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Foresight in Human Resource Management in Knowledge-Based Companies

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A B S T R A C T

The present study was conducted with the aim of foresight in human resource management in knowledge-based companies. This research falls under the category of mixed-method studies (qualitative and quantitative). The qualitative strategy employed was thematic analysis, and the quantitative strategy was a survey approach. The qualitative sample consisted of 14 experts and managers from knowledge-based companies, selected through purposive and snowball sampling methods. In-depth interviews were conducted with these participants. MAXQDA software (2018) was used to analyze the data. Based on the interviews, components were extracted, and through the coding process and subsequent tests, the final model of the study was developed. Findings from the qualitative section indicated that the dimensions for designing a human resource management model in knowledge-based companies include the individual approach, organizational characteristics, environmental conditions, and technology. In the quantitative section, the statistical population consisted of all employees, deputies, and managers of knowledge-based companies, and 384 questionnaires were distributed and collected using convenience sampling. To analyze the research questions, Structural Equation Modeling (SEM) was performed using SmartPLS 3 software. The results of model evaluation showed that all research hypotheses had a significance level of less than 0.05; therefore, all hypotheses were confirmed and accepted with 95% confidence.

Keywords: *Foresight, Human Resource Management, Knowledge-Based Companies.*

1. Introduction

In contemporary human capital literature, the role of knowledge workers as key elements in innovative and knowledge-based companies has been emphasized, and the development of their innovative capabilities is considered dependent on the implementation of targeted and interventionist management programs (Kossyva et al., 2024). In the information age, knowledge is regarded as one of the most valuable assets due to its role in creating economic and social value. It has gained such importance that many economists consider it the core of production, distribution, and consumption in current and future markets, viewing the emergence of knowledge-based economies as a result of this trend (Zamaani Tabaghdehi & Momenimahmouei, 2023; Zhang & Chen, 2023). In this economy, innovation and creative human capital are regarded as fundamental pillars. Within this context, knowledge-based companies have emerged as a new type of organization in the late 20th and early 21st centuries (Sabzi et al., 2023; Salehi Kharizsangi & Rashidi, 2023); companies capable of creating opportunities in turbulent and dynamic environments, and recognized as key drivers of knowledge- and innovation-based economic development (Almasi-Fard et al., 2021). Many researchers have identified innovation as the distinguishing feature of knowledge-based companies—an innovation that results from the transformation of tacit knowledge into explicit knowledge and ultimately into marketable intellectual capital, with human capital playing a fundamental role in this mission (Rajput et al., 2023; Razavi et al., 2023). The focus on human resources and their empowerment—as the most valuable organizational asset—reinforces the notion that people are considered vital and influential partners in organizations, and that the development of human resources leads to balanced and comprehensive organizational development (Mayahi et al., 2023; Mohammadzadeh et al., 2023).

Today, the significance of human capital in leveraging knowledge and achieving innovation has become so pronounced in knowledge-based companies that some experts, including Alvesson (2000), identify human capital as their primary defining characteristic. In the emerging discourse of human capital, knowledge workers are recognized as key resources for innovation in small and knowledge-based organizations, and fostering their innovative potential is deemed to require interventionist managerial programs (Anwar & Abdullah, 2021). This dual importance—the necessity of managerial interventions to unleash innovative capabilities and the need to support knowledge-based companies in attracting, empowering, retaining, and advancing knowledge workers—has led policymakers, policy researchers, and managers at various levels to pursue diverse support strategies (Bahari & Taheri Rouzbahani, 2023). At the macro level, supporting human capital development policies and actions to enhance technology and innovation in knowledge-based companies has always been a key indirect governmental priority (Codreanu, 2019). In fact, today's economy shows that increasing wealth is increasingly influenced by the growth of knowledge. Therefore, as knowledge plays a greater role in economic domains, the process of wealth creation is facilitated (Taqva et al., 2022).

In general, the growing share of knowledge-based economies—exceeding 50% of GDP in some countries—the 20% to 50% contribution of knowledge-intensive industries to the employment of university graduates, and the emergence of global market competition and new business ecosystems have established a unique position for knowledge-based and innovative companies. As a result, the management of these companies has recently come into increasing focus (Bagherian-Kasgari & Fani, 2020). A knowledge-based company is defined as an entity formed to enhance science and wealth, promote a knowledge-based economy, achieve scientific and economic goals, and commercialize the outcomes of research and development in high-tech and value-added sectors (Fooladvand et al., 2022). Its primary goal is to commercialize research findings and increase the self-generated income of universities and research centers (Hassan, 2022). These companies aim to engage scientific elites and university faculty in the economy and meet societal needs, ultimately boosting university revenues and commercializing academic knowledge (Djukic & Zoric, 2022). The emergence of knowledge-based companies dates back to 1979, when a researcher named Little began his initial studies with the intent of establishing such enterprises. Using terms like "technology-driven companies," he successfully founded the first company focused on investigating, developing, and commercializing scientific inventions, knowledge, and innovations (Aghababayi et al., 2022). Since then, a variety of terms such as "knowledge-centric organizations," "high-tech-based companies," "knowledge-based enterprises," and "innovative organizations" have become common in scientific literature (Clarke & Gholamshahi, 2018). Shareholders of these companies are typically educated and

skilled individuals who, instead of contributing monetary capital, produce valuable outputs in the form of intangible assets like intellectual property rights, industrial designs, technical know-how, software, and other intellectual assets (Lotfi et al., 2018).

Nonetheless, researchers (Abolfathi et al., 2021; Khodaparast et al., 2021) argue that despite growing attention to managing knowledge-based companies, the field of human resource management within them remains relatively neglected. This is despite the fact that developing and institutionalizing HRM systems is one of the pillars of business professionalization and plays an undeniable role in enhancing the effectiveness of knowledge-based companies—whether small, medium, or large.

Human resources are regarded as the most valuable organizational asset in realizing talent potential and sustaining high performance (Pak et al., 2019). In response to the pressures of a new competitive environment, managers strive to maximize the capabilities of their human resources, as achieving organizational goals fully requires skilled and talented personnel (Diaz-Carrion et al., 2021). This necessity has elevated HRM as a key organizational domain, encompassing actions aimed at mobilizing and directing both physical and non-physical resources (Anwar & Abdullah, 2021). Smart managers have recognized that investing in the development and empowerment of human capital ensures organizational success, efficiency, and sustainable competitive advantage (Markoulli et al., 2017). Despite the increasing importance of HRM, ambiguities regarding its exact role and responsibilities persist. On one hand, due to its relatively recent emergence compared to other management functions, there was long no perceived need to separate and specialize HRM, which was treated as part of general management. On the other hand, the inherent complexity of human beings—as sentient, thinking, and decision-making entities—has made human behavior management particularly challenging. Employee objectives do not always align with organizational goals, and resistance to managerial decisions has become a source of tension and conflict in HR processes. Even the humanities have struggled to predict human reactions through fixed formulas or models (Pak et al., 2019).

In addition to individual and personality traits, the formation of workgroups and collective interactions adds further complexity to HRM, making human resource administration even more challenging. HRM's core role, therefore, is to identify the latent talents of organizational employees and create conditions for their development and realization (Azizi et al., 2021).

Foresight is an interdisciplinary field of knowledge that seeks to discover, analyze, and strategically design possible futures by studying trends and plausible scenarios. One of the most recognized definitions is by Wendell Bell, who defines foresight as the effort to identify, invent, propose, test, and evaluate possible and probable futures so that, based on societal values, preferable futures can be selected and groundwork laid for shaping a desired future (Damari et al., 2016). In the same vein, Roy Amara describes foresight as any systematic effort aimed at improving the understanding of future consequences stemming from present developments and decisions. He classifies these efforts into three categories: deducing probable futures, which falls under the domain of the art of futurism; deducing possible futures, which pertains to the science of futurism; and deducing preferable futures, which is mostly defined within the realms of policymaking and anticipatory psychology (Afzali et al., 2017).

Ben Martin defines foresight as a systematic process conducted to examine long-term developments in the fields of science, technology, environment, economy, and society. This process emphasizes identifying emerging general-purpose technologies and strengthening strategic research areas that can yield the greatest economic and social benefits for communities (Damari et al., 2016). Contrary to popular belief, foresight does not aim to precisely predict the future, as definitive predictions of future events are not feasible. Rather, it goes beyond mere forecasting and avoids claims of prophecy. It is more akin to an art that, through conscious design and guidance, shapes the future in a more desirable direction (Alizadeh & Jahaniyan, 2020). Common sense dictates that people must begin now to understand what future events might unfold, which are more likely to occur, and which are most desirable (Zarei et al., 2019).

Nevertheless, human resource management remains a major challenge for knowledge-based and innovative companies striving to grow into larger and more complex organizations (Djukic & Zoric, 2022). Due to their unique nature—relying on innovation, knowledge, and specialized human capital—these companies face distinctive HRM needs and challenges. In this context, traditional HRM models may be ineffective, as these companies must attract, retain, and develop top talent with the capability to innovate and create knowledge (Mirmohammadi et al., 2021). Moreover, such companies typically exhibit informal organizational cultures, participatory teamwork, and require

a different HRM approach (Namdar et al., 2020). Given their dynamic environments and rapid technological change, knowledge-based firms must continuously invest in employee training and development (Dilek & ÖZer, 2020). The current pace of change is so overwhelming that traditional methods are no longer sufficient (Alizadeh & Jahaniyan, 2020). Those who possess this knowledge are already shaping the future of the world according to their vision (Djukic & Zoric, 2022). They have misunderstood the nature of change; hence, understanding the future is one of the most vital sciences a nation requires (Afzali et al., 2017).

Foresight is still an emerging and evolving approach that identifies how the realities of tomorrow emerge from today's changes (Mostafavi et al., 2024). Foresight does not aim to predict the future because future events cannot be accurately forecasted. Therefore, given the significance of the topic, this study seeks to answer the question: What is the future of human resource management in knowledge-based companies?

2. Methods and Materials

Given that the present study aims to design a human resource management (HRM) model for knowledge-based companies, it falls within the category of applied research. The research method is mixed-method, combining both qualitative and quantitative approaches. Initially, the qualitative phase employed in-depth interviews using a thematic analysis approach, and the extracted model was derived by coding the interview data. The qualitative sample consisted of 14 experts and managers from knowledge-based companies and HR professionals with both research and operational experience. Participants were selected through purposive and snowball sampling methods, and the interviews were conducted in-depth. The data collection process continued until theoretical saturation was reached. Throughout this process, the coding and analysis of interview transcripts gradually led to data synthesis and categorization. Data analysis was conducted in three stages: open coding, axial coding, and selective coding. To ensure the validity and reliability of the research, the interview questions were reviewed and confirmed by several subject-matter experts. Lincoln and Guba emphasized the criteria of credibility, transferability, dependability, confirmability, and trustworthiness in evaluating qualitative studies. In line with these criteria, the following actions were taken: interview transcription and continuous concurrent analysis during data collection, validation of the coding process by another expert to ensure accuracy and to rule out subjective bias in interpretation, and the use of MAXQDA software for qualitative data analysis.

In the quantitative phase, the statistical population included all employees, deputies, and managers of knowledge-based companies. Using a non-probability convenience sampling method, 384 questionnaires were distributed and collected. Structural Equation Modeling (SEM) using SmartPLS 3 software was employed to test the research questions. Face validity of the items was confirmed by a panel of subject-matter experts. Reliability was evaluated through a pilot test followed by calculating Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE).

Table 1

Reliability and Validity of Research Variables

Variable	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Individual Approach	0.910	0.921	0.910
Organizational Characteristics	0.842	0.870	0.847
Environmental Conditions	0.938	0.865	0.770
Technology	0.766	0.784	0.584
HRM in Knowledge-Based Companies	0.939	0.944	0.719

Cronbach's alpha and composite reliability values for all research variables exceed 0.70, indicating adequate internal consistency and reliability. Additionally, the AVE values for all variables are above the 0.50 threshold, confirming acceptable convergent validity.

3. Findings and Results

This section begins by presenting the demographic characteristics of the experts who participated in this study.

Table 2

Demographic Characteristics of Experts

Demographic Variable	Frequency	Percentage
Gender		
Male	10	71%
Female	4	29%
Age		
Under 35	2	14%
35–45	8	57%
Over 45	4	29%
Education Level		
Master's Degree	4	29%
Ph.D.	10	71%
Work Experience		
10–20 Years	9	64%
Over 20 Years	5	36%
Total	14	100%

The primary aim of the study is foresight in human resource management in knowledge-based companies. In the first phase, thematic analysis was used to identify, analyze, and report patterns (themes) within the data. This method, at a minimum, organizes the data and provides descriptive detail. In the current study, textual data from the interviews were coded and analyzed thematically. From 14 interviews, a total of 388 codes were extracted. The distribution of codes from each interview is presented below.

Table 3

Frequency of Extracted Codes by Interview

Number of Codes	Interviewee
26	Interview #1
21	Interview #2
27	Interview #3
29	Interview #4
35	Interview #5
46	Interview #6
31	Interview #7
29	Interview #8
35	Interview #9
31	Interview #10
19	Interview #11
28	Interview #12
16	Interview #13
15	Interview #14
388	Total

In this study, 388 initial codes were extracted. Given that some codes carried similar meanings, they were grouped into the same category. After consolidating semantically similar codes, 93 distinct codes were identified. Table 4 presents several sample codes.

Table 4

Initial Text Coding

Extracted Concept	Interview Text
Open Communication	Open communication facilitates and enhances interaction between employees and managers in knowledge-based companies. This two-way, transparent communication enables employees to share their opinions, suggestions, and problems with managers.
Inclination Toward Technological Products	Encouraging employees to collaborate and engage in the development and improvement of technological products can significantly enhance company performance and outcomes.
Effective Interaction with Human Capital	Interaction helps provide opportunities and empower employees to present and utilize their ideas and innovations in the work environment.
Diversity of Specialized Human Capital	The diversity of specialized human capital, as an influential concept in HRM in knowledge-based companies, ensures improved performance, increased innovation, and sustainable growth.
Flexible Structures	Flexible structures facilitate collaboration and communication within the organization. Through effective communication and strengthened teamwork, these structures enhance performance and foster innovation.
Perception of Knowledge-Based Products	Employees' perception of the value of knowledge-based products can help develop their skills and competencies and motivate them to learn and progress in new fields.
Perception of Knowledge-Based Products	Employees' understanding of the importance and value of knowledge-based products can encourage active participation and innovation in organizational processes.
Perception of Knowledge-Based Products	Employees' perception of the quality and innovation of knowledge-based products can lead to greater satisfaction and organizational commitment.
Perception of Knowledge-Based Products	Positive perceptions of knowledge-based products can enhance motivation and role modeling, encouraging employees to improve performance and achieve organizational goals.
Perception of Knowledge-Based Products	Positive perceptions can also reinforce an innovative organizational culture and increase openness to change.
Inclination Toward Technological Products	Providing training on new technologies and innovations enables employees to update their technical skills and contribute to the development of technological products.

Table 5

Final Dimensions, Components, and Indicators for Designing the Foresight Model of Human Resource Management in Knowledge-Based Companies

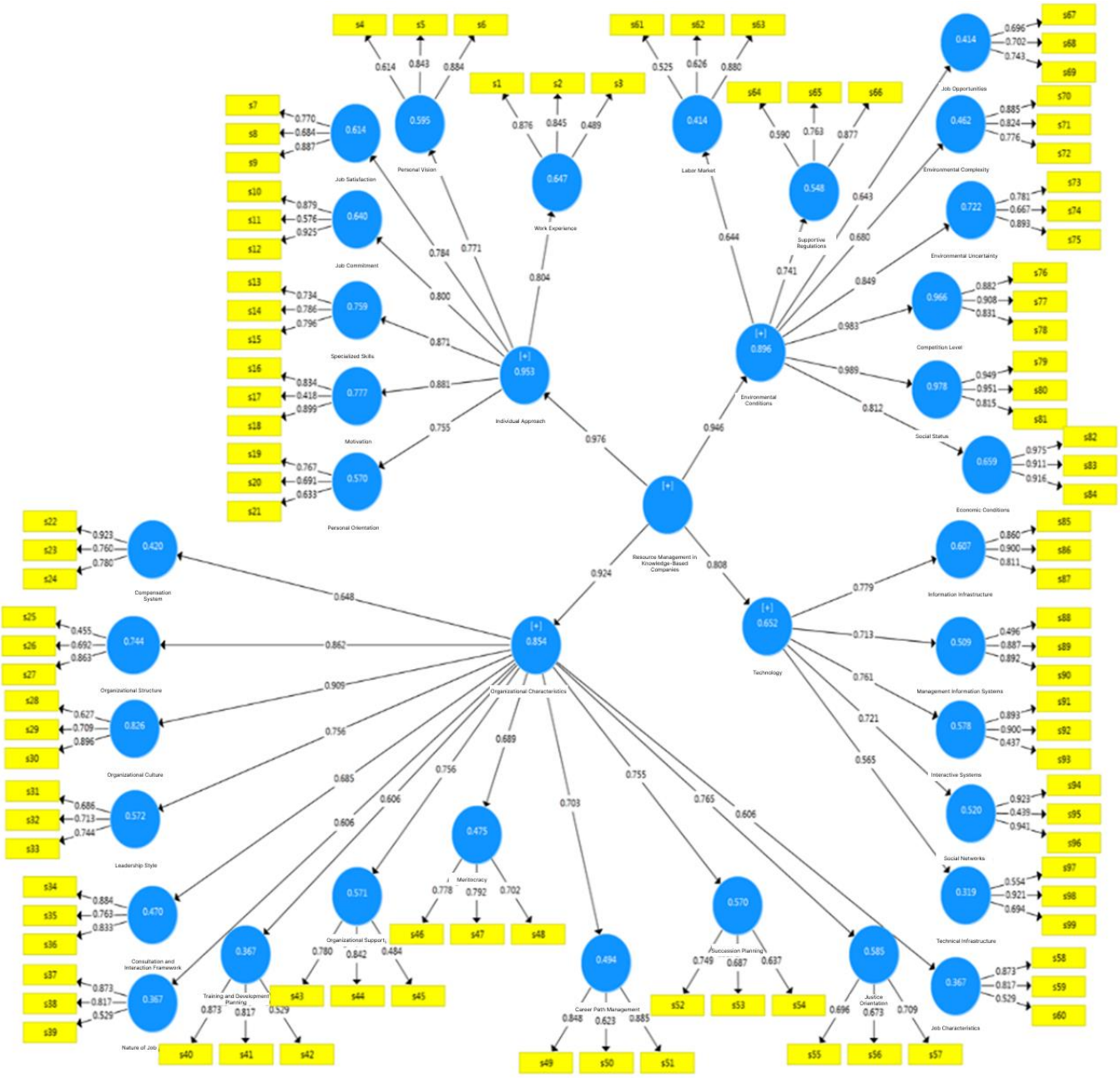
Dimension	Component	Indicator
Individual Approach	Work Experience	Years of experience; experience in knowledge-based companies; relevant job experience
	Personal Vision	Perception of future career; envisioned career path; long-term professional outlook
	Job Satisfaction	Fulfillment of job expectations; satisfaction with job nature, colleagues, and supervisors
	Job Commitment	Attachment to the company; understanding the importance of knowledge-based company activities
	Specialized Skills	Technical knowledge; subject-matter expertise; technological proficiency
	Motivation	Interest in technological products; engagement in innovative activities
	Personal Orientation	Personal tendencies; perspectives on knowledge-based products; perception of products
Organizational Characteristics	Compensation System	Salary distribution; distinctive benefits; incentives for talent attraction
	Organizational Structure	Interaction with colleagues; reporting lines; flexible structures; open communication
	Organizational Culture	Core values; norms in producing knowledge-based products; public identity of the company
	Leadership Style	Guidance and treatment of human capital
	Interaction and Consultation	Soliciting employee input; participatory activities; effective employee engagement
	Nature of Job	Importance and complexity of knowledge-based jobs
	Training and Development Planning	Planning training programs; human capital growth strategies
	Organizational Support	Managerial support; material and emotional support
	Meritocracy	Valuing specialized talent; focus on talent management; prioritizing qualified personnel
	Career Path Management	Flexible design; goal-oriented career paths; alignment with interests and expertise
	Succession Planning	Developing expert staff; talent recruitment and training; focus on future needs
	Justice Orientation	Fairness in compensation, promotions, and appointments
	Job Features	Job design processes; HR strategic planning; workforce diversity planning; retirement systems; job development; health and safety
Environmental Conditions	Labor Market	Availability and diversity of skilled labor
	Supportive Regulations	Legislation for protecting knowledge workers and supporting talent management
	Job Opportunities	Promotion prospects; career advancement; attractive future-oriented positions
	Environmental Complexity	Interrelated external factors; uncertainty in the external environment
	Environmental Uncertainty	Uncertainty in product sustainability; rapid environmental changes; doubts about workforce expertise
	Competition Level	Industry competitiveness; number of competitors; R&D investment by rivals
	Social Status	Social position of working in knowledge-based companies; societal acceptance of these roles

	Economic Conditions	National economic development; inflation; GDP contribution of knowledge-based companies; future income potential
Technology	IT Infrastructure	Technical infrastructure; knowledge-sharing software
	Management Information Systems	Implementation and decision-making effectiveness
	Interactive Systems	Office automation systems; networked communication systems
	Social Media	Use of interactive social platforms; mass communication tools
	Technical Infrastructure	Necessary hardware; interactive infrastructure; communication frameworks for knowledge and skills

Upon reaching theoretical saturation in the interviews, the qualitative data analysis concluded. The entire process and analysis were conducted using the qualitative data analysis software MAXQDA 2018.

Figure 1

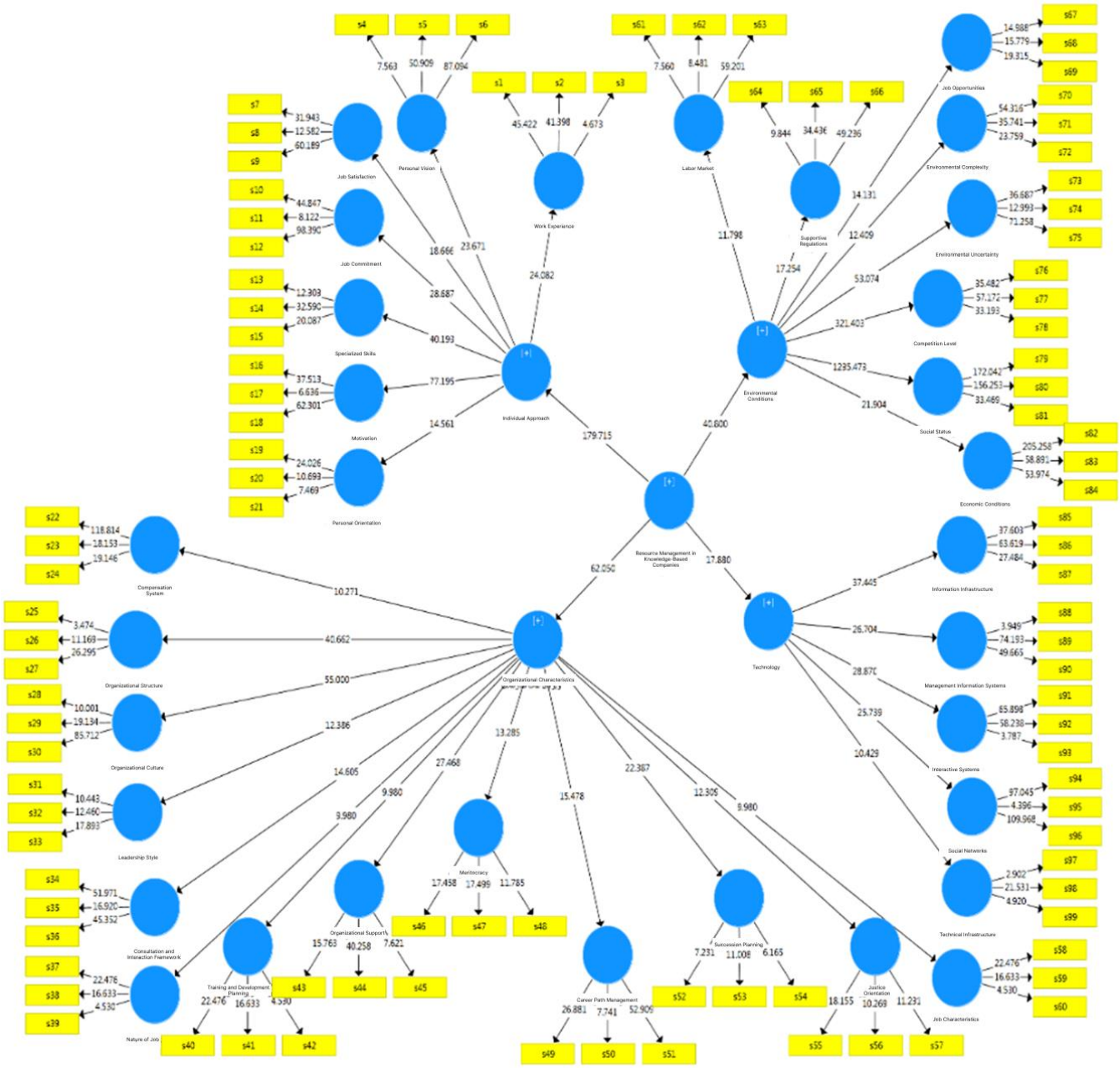
Path Coefficients of the Research Model



As shown in the figure, all research items have outer loadings greater than 0.4, indicating that no items need to be removed from the model.

Figure 2

t-values of the Analytical Model



As observed, the *t*-statistics for all paths exceed 1.96, indicating that the research model is statistically significant and supported.

In examining the structural model, the relationship between independent and dependent variables is assessed. According to Hanseler, the evaluation of a structural model involves analyzing the coefficient of determination (R^2), path coefficient (β), and predictive relevance (Q^2). R^2 values are not reported for the exogenous variables of the model. Chin identified values of 0.19, 0.33, and 0.67 as indicators

of weak, moderate, and strong explanatory power, respectively. Path coefficients are standardized beta coefficients from linear regression analysis, with significance levels at 90%, 95%, and 99% corresponding to *t*-values of 1.64, 1.96, and 2.58, respectively.

The predictive relevance criterion (Q^2), also referred to as the quality index of the structural model, is calculated only for the endogenous constructs with reflective indicators. The benchmark values for Q^2 are 0.02 (weak), 0.15 (moderate), and 0.35 (strong). Q^2 values greater than zero indicate that the observed values are well reconstructed and the model possesses good predictive capability, thus confirming the adequacy of the structural model.

According to these theoretical foundations, the results presented in Table 6 confirm that the model is structurally valid and that there are strong relationships among the variables.

Table 6

Coefficient of Determination (R^2) and Q^2 Criterion for Endogenous Constructs

Variables	R Square (R^2)	Q^2 Criterion
Individual Approach	0.953	0.339
Organizational Characteristics	0.854	0.280
Environmental Conditions	0.896	0.681
Technology	0.652	0.236

The values of 0.01, 0.25, and 0.36 are considered weak, moderate, and strong thresholds for this criterion.

The model's overall goodness-of-fit index (GOF) is calculated as:

$$GOF = \sqrt{(\text{Average Communality} \times \text{Average } R^2)} = 0.802$$

Based on the above results, it can be concluded that the model has a strong fit.

4. Discussion and Conclusion

The aim of this study was to design a foresight model for human resource management (HRM) in knowledge-based companies. The findings revealed that the main dimensions of the foresight model in HRM include the individual approach, organizational characteristics, environmental conditions, and technology. Additionally, the components of the foresight-based HRM model, developed through scenario planning, consist of work experience, personal vision, job satisfaction, job commitment, specialized skills, motivation, personal orientation, compensation system, organizational structure, organizational culture, leadership style, consultation and interaction framework, job nature, training and development planning, organizational support, meritocracy, career path management, succession planning, justice orientation, job characteristics, labor market, supportive regulations, job opportunities, environmental complexity, environmental uncertainty, competition level, social status, economic conditions, information infrastructure, management information systems, interactive systems, social networks, and technical infrastructure.

The results of this research align with the prior findings (Anwar & Abdullah, 2021; Damavandian & Akbari, 2021; Hassan, 2022; Khademi-Kallehloo & Sahebkar-Khorasani, 2022; Khodaparast et al., 2021; Niknam et al., 2021). The findings suggest that knowledge-based companies, due to their unique nature—emphasizing innovation, knowledge, and specialized human capital—face distinct needs and challenges in HRM. Operating in dynamic and uncertain environments, these companies require a high degree of agility and flexibility in HRM practices. Traditional HRM models may not function effectively in such contexts. These firms must recruit, retain, and develop top talent and specialists capable of innovation and knowledge creation.

Given that human resources are considered one of the core pillars of knowledge-based companies, their qualitative development necessitates the design of a scientifically grounded process tailored to the organization's needs and ensuring successful implementation. Therefore, it is recommended that knowledge-based companies focus on strengthening organizational and managerial factors that influence human resource development. In doing so, they should also revisit and update their strategic goals and visions. In redesigning such companies, priority should be given to concepts such as job meaningfulness, resource accessibility, performance evaluation methods, and optimization of organizational structures.

Moreover, implementing programs such as business process reengineering, job design, job development and enrichment, job rotation, and the creation of effective feedback systems can help improve job characteristics.

Additionally, the use of localized job design methods tailored to the organizational culture and existing human capital capabilities can contribute to enhanced efficiency and effectiveness of the workforce.

Like all research, this study has limitations. One such limitation concerns the proposed model, which does not cover all possible scenarios. Future studies may build on this model using other proposed frameworks to enhance its comprehensiveness. Due to time and financial constraints, testing the model with quantitative data was not feasible. It is therefore recommended that future research quantitatively test the proposed model to yield more reliable and generalizable results.

In this study, various dimensions of HRM were identified through an extensive review of scientific literature and studies. However, instead of relying solely on secondary research, HRM dimensions could also be identified through detailed field studies and empirical investigation. The HRM framework and scale developed here hold significant implications for researchers exploring foresight in human resource management across cultures.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were considered.

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