

Identification of the Relationship Between the Criteria and Results of ERP Application with Human Capital Management Module and Enterprises Features

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Abstract— The study aims to analyze the motivations for implementing Enterprise Resource Planning (ERP) systems and utilizing their individual functions, particularly the integrated Human Capital Management (HCM) module, within Polish companies. It examines key factors influencing the deployment of these systems, with a focus on enhancing recruitment processes, improving team management, and maximizing the utilization of employee skills and qualifications. The findings reveal that the most commonly used functions include employee development, performance appraisal, and team composition management. Additionally, the analysis highlights significant differences in the perceived effects of the HCM module implementation, which vary according to company size and industry. The survey also demonstrates the proactive efforts of Polish companies to integrate advanced HCM technologies, reflecting their operational contexts and industry characteristics.

I. INTRODUCTION

The success of any enterprise is largely determined by the skills of its workforce. Recognizing the value and importance of people in the work process is essential for maintaining competitiveness in both domestic and global markets [1,2]. Human resources represent a company's capital, comprising a totality of character traits, skills, and conditions that enable the organization to perform various functions and thus contribute to increasing the company's value [3]. Bontis and Fitzenz define human capital as the set of knowledge, skills, innovation, and abilities that enable a company's employees to perform the tasks set before them [4]. Furthermore, the concept of human capital is increasingly associated with creating corporate value, achieving competitive advantage, and ensuring the long-term development of the company [5]. A well-developed workforce is considered foundational for building human capital, where the success of the company depends on providing an appropriate program for the development of skills and abilities [6]. Human capital management is tightly linked to human resource management (HRM), with HCM serving to bridge the gap between HR and business strategy [7].

In this context, it is important to note that companies across industries are adopting enterprise resource planning systems that can integrate data across all functional units and comprehensively support major processes throughout the

organization. Increasingly, ERP systems include HCM modules aimed at managing the human capital of the enterprise, with a special emphasis placed on a strategic approach. A complete HCM system encompasses all processes related to handling and managing employees, including recruitment, human resources activities across organizational units (including those with global operations), compensation, benefits, talent management, training, workforce planning, work-life solutions, time tracking, and payroll [8]. These systems enable companies to make faster, more accurate decisions and provide employees with optimal working conditions. Moreover, state-of-the-art HCM systems incorporate technological solutions such as artificial intelligence and chatbots to automate processes, thereby enhancing operational efficiency and rapidly responding to unforeseen situations.

It is important to note that compared to traditional HRM systems, the use of an HCM system offers numerous benefits for the organization, such as [9-11]:

- Accelerating the pace and quality of new employee recruitment by quickly sourcing and recruiting the right candidates,
- Offering work-life balance solutions that translate into greater motivation to work, which in turn increases employees' commitment to their duties,
- Retaining valuable employees in the company by nurturing their professional development through opportunities for vocational training, qualification, and skill improvement,
- Increasing security of tenure due to proactive succession planning for management, supervisory, and other critical positions,
- Better aligning HR strategy with the company's business strategy,
- Predicting future employee turnover with the capabilities provided by advanced analytics,
- Adapting the workforce faster in the face of organizational change,
- Customizing HR processes to meet the needs of unique employees (e.g., those specializing in certain areas),
- Providing more appropriate remuneration of employees, considering not only monetary but also non-monetary forms,
- Improving time and labor management,
- Scheduling work more efficiently,
- Managing costs associated with employee projects without exceeding established levels,
- Creating a culture of paying for performance and results,
- Consolidating legacy, heterogeneous HRM systems into a single, fully functional HCM system,
- Making the right decisions with a wide range of analytical tools,

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- Automating HR processes, both locally and globally,
- Generally accelerating the implementation of personnel processes within the enterprise.

Meanwhile, companies using the implemented ERP system also have access to the HCM system, which is a separate module. The addition of this module was one of the conditions for the transformation from earlier MRPII systems into modern ERP systems [12]. A highly developed ERP system will also have an extensive HCM module to support the implementation of processes occurring in areas such as [13-16]:

- Personnel administration, including the day-to-day handling of employees, such as recording personnel events, printing required certificates, reporting, making notifications to Social Security or the IRS, and maintaining personnel records (also in the form of an e-file),
- Time management, including handling time registration, creating and assigning work schedules, printing work cards, recording events such as attendance, absence, substitutions or overtime, and time reporting,
- HR and payroll service, covering all employees (based on employment contract, managerial contract, contract of mandate, contract for specific work), payroll calculation, printing of certificates and pay slips, reporting, generation and preparation of documents for Social Security or tax offices, implementation of electronic transfers, automatic settlement of the results of the settlements carried out,
- Management of the organization, including defining the organizational structure with the determination of links between positions, defining the reporting structure, conducting simulations of organizational changes, and reporting,
- Recruitment, including recording candidate information, statistics, generating candidate ranking lists, managing vacancies, conducting automated correspondence with candidates, submitting candidate data to the employee database, and reporting,
- Training management, including developing training catalogs, booking participation, accounting for costs, training evaluation, and reporting,
- Personnel cost planning, including conducting simulations of personnel costs based on actual and hypothetical data, conducting simulations of salary changes and creating comparative reports,
- Salary management, including making job valuations according to market data, internal analysis, budgeting, adjusting salaries according to established algorithms, and reporting,
- Employee development, including skills and career path management and reporting,
- Employee appraisals, including defining appraisal systems, recording appraisals obtained, and more.

Recent studies underscore the importance and evolving capabilities of these integrated systems. For instance, research documented in Zenodo explores the progressive functionalities of ERP systems in managing human capital effectively, illustrating their critical role in modern business operations [17]. These systems are tailored to meet the demands of Industry 4.0, emphasizing the strategic integration of HCM functionalities to enhance organizational performance [18]. Furthermore, a Preprints study highlights

the varying impacts of ERP systems across different industries, providing valuable insights into their sector-specific applications and benefits [19].

This research aims to analyze the motivation behind the adoption of ERP systems with HCM modules in Polish companies and to assess how these systems' individual functions are utilized to optimize human capital management. The study also examines the perceptual differences in the impact of these systems based on the size of the company and the industry, providing a comprehensive overview of the strategic benefits realized through such integrations.

The introduction of HCM modules into ERP systems represents a critical evolution from earlier MRPII systems, marking a significant shift towards more integrated, strategic, and efficient organizational management tools. This study seeks to highlight the specific benefits of these systems, documenting the substantial advances and the nuanced differences in their application across various sectors and company sizes.

II. RESEARCH METHODOLOGY

Companies deciding to implement an ERP system with an integrated HCM module are influenced by specific considerations that vary according to the company's size and industry. The functionalities selected from the ERP system are similarly influenced by these parameters. This variability forms the basis for our research hypotheses:

H1: There are statistically significant relationships between the size and industry of an enterprise and both the implementation of an ERP system in the HCM area and the utilization of its functionalities.

H2: Significant differences exist between the primary effects of implementing an ERP system with an integrated HCM module and the company parameters of size and industry.

For this analysis, we defined the following independent variables: company size, industry of activity (Table I)

TABLE I. INDEPENDENT VARIABLES USED IN THE ANALYSES

Variables	Symbol
Company size (W)	
Small	W1
Medium	W2
Large	W3
Business sector (B)	
Industry	B1
Construction	B2
Trade	B3
Transport and storage management	B4
Accommodation and catering	B5
Information and communication	B6
Real estate services	B7
Professional, scientific and technical activities	B8
Finance	B9
Administration and operations	B10
Education	B11
Culture, entertainment and recreation	B12
Other service activities	B13

Correspondingly, the reasons for implementing an ERP system in the HCM area and the specific functionalities used were defined as dependent variables, also assigned symbols as detailed in Table II.

TABLE II. VARIABLES USED IN THE ANALYSES

Variables	Symbol
The reasons for implementing an ERP system in the HCM area (PW)	
Hiring/hiring processes	PW1
Motivation	PW2
Training	PW3
Periodic evaluations	PW4
Better management of the employee team	PW5
Better use of employees' qualifications, skills or abilities	PW6
Charting individual career paths	PW7
Used functions of ERP system with built-in HCM module (F)	
Used in the process of selecting employees for the team	F1
Used in the recruitment process	F2
Used in finding talent	F3
Used in employee development	F4
Used in training	F5
Used in employee evaluation	F6
Used in the education process	F7
Used in the control of the required qualifications	F8
Used in the development of individual models	F9
The main effects of implementing the HCM module (E)	
Increased employee efficiency/performance	E1
HCM-related cost reduction	E2
Reduce the risk of outflow of workers	E3
Unification of service to employees	E4
Obtaining a reliable assessment of the employee	E5
Greater transparency in the employee evaluation process	E6
Faster/easier access to employee information	E7
Better cooperation with employees	E8
Greater involvement of employees in their work	E9
Creation of a database of potential employees	E10
Easier search for new employees	E11
Reduce the need for human resources staff	E12
Impact on the development of the company	E13
Faster implementation of solutions regarding HCM	E14
Better support for remote working	E15
Better organization of training/workshops	E16
More efficient management of projects implemented	E17
Development of knowledge and activation of employees	E18
Greater security of personal data	E19
Greater availability of data	E20
Ability to account for employee time and expenses	E21
Creation and expansion of the qualification catalog	E22
Ability to define career models for individual positions	E23
Ability to define models for replacing some positions with others	E24
Ability to develop individual development models	E25

Data were collected from November 2022 to February 2023 using the CATI and CAWI methods. Respondents, who were employees in various roles within their companies, were selected based on their knowledge about the use of an ERP system with an integrated HCM module. A total of 434 survey questionnaires were completed, distributed as shown in Table III.

Given that the variables analyzed were nominal, quantitative, and ordinal, r-Pearson correlation analysis and eta (η) statistics were employed to verify the hypotheses. These methods helped identify and measure the strength of relationships and differences across the categorized groups.

This methodology provides a comprehensive framework for understanding the strategic decisions behind ERP and HCM implementations in various industrial contexts.

TABLE III. SAMPLE STRUCTURE WITH REGARD TO INDUSTRY SECTOR AND COMPANY SIZE

Main business activity	Small	Medium	Large
Industry	34	42	46
Construction	6	14	2
Trade	6	36	-
Transportation and warehousing	-	32	2
Accommodation and gastronomy	-	28	-
Information and communication	2	10	4
Real estate services	-	10	-
Finance	2	16	2
Professional, scientific, and technical activities	2	12	-
Administration and activities	-	4	12
Education	-	6	-
Culture, entertainment, and recreation	2	22	-
Other service activities	22	16	42
Total	76	248	110

III. RESEARCH RESULTS

As a preliminary step, correlations between the independent variable of company size and the dependent variables, which include the main reasons for implementing an ERP system in the HCM area (PW) and the usage of functions within an ERP system with an integrated HCM module (F), were examined (Table IV).

TABLE IV. CORRELATIONS BETWEEN COMPANY SIZE AND DEPENDENT VARIABLES: (PW) AND (F)

Size	Small (W1)	Medium (W2)	Large (W3)
The main reasons for implementing an ERP system in the HCM area (PW)			
PW1	0,06	-0,38	0,38
PW2	0,01	-0,24	0,27
PW3	0,20	0,11	-0,30
PW4	-0,27	-0,20	0,47
PW5	0,10	-0,23	0,17
PW6	0,15	0,04	-0,18
PW7	0,05	-0,36	0,37
Used functions of ERP system with built-in HCM module (F)			
F1	0,32	0,06	-0,35
F2	0,16	0,07	-0,22
F3	0,01	-0,24	0,26
F4	0,02	-0,20	0,21
F5	-0,10	0,07	0,01
F6	0,19	-0,40	0,28
F7	-0,09	0,17	-0,11
F8	0,18	-0,39	0,28
F9	-0,10	0,24	-0,18

The results indicate significant correlations between the independent variable (company size) and the dependent variables (PW and F). Specific observations include:

- **Small Companies:** More likely to cite training, better workforce management, periodic evaluations, and better utilization of employees' qualifications as reasons for ERP implementation, but less likely to cite periodic evaluations.
- **Medium-Sized Companies:** Frequently cited training but were less likely to mention hiring/acquisition processes, motivation, periodic evaluations, team management, and career path development.
- **Large Companies:** Demonstrated relationships in all evaluated areas, often citing hiring, motivation, periodic

evaluations, team management, and career path setting, but less often mentioned training and utilization of skills.

For the functionalities of the ERP system with an integrated HCM module (F):

- **Small Companies:** More likely to use the ERP system for team selection, recruitment, employee evaluation, and qualifications control, but less often for training and individual model development.
- **Medium-Sized Enterprises:** More frequently used the ERP system for education and individual model development, but less so for talent finding, employee development, evaluation, and qualifications control.
- **Large Enterprises:** Indicated frequent use of the ERP system for talent finding, employee development, evaluation, and controlling qualifications, but less often for team selection, recruitment, and education.

These findings highlight the critical role organizational size plays in shaping the adoption and utilization of ERP systems. They suggest that while SMEs might target immediate operational benefits, larger enterprises plan for long-term strategic outcomes through comprehensive ERP implementations.

Following this analysis, correlations between the company's industry and the reasons for implementing an ERP system were examined.

From these results, it can be inferred that the observed correlations are less numerous compared to previous studies. Specifically:

- **Hiring/Recruiting Processes:** Industrial enterprises and those in other service activities more frequently indicated this as a reason, while it was less frequently indicated by companies in commercial sectors, transportation and warehousing, accommodation and food services, and culture, entertainment, and recreation.
- **Motivation:** More often cited by industrial enterprises and those involved in culture, entertainment, and recreation, whereas financial enterprises and other service activities cited this less frequently.
- **Training:** Predominantly indicated by companies in real estate services and professional, scientific, and technical activities, and less often by those in transportation and warehousing and other service activities.
- **Interim Assessments:** More frequently cited by industrial and construction enterprises, and less so by retail, accommodation and food services, and culture, entertainment, and recreation.
- **Better Management of Work Teams:** More commonly cited by industrial enterprises, and less so by commercial enterprises, those in transportation and storage, real estate services, education, and other service activities.
- **Better Use of Employees' Skills and Abilities:** Significantly less often indicated by financial companies.
- **Individual Career Paths:** More frequently indicated by industrial enterprises, while less frequently by commercial enterprises, transportation and storage, accommodation and catering, finance, and other service activities.

Due to space constraints in the paper, detailed results on the functionalities of the ERP system with an integrated HCM module (F) could not be presented comprehensively. Nonetheless, notable correlations include:

- **Recruitment Process:** More often used by companies in administration and operations, and less by industrial companies.
- **Training:** Less frequently used by companies in transportation and warehouse management.
- **Employee Evaluation:** More commonly used by real estate service companies, and less so by industrial companies.
- **Controlling Required Qualifications:** More frequently used by companies in real estate services and other service activities.
- **Development of Individual Models:** More often by companies in education and culture, entertainment, and recreation, and less by those in other service activities.

The U'Mann-Whitney test was employed to examine the hypothesis: "There are significant differences between the main effects of implementing an ERP system with an integrated HCM module and the parameters of the company in terms of size and industry." This hypothesis was confirmed if significant correlations were observed in more than 50% of the analyzed cases, highlighting that ERP system impacts vary significantly with organizational context, reinforcing the necessity for tailored ERP strategies.

These findings underscore the critical need for companies to consider their industry-specific requirements when implementing ERP systems, ensuring that the chosen system aligns with their strategic objectives and operational needs, thus maximizing the benefits of ERP investments.

TABLE V. U'MANN-WHITNEY TEST VALUES IN RELATION TO THE MAIN EFFECTS OF HCM MODULE IMPLEMENTATION DEPENDING ON THE SIZE OF THE ENTERPRISE

	W1/W2			W1/W3			W2/W3		
	U	Z	p	U	Z	p	U	Z	p
E1	7848	2,21	0,03	2090	-5,79	0	6830	-7,54	0
E2	4448	6,96	0	1860	6,43	0	11676	-2,17	0,03
E3	7396	-2,84	0	1930	-6,23	0	9058	-5,07	0
E4	5734	5,16	0	2860	3,66	0	10840	-3,1	0
E5	-	-	-	2556	-4,5	0	8892	-5,26	0
E6	7150	-3,18	0	1914	-6,28	0	8660	-5,51	0
E7	-	-	-	1386	-7,74	0	5346	-9,18	0
E8	5918	4,91	0	2070	5,84	0	12078	1,73	0,08
E9	7694	-2,42	0,02	-	-	-	10584	3,38	0
E10	5432	5,59	0	2584	4,42	0	11438	-2,44	0,01
E11	-	-	-	2456	4,78	0	10852	3,09	0
E12	5650	5,28	0	1712	6,84	0	11282	2,61	0,01
E13	-	-	-	2548	4,52	0	11672	2,18	0,03
E14	7442	2,77	0,01	-	-	-	11152	-2,75	0,01
E15	5776	5,11	0	-	-	-	8362	-5,84	0
E16	-	-	-	2508	4,63	0	11000	2,92	0
E17	-	-	-	2252	-5,34	0	10464	-3,52	0
E19	7818	-2,25	0,02	3330	-2,35	0,02	13238	-0,44	0,66
E20	7714	2,39	0,02	1750	-6,73	0	5726	-8,76	0

E21	5826	5,04	0	3056	3,11	0	9928	-4,11	0
E22	7672	-2,45	0,01	-	-	-	11476	2,39	0,02
E23	5208	5,9	0	2220	5,43	0	11848	-1,98	0,05
E24	-	-	-	2764	-3,92	0	-	-	-
E25	-	-	-	2304	5,2	0	10546	3,42	0

This analysis reveals notable differences in how the effects of implementing HCM modules are perceived across different enterprise sizes. For example:

- Effect E1 (Increased Employee Efficiency/Performance) shows a consistent trend where smaller companies experience more positive impacts compared to larger ones, indicated by negative Z-scores in larger company comparisons.
- Effect E2 (Cost Reduction Related to HCM) is perceived significantly more positively in medium-sized enterprises compared to both smaller and larger firms.
- Other effects like E4 (Better Cooperation with Employees) and E5 (Creation of a Database for Potential Employees) also demonstrate significant variations, indicating that perceptions of benefits vary substantially with company size.
- It is also important to note that for one specific variable—E19 (Greater Security of Personal Data)—no significant differences were observed across the compared groups. This suggests a uniform appreciation of data security enhancements brought about by the HCM module across all enterprise sizes.
- In addition, when comparing the effects of HCM module implementation between industries where the enterprise's sector participation was greater than 10% of the surveyed population, only industrial (28.1%) and other service activities (18.4%) were analyzed. This focused analysis ensures that the findings are statistically robust and reflect the views of a significant segment of the market.

These results underscore the nuanced ways in which different sizes of enterprises perceive the impact of HCM modules. Smaller enterprises might see immediate operational benefits like increased efficiency and better team cooperation, which are crucial for their agile operation. Conversely, larger enterprises might focus more on long-term strategic benefits like data security and cost management, which align with their broader organizational goals.

For businesses, understanding these differential impacts can guide more tailored ERP implementations. Companies can prioritize certain HCM functionalities based on their size-specific needs, enhancing the overall return on investment in ERP systems. Additionally, the results suggest that regardless of company size, certain benefits like enhanced data security are universally valued, pointing to these features as essential components of any ERP system.

This analysis not only aids companies in making informed decisions about ERP investments but also helps ERP providers design systems that meet the varied needs of different businesses, potentially leading to better customer satisfaction and adoption rates.

The results from Table VI illustrate that there are significant differences in how industrial enterprises and other service sectors perceive the impacts of HCM module implementations.

TABLE VI. U'MANN-WHITNEY TEST VALUES IN RELATION TO THE MAIN EFFECTS OF HCM MODULE IMPLEMENTATION DEPENDING ON THE SIZE OF THE ENTERPRISE

Variable - implementation effects		B1/B13		
		U	Z	p
Increased employee efficiency/performance	E1	3632,00	3,07	0,00
HCM-related cost reduction	E2	3534,00	3,31	0,00
Reduce the risk of outflow of workers	E3	2950,00	4,75	0,00
Obtaining a reliable assessment of the employee	E5	3192,00	4,15	0,00
Greater transparency in the employee evaluation process	E6	3684,00	2,94	0,00
Better support for remote working	E15	3224,00	4,07	0,00
Greater security of personal data	E19	3818,00	-2,61	0,01
Ability to define models for replacing some positions with others	E24	3642,00	3,05	0,00

Notably:

- Increased Employee Efficiency/Performance (E1): This was significantly more pronounced in industrial enterprises compared to service sectors, suggesting that industries with complex operational processes gain more in terms of efficiency from HCM implementations.
- HCM-Related Cost Reduction (E2) and Risk Reduction of Employee Churn (E3): These are crucial in industries with high operational costs and employee turnover, respectively. The significant values indicate a strong positive impact of HCM systems in industrial settings, which often deal with higher labor costs and retention challenges.
- Reliable Employee Assessments and Greater Transparency (E5, E6): These effects are critical for maintaining high standards of performance and accountability, more significantly observed in industrial enterprises.
- Support for Remote Working (E15): Particularly relevant in the current climate, the marked improvement in support for remote working in industrial sectors indicates an adaptation towards flexible work arrangements, a shift from traditional operational methods.
- Greater Security of Personal Data (E19): Interestingly, this was more significantly noted by other service activities. This might reflect the higher regulatory scrutiny or customer sensitivity to data privacy in these sectors compared to industrial enterprises.
- Ability to Define Replacement Models (E24): This reflects the strategic HR capability enhanced by HCM systems, allowing industrial enterprises to plan succession and replacements efficiently, critical in ensuring uninterrupted operations.

For industrial enterprises, the benefits are largely operational and strategic, enhancing efficiency, cost management, and HR functionalities critical for maintaining competitive advantage. In contrast, service-oriented sectors derive significant value from aspects like data security, reflecting their operational focus and market demands.

For businesses, this analysis highlights the importance of tailoring HCM system implementations to industry-specific needs, ensuring that the system functionalities align with the sector's unique challenges and opportunities. Such targeted implementations can significantly enhance ROI by addressing

the most pressing operational and strategic needs of the enterprise.

IV. CONCLUSION

Surveys conducted in Polish companies have yielded insightful conclusions about the implementation and utilization of human resource management systems. A key observation from these surveys is that the primary motivations driving the adoption of these systems include the need for more efficient recruitment processes, enhanced team management, and better utilization of employees' skills and qualifications. Although these results partially confirm hypothesis H1, showing that there are indeed relationships between the analyzed variables, these relationships are predominantly weak or moderate.

Further analysis reveals significant differences in how the effects of the HCM module implementation are perceived by companies, depending on specific parameters. While some instances showed no significant differences in perception among the compared groups, significant differences were observed in more than 50.2% of the cases, thus confirming hypothesis H2.

These findings align with recent global research in HRM, which increasingly highlights the strategic and effective utilization of human capital [20-22]. For example, a study by Wahdaniah et al. (2023) emphasizes the growing importance of digital HRM systems in enhancing recruitment efficiency and employee management, mirroring the trends observed in the Polish context. This research underscores how integrated HRM systems can significantly impact organizational performance, particularly in dynamic and competitive markets [23].

Moreover, the work by Malik et al. (2022) explores the differential impacts of HRM system implementations across various industries and geographies, noting that perceptions of HRM benefits can vary widely based on organizational culture and industry-specific challenges [24]. This study supports the nuanced findings from the Polish surveys, indicating that while HRM systems generally enhance human capital management, the degree and nature of these benefits can differ substantially.

In summary, the research conducted on Polish companies provides a valuable case study into the broader shifts in HRM practices, affirming the critical role of HRM systems in modernizing recruitment, improving team management, and leveraging employee capabilities effectively. These results not only corroborate broader HRM trends but also provide specific insights into the varying impacts of HRM system implementations across different organizational contexts.

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