it is methodologically grounded in a structured review of relevant literature, international policy frameworks (e.g., OECD Skills Strategy, 2019), and best practices in HR analytics. This allowed for the identification of key dimensions through which personnel development contributes to both economic outcomes (e.g., productivity, innovation capacity) and social outcomes (e.g., skill adaptability, employee well-being) (Margherita & Bua, 2021).

To ensure the framework's relevance and usability, the design process incorporated elements from evidence-based HR models and indicator construction methodologies. The feasibility of practical application was assessed by referencing typical data collection approaches used in HR analytics, including employee surveys, expert interviews, and internal statistical reporting. While these tools were not implemented directly, they were considered in the context of data availability and organizational capacity.

The selection of indicators was based on a preliminary list derived from recurring concepts in academic literature and international standards related to human capital development. This list was systematically refined according to four key criteria. First, conceptual relevance ensured that each indicator meaningfully reflected a component of socio-economic efficiency in the context of digital transformation – such as digital skill acquisition, innovation participation, or the effectiveness of training outcomes. Second, the criterion of measurability emphasized the importance of practical data accessibility, favoring indicators that could be reliably quantified through internal HR systems, workforce analytics platforms, or external benchmarking sources. Both quantitative metrics (e.g., training ROI, productivity) and qualitative measures (e.g., perceived value of training, adaptability) were included. Third, a balanced representation of economic and social dimensions was maintained to capture the full spectrum of personnel development impacts – from financial efficiency to intangible outcomes like employee engagement and organizational learning culture. Finally, cross-sector applicability was prioritized, ensuring that the indicators are sufficiently general to be relevant across industries and adaptable to organizations of varying size and structure, including public institutions, SMEs, and large enterprises. This comprehensive approach enhances the versatility and strategic usability of the indicator framework.

Although the proposed indicators were not empirically tested, the article outlines potential methods for prioritizing and weighting them in practical use. Multicriteria analysis techniques, particularly the Analytic Hierarchy Process (AHP), are recommended to structure expert judgments and assign relative importance to each indicator based on strategic relevance. AHP enables pairwise comparisons among criteria, producing consistent and quantifiable weightings (Saaty, 2008). Additionally, expert scoring (e.g., rating indicators on a scale from 1 to 10) may be used during early-stage implementation to calibrate indicator relevance within specific organizational contexts. Where data availability allows, statistical weighting methods (such as entropy-based analysis or factor analysis) can be applied to validate and refine indicator significance using variance-based metrics.

These techniques support flexible adaptation of the framework: organizations can emphasize the indicators most aligned with their development goals, while maintaining methodological consistency. This also allows for comparative analysis and benchmarking over time or across institutions.

Although theoretical, the methodology emphasizes real-world feasibility. For example, adaptability or digital engagement can be assessed through Likert-scale employee surveys; training effectiveness may be measured via post-program evaluations; and digital skills can be tracked using HRIS systems or certification records. Productivity, retention, and innovation metrics can be obtained from existing performance reports. The proposed indicator framework offers a structured, scalable, and evidence-informed approach to assessing personnel development efficiency. It reflects the complexity of modern HR practices in the digital era and lays a solid foundation for future empirical validation and strategic application within organizations.

4 Development of the Socio-Economic Indicator Framework

The framework developed in this study offers a multidimensional approach to assessing the socio-economic efficiency of personnel development in the digital era. It is conceptually distinct from traditional models that emphasize static indicators such as training hours or the number of sessions, which often fail to capture the dynamic and ongoing nature of digital learning, behavioral change, and innovation-related outcomes. Instead, the proposed system integrates both quantitative and qualitative indicators to reflect a more comprehensive picture of development effectiveness, taking into account not only measurable business performance but also changes in individual engagement, digital adaptability, and organizational culture (Sikora & Ferris, 2019).

Quantitative indicators in this framework focus on tangible, data-driven outcomes resulting from development initiatives. These include metrics such as the return on investment in training programs, improvements in employee productivity following participation in upskilling efforts, the proportion of staff acquiring digital competencies or certifications, and retention levels after completing digital learning initiatives. Such data can be collected through existing human resource information systems, learning management platforms, performance evaluations, and internal mobility records. These indicators provide clear evidence of the economic impact of training efforts and support performance tracking at both individual and organizational levels (European Commission, 2022).

Alongside these, the framework incorporates qualitative indicators that aim to capture more nuanced, perception-based responses to development strategies. These include employee adaptability to technological change, satisfaction with digital training tools, active participation in knowledge-sharing platforms, and subjective assessments of training usefulness in daily work. They also extend to broader cultural elements, such as the emergence of a digital mindset or an organization's overall readiness for innovation. Information of this kind is gathered through surveys, interviews, 360-degree feedback, and other instruments that enable continuous monitoring of developmental outcomes beyond financial returns (Margherita & Bua, 2021).

To facilitate implementation, the framework organizes indicators into two overarching dimensions – economic and social – though in practice these categories are interdependent and often overlap in application. The system is designed to be visualized using analytical tools such as dashboards for trend analysis, heatmaps to detect performance gaps, and internal scorecards for benchmarking across departments or units. These visualization techniques not only enhance clarity but also assist HR managers in communicating insights to decision-makers and aligning development programs with strategic objectives.

Implementation of the framework requires a clear structure of indicator definitions, data sources, and timelines for measurement, adapted to the organization's size, sector, and level of digital maturity. For instance, in companies operating in knowledge-intensive sectors, qualitative indicators related to digital collaboration or cultural openness to change may play a more central role than in more operationally focused environments. Regardless of the context, the proposed system promotes continuous learning and long-term strategic thinking by embedding personnel development into the broader performance and innovation agenda.

The strength of the framework lies in its adaptability and evidence-based logic. It not only supports internal diagnostics and decision-making but also enables organizations to benchmark their performance over time and in comparison to peers. By connecting digital training efforts with concrete organizational outcomes and behavioral shifts, the model positions personnel development as a key driver of socio-economic value in the digital economy. As such, it lays a strong foundation for future empirical validation and offers a versatile tool for practical use in HR analytics and strategic workforce planning.

5 Findings

The proposed framework presents a theoretically grounded and methodologically structured approach to evaluating the socio-economic efficiency of personnel development in organizations undergoing digital transformation. Its key contribution lies in its multidimensional structure, which integrates both economic performance metrics and socially oriented indicators. This dual focus addresses a persistent gap in traditional HR evaluation models that often

overemphasize short-term outputs – such as the number of training hours or session completions – while neglecting the broader strategic and cultural outcomes of human capital development (Sikora & Ferris, 2019).

From a strategic human resource management perspective, the framework reflects the ongoing shift from transactional, input-based training practices toward more dynamic and outcome-driven development strategies. This aligns with the evolution of modern HRM, where continuous learning, organizational agility, and employee empowerment have become core priorities. The proposed indicator system supports these trends by offering tools to assess not only the volume or cost of training, but its impact on digital adaptability, retention of knowledge, and transformation of workplace culture. In this sense, the framework contributes to a broader understanding of how personnel development enhances long-term organizational resilience and innovation capacity (Vial, 2019).

In practical terms, the model can assist HR professionals and decision-makers in several key areas. First, it provides a logical and evidence-based mechanism to link investment in learning and development with quantifiable business outcomes, such as increased productivity or improved retention. Second, it serves as a diagnostic instrument to uncover hidden gaps in development strategies – particularly in areas like employee engagement with digital tools, responsiveness to change, or participation in innovation initiatives. By highlighting these less-visible dimensions, the framework enables more targeted interventions. Third, the framework supports internal benchmarking and comparative analysis across departments or business units. Organizations can use it to establish baseline metrics, monitor longitudinal progress, and assess the effectiveness of specific learning formats or technologies.

Moreover, for companies aiming to transition toward data-driven HR management, the indicator system offers a blueprint for integrating learning and development metrics into automated dashboards and internal analytics systems. For example, learning management systems (LMS) and human resource information systems (HRIS) can be configured to track selected indicators – such as completion rates for digital upskilling programs, feedback scores from training participants, or correlations between training engagement and productivity KPIs. Such integration facilitates real-time monitoring, performance forecasting, and evidence-based decision-making, thereby reinforcing the role of HR as a strategic business function (Meijerink, Bondarouk, & Lepak, 2020).

At the same time, several limitations must be acknowledged. The framework remains a theoretical construct and has not yet undergone empirical validation through field testing or case study analysis. As such, its applicability for direct comparison across organizations or industries is limited at this stage. Furthermore, the relevance and feasibility of certain indicators may vary significantly depending on organizational size, sectoral characteristics, and digital maturity. For instance, indicators related to innovation behavior or digital mindset may be more salient in technology-intensive industries than in traditional manufacturing or service sectors. Similarly, smaller enterprises may lack the data infrastructure to capture and analyze complex HR metrics.

Another important consideration is the subjectivity associated with certain qualitative indicators – such as perceived usefulness of training or readiness for innovation. These constructs require carefully designed measurement tools, including validated survey instruments, standardized scoring protocols, and triangulation with other data sources, to ensure reliability and minimize bias. Without such rigor, there is a risk that organizations may draw inaccurate conclusions or misallocate resources based on skewed perceptions rather than objective outcomes. Given these considerations, further research is needed to empirically test the validity and reliability of the proposed indicators. Pilot implementations across diverse organizational contexts would help refine the framework and identify which components are universally applicable and which require contextual adjustment. Comparative studies across regions and industries could also uncover sector-specific dynamics, such as variations in training ROI or cultural readiness for digital adoption. Moreover, future studies could explore how the framework can be integrated into advanced HR analytics platforms, potentially using machine learning algorithms or predictive modeling to assess the long-term impact of personnel development on strategic goals.

In summary, the framework offers both conceptual and practical value. It encourages a shift in thinking from measuring training as an isolated activity to viewing personnel development as a core driver of socio-economic performance. By combining traditional performance metrics with indicators of learning culture, adaptability, and innovation, the system empowers HR leaders to align human capital strategy with broader organizational transformation objectives. Although theoretical at this stage, the model lays a strong foundation for future empirical inquiry and real-world application in a digitalized, knowledge-based economy.

6 Conclusions

The conducted study offers a conceptual framework for evaluating the socio-economic efficiency of personnel development in the context of digital

transformation. Based on the analysis of scientific literature and strategic HR trends, a structured system of indicators was proposed, integrating both quantitative metrics (e.g., productivity, ROI of training, digital skills index) and qualitative ones (e.g., adaptability, engagement, innovation readiness). The following conclusions summarize the key results and implications of the research:

1. Intellectual culture has been identified as a core intangible asset of modern organizations.

It includes not only knowledge and skills, but also employee behaviors, attitudes toward learning, and their ability to engage in knowledge sharing and innovation. This culture shapes the strategic potential of human capital and directly impacts organizational competitiveness.

2. Traditional models of HR evaluation are no longer sufficient in the digital environment.

Static, input-based metrics (e.g., hours of training or costs) fail to reflect the complexity of modern development processes, which are dynamic, self-directed, and often mediated through digital platforms. Therefore, a shift toward integrated performance systems is necessary.

3. The proposed framework addresses the need for multidimensional evaluation.

By combining economic and social indicators, the system captures not only measurable performance outcomes but also behavioral changes and employee engagement that contribute to long-term resilience and adaptability.

4. Practical implementation of the model requires strategic alignment of HR functions.

Organizations should embed the framework into corporate policies, HR analytics systems, and learning strategies. This involves creating conditions for continuous learning, supporting internal mentoring, and fostering a data-driven culture of development.

5. The model is applicable across industries and scalable to organizations of different sizes.

Due to its conceptual flexibility, the framework can be adapted to sector-specific needs and digital maturity levels, providing a common language for benchmarking and strategic workforce planning.

While the framework is theoretically substantiated, future empirical studies are necessary to validate the indicators in practice. This includes testing the model in different sectors, analyzing cross-country applications, and exploring correlations between specific indicators and business performance outcomes. Additionally, further research should focus on the integration of these indicators into automated HR systems and digital dashboards, enabling real-time monitoring of development effectiveness.

In summary, the study highlights the strategic importance of fostering intellectual culture and implementing robust evaluation tools in HRM. The proposed system offers a foundation for organizations to move beyond traditional training metrics and build adaptive, innovation-driven, and socially sustainable models of personnel development.

References:

[1] Becker, G. S. (1964) Human capital: A theoretical and empirical analysis, with special reference to education. Chicago, IL: University of Chicago Press.
[2] Bondarouk, T., & Brewster, C. (2016) Conceptualising the future of HRM and technology research. *The International Journal of Human Resource Management, 27*(21), 2652–2671.
[3] Delaney, J. T., & Huselid, M. A. (1996) The impact of human resource management practices on perceptions of organizational performance. *Academy of Management Journal, 39*(4), 949–969.
[4] European Commission (2022) The European Digital Competence Framework for Citizens (DigComp 2.2). Luxembourg: Publications Office of the European Union. E-source: https://data.europa.eu/doi/10.2760/115376
[5] Margherita, A., & Bua, I. (2021) The role of human resource practices for the development of Operator 4.0 in Industry 4.0 organisations: A literature review and a research agenda. *Business Process Management Journal, 27*(2), 473–495.
[6] Meijerink, J., Bondarouk, T., & Lepak, D. (2020) When HRM meets the digital workforce: A review and research agenda. *Human Resource Management Review, 30*(1), 100685. DOI: https://doi.org/10.1016/j.hrmr.2019.100685
[7] OECD (2019) OECD skills strategy 2019: Skills to shape a better future. Paris: OECD Publishing.
[8] Pulakos, E. D., Arad, S., Donovan, M. A., & Plamondon, K. E. (2000) Adaptability in the workplace: Development of a taxonomy of adaptive performance. *Journal of Applied Psychology, 85*(4), 612–624.
[9] Saaty, T. L. (2008) Decision making with the analytic hierarchy process. *International Journal of Services Sciences, 1*(1), 83–98.
[10] Sikora, D. M., & Ferris, G. R. (2019). Strategic talent management: A review and research agenda. *Human Resource Management Review, 29*(3), 100678.
[11] Ulrich, D., Younger, J., Brockbank, W., & Ulrich, M. (2012) HR from the outside in: Six competencies for the future of human resources. New York, NY: McGraw-Hill.

[12] Vial, G. (2019) Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems, 28*(2), 118–144.
[13] World Economic Forum (2023) The future of jobs report 2023. Geneva: World Economic Forum. E-source: https://www.weforum.org/reports/the-future-of-jobs-report-2023/

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