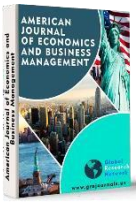

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Article

Basic Approaches to The Study of Human Resources: Essential-Descriptive Analysis

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Abstract: In the new industrial and digital economy, human capital has become the most critical element of economic growth and innovation. The progress of enterprises and their national economies relies heavily on its effective use and development! Various models for measurement and management of human resources have been presented (Kaplan and Norton; Fitzens; Armstrong). Nevertheless, the majority of models not considered education quality and innovation potential in the human capital system. While theoretical discourse has attempted to tackle the critical role of human capital in education–innovation interaction as two major drivers of economic growth, it remains largely unexplored whether or not the developing economy's human capital assessment reflects education and innovation as its central components–especially in the era of transformational digital phenomena. The purpose of this study is to examine theoretical and practical aspects of human capital management, to analyze the main indicators of the use of human capital and to present own concept of the model of human capital of a country, the involvement of which offers an extended model based on the inclusion of dimensions of science and education quality. An apt expression of the analysis is identification of five main evaluation dimension financial, customer, innovation, internal environment, and education quality and its categorical indicators level of adaptability and level of innovation capacity (Green, Yellow and Red). The proposed model adjusts Kaplan and Norton balanced scorecard by introducing a fifth dimension related to science and education, and calces the correlation between innovation capability and economic efficiency. Such findings lead to greater conceptual underpinnings for companies to rethink their human capital management strategies as a function of the digital and innovative economy that shapes the world today, where investment in education, lifelong learning and intellectual development leads to sustainable competitiveness.

Keywords: Human Capital, Human Resource, Digital Economy, Integration, Market Economy, Industrial Economy

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1. Introduction

In the twenty-first century, human capital is considered the most important agent of innovation, productivity, and economic development. The global economy has matured from industrial to post-industrial, to digital, and now to innovation. Each of these stages has radically changed the manner by which enterprises deliver value. Thus, with changing times human capital has now becomes the center point for the competitiveness and sustainability of any institution which can be define as effective management and development of human capital. Human capital theory (R. Becker) and balanced scorecard framework (Kaplan & Norton) paved the way for theories which elucidate the theories of how investment in knowledge, skills, and competencies lead to increasing organizational

performance and consequently, national economic growth. But as the world economy shifts to knowledge- and technology-driven industries, these traditional frameworks must be updated for an economy characterized by digitalization, automation, and artificial intelligence.

Academics like Armstrong, Fitzens, and Shirinkina have studied human capital management via multiple dimensions from the perspective of productivity, innovation, and cost effectiveness. But the centrality of science and education to innovation is often absent from models. Human capital reflects this new paradigm and not just in developed economies; industrial transformation and digital integration are concurrent phenomena in many developing economies requiring a continuous reinvestment in intellectual development and adaptive learning. This has led to an urgent requirement to incorporate education quality and research productivity within human capital assessment frameworks. This shortage of empirical and conceptual studies on the relationship between innovation and education highlights the need for an updated analytical framework that integrates both innovation and education-based measures.

The current research uses a comparative and analytical approach based on statistical and econometric analysis to assess existing theories and propose an improved model of human capital use. This model adjusts Kaplan and Norton balanced scorecard of the four dimensions by adding science and education quality as a fifth dimension for the purpose of innovation potential and knowledge transformation. It takes the human capital a step further, classifying it into adaptive ("Green", "Yellow" and "Red") so that the state of the personnel's readiness for digital innovation and organizational change can be assessed.

We expect the results will show that there are very strong links between the development of the education system, the innovation capacity in the country and the efficiency of human capital. These results have implications for policy-makers, enterprise-managers and educators, emphasizing the need for continued investment in education and human capital. In this sense, the inclusion of the quality of education within the analysis of human capital accelerates the progress of sustainable economic models in which the human being is always maintained as the main engine of the digital and innovative transformation.

Literature Review

Currently, the content of the goal of the network human resource management system is determined by the effectiveness of network human resource management. In conditions of economic instability, the integration of knowledge, skills and abilities becomes a strategic competitive advantage of network enterprises, along with the economic and production capabilities [1]. According to G. Schmidt and R. Marr, the content of human resource management is based on the idea that people are considered a strategic advantage of the enterprise in the competitive struggle, and this advantage must be developed and stimulated in order to fulfill the mission and achieve strategic goals [2]. Foreign enterprises have radically changed their attitude to "human resources" and their role in achieving commercial success over the past decades. The phrase "Before creating a machine, we create people" has now become the main motto of every effectively operating enterprise. Such enterprises have a large methodological set of methods and tools for working with human resources, tested in practice for a long time [3]. In our opinion, the theory of human resource management is the main and most modern concept of management. According to this concept, human resources are one of the resources that must be effectively managed, investing in them and creating conditions for their continuous development.

2. Materials and Methods

In this research, we use a multi-pronged analytical methodology based on comparative, statistical, and econometric techniques in the use and exploration of human

capital in the digital and innovative economic system. The research process starts with a theoretical perspective on the nature of the underlying and modern human capital models, specifically the Kaplan and Norton balanced scorecard paradigm and the later empirical revisions by Fitzens and Armstrong. By identifying similarities and distinctions in regard to measurement of human capital efficiency and adaptability, a comparative analysis is used between these models. Selective and Analytical observation methods are used to understand the relationships from innovative to education quality to performance indicators. Statistical and multi-factor econometric techniques are used in quantitative analysis for assessing the effectiveness of human capital utilization, and for calculating the effects of education and innovation on organizational results. Furthermore, to process the vagueness or uncertainty of the qualitative interaction between different factors to formulate an enhanced model of human capital assessment, economic-mathematical modeling and fuzzy set theory are utilized. We then apply forecasting methods to predict the long-run consequences of human capital investment over time given different economic environments. This is a synthesis of these methods that could enable an improved model, that combines science and education quality, as its fifth dimension in the human capital performance assessment. In sum, the methodological framework guarantees both theoretical stringency and empirical relevance, yielding results that facilitate strategic human resource and innovation management decisions.

3. Results and Discussion

One of the main characteristics in assessing human capital is the presence of individual character, that is, each person demonstrates his own unique character during his work [4]. A person needs to form and develop the above-mentioned unique character during his work, and he needs to make creative decisions during his work, reflecting them in the results of his work. The theoretical essence of the system of unique characters of each employee in the use of human capital in service enterprises was studied.

At the same time, the concepts of "personnel", "staff", "human resources", "human capital" are, in our opinion, synonymous with each other and there is a unique integration between them. Authors from the USA and Europe, E. Brooking, T. Stewart, L. Edvinsson, MS Meloun, conducted scientific research on the use of human capital in organizations, the formation and development of intellectual human capital, and human capital plays an important role in the formation of an innovative organization, which affects its high level of efficiency, market value development, and active capitalization.

R. Kaplan and D. Norton provided information on a system of balanced indicators that affect the effectiveness of human capital, but at the same time emphasized that a single indicator cannot radically change all processes or the functioning of the system, believing that when all indicators are present together, significant changes in the use of human capital are possible [5].

Figure 1 above presents the main balanced indicators of the use of human capital, which are divided into four main groups and researched on four positions. Firstly, from the point of view of the buyer, secondly from the financial point of view, thirdly from the innovation point of view, and fourthly from the internal environment, see Figure 1.

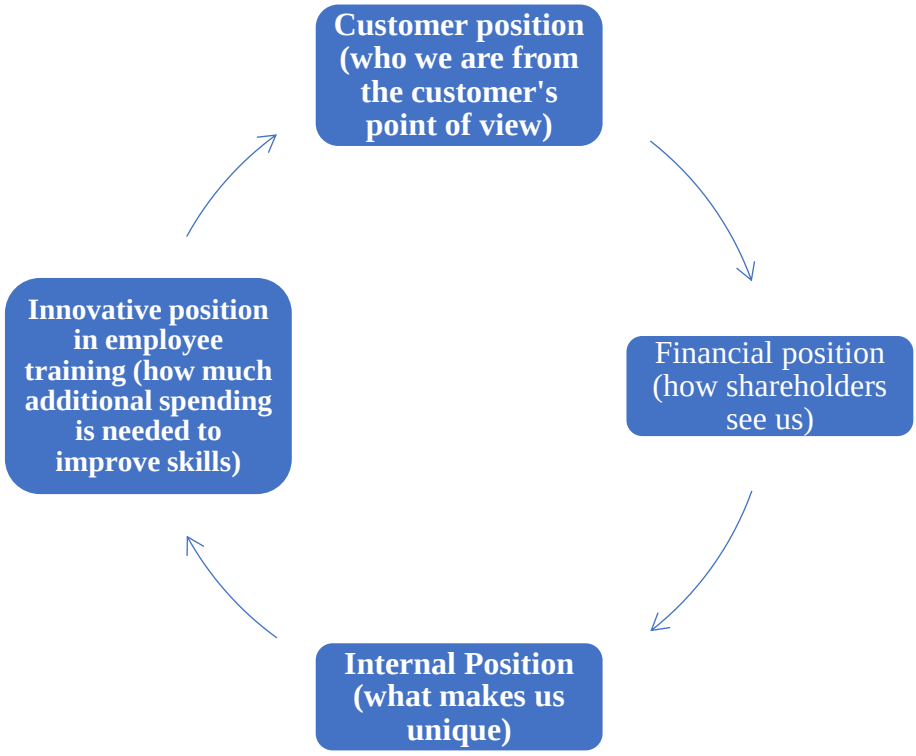

Figure 1. R. Kaplan and D. Norton's balanced scorecard model of human capital utilization.

This system of indicators does not provide control, but rather develops the main strategies for the development of human capital, forms the ability to work on oneself individually within the organization, and ensures the formation of the internal structure of the use of human capital. In our opinion, as a result of the processing of the above model, it was presented as a model of indicators for the use of human capital, and while the balanced scorecard model of R. Kaplan and D. Norton was based on four positions, our model is based on five positions, and as the fifth position we introduced the quality of science and education. If we do not pay attention to science and quality education, problems will arise in the development and use of innovations in enterprises and organizations, since innovations are developed by specialists who have received quality education. In addition, the above indicators will be different for each enterprise and organization, it will be necessary to independently determine the level of their impact, and independently develop human capital, see Figure 2.

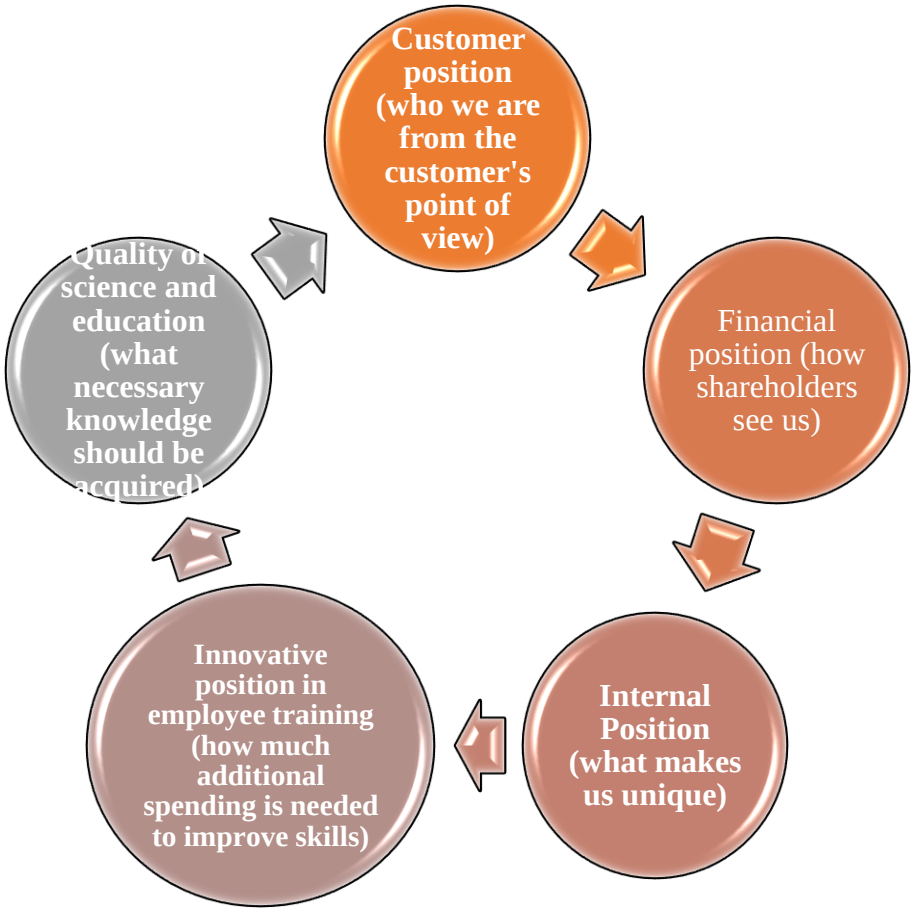

Figure 2. Human capital utilization indicators model.

In 1996, R. Kaplan and D. Norton developed the balanced scorecard, and J. Fitzens [6] transformed the above balanced scorecard into a new composite system. In his opinion, it is possible to assess human capital through a balanced scorecard and increase its efficiency. In the new composite system, three main indicator indices were developed:

First, the Human Capital Revenue Index is an index that shows human capital income, which includes the basic income of an employee during his or her main working hours;

Human Capital Cost Index – an index that shows the cost of human capital, which is a measure of the percentage of total income spent on human capital, indicating the costs of an employee during their main working hours;

The Human Capital Profit Index is a measure of the profit an employee makes during their prime working hours. It also identifies the group of people who are most likely to make investments in human capital.

In our opinion, it is advisable to divide human capital into several categories by identifying indicators such as rapid acquisition, rapid adoption, and the ability to quickly implement new innovations. The main characteristics and characteristics of the categories divided into "Green", "Yellow", and "Red" are determined by identifying separate data.

According to E.V. Shirinkina, the first and third indicators are relatively unclearly reflected, the organizations in which she conducted the study did not have a category of purchased services, therefore, the first and third indicators were reflected implicitly in her studies, and expenses were calculated after the organization made a profit. The system of balanced indicators was improved by adding the financial index of Y. Fitzens in addition to the balanced indicators of Kaplan and Norton.

In addition, M. Armstrong developed theories of human capital management, revised Watson-White's index of human capital indicators, and improved Andrew Mayo's human capital monitoring views [7]. Watson-White, M. Armstrong jointly improved the issues of human capital management, and in 2001, Watson-White's four-factor human capital model

was developed, all of which increased the value of human capital from the point of view of the market economy.

$$Irs = Iv \times Ik \times Iu \times Ich$$

Here, IRS is the company's market value index;

IV – general salary and responsibility index;

Ik - index of personnel collegiality and flexibility;

Iu – employee retention index;

Ich is an index of openness of communication.

If we look at the results of the author's research, from the point of view of a market economy, the factors affecting the development of a company can be about 30%. In the Sears Roebuck model, an algorithm for moving through the development of human capital is developed by developing flowcharts. The main relationship in this algorithm is along the lines of "employee-customer-profit". This model studies the reasons for the increase in the attitude of employees to the customer, sales volume, and the profit of the organization, according to which the organization has created such favorable working conditions, and employees are satisfied with such working conditions.

The high or low efficiency of organizations and enterprises, the constant increase in annual income, the reduction of costs due to which the cost of products or services of an enterprise or organization decreases, should first of all pay attention to the human factor. In the current situation, attracting foreign specialists and widely using foreign experience is becoming a tradition in our country, which is good, but if we offer our employees the same working conditions and salaries as foreign specialists, we will be able to form a new innovative personnel layer.

In addition, in a number of enterprises and organizations, the results of each employee's individual labor activity are calculated, which we consider to be one of the most correct methods. The reason is that if the activities of each staff member are analyzed individually, their labor efficiency will be higher. Individual coefficients are also developed, according to which the growth of the staff during their labor activity, the benefit they bring to the enterprise, and the result of the personal qualitative labor activity of the staff are calculated.

In our opinion, in order to achieve such results, to improve personal performance, personnel should study special knowledge, acquire the knowledge necessary for their work. As confirmation of these ideas, it is appropriate to pay attention to the opinions of scientists who have conducted scientific research on human capital. S.A. Dyatlova, I.V. Ilyinsky studied investment in human capital, M.M. Kritsky, L.G. Simkin studied the depreciation value of human capital, V.T. Smirnova, E.M. Samorodov studied increasing the profit of an enterprise or organization through the use of human capital [8][9].

In addition, several researchers link the processes of human capital development with the stages of industrial development and the level of development of technology. In our opinion, such a connection exists, and the level of industrial development, an indicator of economic development, and the level of rapid assimilation of knowledge and innovations by employees further enhances the above connection.

Among the first in the CIS countries, D.S. Lvov, S.Yu. Glazyev conducted research on technological structures, waves of innovations. A.A. Akaev, S.Yu. Rumyantsev, A.I. Sarigulov, V.N. Sokolov were engaged in such research, continuing discussions in scientific research and extensively analyzing scientific developments related to technological structures. Y. Yakovets, on the other hand, linked technological structures with the processes of generational change in technologies, and revised the expressions about new generations of equipment and technologies, and technological potential [10][11][12].

From the research of the above authors, it can be seen that each technological system is distinguished by its own characteristics or factors, but the human factor is at the center of each process, while the average period of technological development was about 40 years. Industrial revolutions were considered the main drivers of technological development, and each industrial revolution, in turn, was distinguished by the emergence of various forms of regional innovations. Each of these innovations, making a worthy

contribution to industrial development in its time, was a major impetus for the development of interconnected technologies and the rapid development of the economy. Each industrial revolution led to the creation of new products, the emergence of new infrastructures and industries, and ensured long-term sustainable development. During these industrial revolutions, attention to the human factor increased, and each revolution demonstrated the need to develop human capital.

Industrial structures, in turn, cause the development of new resources and structures, as builders of new relationships, ensuring long-term development and forming an adequate new paradigm. In the conditions of an industrial economy, the composition of industrial workers is typical for the period of industrial structures 1-3, requiring a lot of physical labor and medium qualification requirements, see Table 1.

Table 1. Changes in human capital in the era of technological innovation.

Development stages	years	Industrial sleepers	For industrial purposes characteristics	Demand for workers
1	1785-1835	First	New technology, textile industry. Hydropower	Physical labor 50%, no special training is required. Training in short-term preparatory courses is sufficient
2	1830-1890	Second	Mechanical production, development of transport, energy through steam engines	
3	1880-1940	Third	Development of mechanical engineering, electrical engineering industry, electricity	50% perform technical tasks, sufficient knowledge of the starting point of special education
4	1930-1990	Fourth	The development of flying machines, the introduction of computers. Oil, coal, nuclear energy	
5	1985-2000	Fifth	The development of microelectronics, genetic engineering, biotechnology, informatics, the Internet, the development of space, the emergence of nanotechnology. Oil, gas, nuclear energy	50% of the work is analytical work, improvisation, creative thinking, high

6	2000-2035	Sixth	Development of nanotechnologies, nanobionics, robotics, artificial intelligence, development of space technologies, development of alternative types of energy	level of knowledge and skills, language skills, autonomy in the work process, and the highest level of education and the presence of a continuous learning process.

And Y. Rasmussen set the task of classification as a goal, and during the period of 3-4 industrial systems, physical labor decreased by 50% and more specialized skill requirements began to be demanded. In addition, it will be possible to provide special education through short-term training courses [13]. But starting from the 4th industrial stage, labor activities based on high qualification requirements began to be formed on the basis of workers having special knowledge, skills, and technical skills.

The fourth industrial revolution served as the main driver of the 6th industrial model. The issues of building an innovative economy with a fully knowledge-based labor activity in the 5th-6th industrial models were solved. It was during this period that the need for the development of highly qualified, knowledge-based human capital was felt, more than 50% of the labor in these models is knowledge-based analytical labor. This requires the development of a high-level educational service, a continuous cycle of education, requiring employees in these models to constantly develop their knowledge, creative thinking, and the development of professions based on narrow specializations.

This involves the effective use of human capital through the development of concepts, the preparation of developments arising from their creative thinking, and the development of human capital that is compatible with both the innovative and digital economy. In the innovative economy, the main source of income is ideas, scientific conclusions, proposals, inventions, discoveries created as a result of people's intellectual abilities. The goal is to intellectualize labor, develop innovative developments, and create an environment for free creativity. In such a period of development, "Science, education" is the main driver of economic development, see Table 2.

Table 2. Human capital in the changes of the main periods of the economy.

No.	The main types of economy	Characteristics of the economy	Demand for human capital
1	Agrarian economy	In the economy, agriculture is based on cultivation, storage, processing industry	No high qualification requirements are required.
2	Industrial economy	Industrial development is based on adaptation to consumer requirements	Due to the fact that it is a work activity based mainly on physical labor, low skill

			requirements are requested
3	Post-industrial economy	Along with the development of industry, it is based on meeting social needs, developing education and healthcare.	Due to the process of modernization and diversification of the economy, specialization of workers in different professions
4	Digital economy	It is based on the development of the economy based on digital technologies	Be aware of IT technologies , be able to use various applications, programs.
5	Innovative economy	Innovative work is based on satisfying needs	Preparation of innovative developments through the formation of intellectual ability, development of personnel with a creative approach

From the data of Table 2, it can be seen that it is possible to see the changes in human personnel during the evolution of development. In the industrial economy, attention to labor resources was not at a high level, production by the conveyor method was developed, and in the post-industrial society, the attention to labor resources changed a little and the need to invest in human capital was realized.

The transition to a digital economy has fundamentally changed the focus or views on human capital, and the use of new IT, the proliferation of various mobile applications, and the digitization of key sectors of the economy have in turn encouraged people to master new sciences [14]. The fifth industrial revolution, in turn, has provided an opportunity to develop an innovative economy in the country, created a layer of intellectual workers, and a process of intellectualization of human capital, intellectual abilities, and labor.

The fourth industrial revolution or the sixth industrial revolution, in turn, has developed the digital economy, and since then, attention has been paid to the digitization of human capital. While the replacement of manual labor with machines and mechanisms has given impetus to the development of the "manufacturing" industrial economy, the digitalization of labor, the creation of a digital society, and the introduction of artificial intelligence into production (brainfacturing) have formed the digital economy, and the intellectualization of labor, in turn, has led to the development of the innovative economy [15]. The term "brainfacturing" has not been in science for a long time, it was introduced by Antoine van Agtamaelem, and its literal translation from English means "brain production". The main requirement for workers in the digital and innovative economy is knowledge, and the requirements for them to quickly learn how to use machines and machines, and to create programs are placed on human capital. As the economy transitions to a new qualitative stage, knowledge-based production will replace classical production.

If we observe the above processes, new economic models are being formed as a result of the development of generations of people who have mastered science through the transformation of human capital. Whether our society likes it or not, in order to develop the economy, we must first invest in human capital. The more we engage in various

distractions instead of mastering science and education, the more we will continue to increase the stagnation in economic development, which in turn will usher in a new era of crises.

As a result of the automation of labor processes and the introduction of artificial intelligence, the demand for human labor is decreasing, and it is necessary to redirect the vacated labor resources to new jobs. The reduction of jobs is not only influenced by the development of technologies, but also by the personnel policies of companies. Serious changes in traditional professions, in turn, will lead to structural changes in human capital, which will occur in conjunction with digital technologies. These include online communication, programming, website creation and processing, in addition, new technological changes are setting new tasks for these professions and requiring them to develop positions based on new strategies. In 2022, as a result of the development of new technologies, 75 million jobs will be lost worldwide, and 133 million completely new jobs will be created in their place.

In many countries, attention to new technologies is increasing, which has led to an increase in the use of artificial intelligence, and today the world's five largest companies have begun to use artificial intelligence. However, there is a need for specialists who can work with such complex technologies, that is, those who work with artificial intelligence.

In addition, the deepening of integration processes between countries of the world, in turn, requires the development of new theories of labor relations and labor resources. At the same time, the issues of digitization of labor resources are becoming more serious, VUCA-strategies are engaged in the processes of digitization of human capital, in addition, human capital is being replaced by SPOD-strategies with digital management [16]. These strategies are engaged in all processes of digital management of human capital. And we can work on exactly such strategies, the difference from them will be that we digitize the processes of using and developing human capital. The difference from previous authors in the digitization of human capital in our study is that these strategies should be simple.

In our opinion, concepts for the use of human capital are more likely to have features specific to the digital economy, but great attention should also be paid to theories and scientific developments specific to the innovative economy . It is necessary to develop a new structural characteristic of human capital and clarify the factors affecting it.

4. Conclusion

The study highlights that effective utilization and continuous development of human capital remain fundamental to achieving sustainable economic growth in the era of digital and innovative transformation. The proposed expansion of Kaplan and Norton's balanced scorecard model into a five-dimensional framework incorporating science and education quality demonstrates that innovation capacity and educational excellence are decisive factors in enhancing human capital performance. The findings emphasize that organizations prioritizing lifelong learning, intellectual development, and adaptive skills experience higher efficiency, innovation readiness, and market competitiveness. Furthermore, categorizing personnel based on adaptability indicators ("Green," "Yellow," and "Red") provides a practical tool for assessing workforce potential and identifying areas for targeted investment. These results imply that integrating education and innovation indicators into human capital management systems can substantially improve decision-making processes in enterprises and national policy design. Future research should focus on empirically validating the proposed model across diverse economic sectors and countries, exploring the quantitative relationships between digitalization, education quality, and human capital efficiency to strengthen theoretical foundations and practical strategies for the knowledge-based economy.

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