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DEVELOPING STRATEGIES FOR HUMAN RESOURCE DEVELOPMENT IN BUSINESS ORGANISATIONS IN THE CHEMICAL INDUSTRY

AUTHOR'S ABSTRACT

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I. GENERAL CHARACTERISTICS OF THE DISSERTATION

1. Relevance of the research

Today, people are becoming a determining factor in achieving the strategic success of different plants[1] and production operations. This issue is of major strategic importance for the heavy industrial sector in Bulgaria as well.

The present study focuses on the strategic development of the manufacture of pulp, paper and paperboard.[2] The sector is characterised by a very high degree of automation and high capital intensity. This is accompanied by compliance with strict requirements concerning environmental protection and occupational safety.

In manufacturing enterprises, machinery and equipment are renewed very rapidly. At the same time, however, modern approaches to the strategic management of human resources are lacking. Traditional methods for determining labour budgets mechanically carry forward past expenditure. They restrict the strategic outlook to very short future periods. This prevents companies from acting proactively at the strategic level. The problems are compounded by an acute shortage of process engineers. Professional competencies become obsolete rapidly, while smaller regions face severe demographic constraints. As a result, workforce planning is often carried out at the last moment. A long-term strategic vision is lacking. All of this creates an urgent need for a new management approach. It must be strategically oriented and flexible.

2. Research thesis

The introduction of an innovative approach to the strategic management of human resources in business organisations in Bulgaria's chemical industry has strong potential to improve the staffing of internal activities and business

[1] The terms "plant", "enterprise", "firm", "business organisation", "company", "business entity" and "production unit" are used as synonyms throughout the dissertation.

[2] The sector "Manufacture of pulp, paper and paperboard" (according to the Classification of Economic Activities) is more commonly known in practice as the "pulp and paper industry".

processes and, consequently, the strategic competitiveness of organisations as a whole.

3. Object of the research

The object of the research is business organisations in Bulgaria's pulp and paper industry (Section 17 of the Classification of Economic Activities, codes 17.11 and 17.12).[3] They are analysed through the prism of their strategic management and planning systems. The population under study is highly concentrated. More than 500 companies are registered in the sector, yet over 75% of revenue is generated by only 25 enterprises. These plants determine the strategic profile of the industry. The number of people employed in this production exceeds 7,000.

4. Subject of the research

The subject of the research comprises the processes, methods and relationships involved in developing long-term strategic plans for the development of people in the industrial sector.

5. Main aim

The aim is to examine the current state of strategic human resource planning in the sector. The dissertation seeks to identify the key problems it faces. On this basis, a new model for predictive and strategically flexible management through data processing and artificial intelligence (AI) is developed and tested.

6. Research tasks

- To build a theoretical scientific framework. The evolution of the models is examined and the chain from strategic ideas to their day-to-day planning is traced.
- To establish the alignment between the overall strategic goals of the business and the workforce provision plans of the plants.

- To study the market barriers to the development of strategic labour potential in Bulgarian enterprises.
- To propose new research approaches for the objective assessment of skills in order to improve strategic accuracy in planning.
- To define an algorithm for implementing data-mining technologies in the long-term strategic forecasting of workforce needs.
- To develop and test an original model for flexible strategic management of people in the sector.

7. Methodological basis and instruments

The research is based on the systematic approach in strategic management. The practical study was conducted through interviews with senior and middle management in the sector under codes 17.11 and 17.12. Statistical estimates and procedures for diagnostic synthesis and hypothesis testing were used in processing the data.

8. Research limitations

The study is statistically limited to large and medium-sized enterprises in Bulgaria's pulp and paper industry. The results also take into account the geographical characteristics of the regions in which the companies operate.

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III. **MAIN CONTENT OF THE DISSERTATION**

INTRODUCTION

The relevance of the dissertation research is presented. The research thesis is formulated. The object, subject, aim and research tasks of the dissertation are specified. The methodology used is described.

CHAPTER ONE. STRATEGIC PLANNING AND MODELS FOR HUMAN RESOURCE DEVELOPMENT

1.1Models for human resource development

In the practice of chemical companies, a combined approach is required. The rational model provides the necessary discipline and accountability in production. The humanistic model helps employees remain loyal and proactive. This symbiosis forms the basis of contemporary strategic planning. Human resource development is now perceived as a process linking the plant's technological progress with the team's intellectual capacity.

The analysed evolution of the models outlines the need to build an integrated management hierarchy. In the practice of chemical companies under Classification of Economic Activities codes 17.11 and 17.12, a fundamental error is often made: operational planning is confused with long-term strategising. For human resource management to be effective, it is appropriate to consider it as a three-stage logical sequence. Each subsequent stage is a natural continuation of the preceding one.

1.2The basic relationship "conceptualisation - strategising - planning" in human resource management

In contemporary scientific literature, strategising is defined as the actual bridge between vision and action. Here, the concept of vertical alignment assumes leading importance. In practice, this means that the corporate strategy of the

chemical enterprise and the human resource development strategy must operate in full synergy. They cannot and should not exist as isolated systems. This dissertation advances the view that if a company is planning a major technological leap or the introduction of new production capacity, the human factor must be prepared for the change as early as the design stage. Otherwise, even the most modern installation would remain non-functional because of a lack of competent personnel.

Strategising should be based on established scientific methods. In this context, the classical SWOT analysis is transformed and directed specifically towards human capital. The team's specific internal capabilities are examined - the availability of unique know-how, levels of engagement and age structure. In parallel, the external environment is subjected to a detailed filter through PESTEL analysis.

In the chemical sector, external factors are decisive:

- Political and regulatory. New European environmental regulations require entirely new competencies in decarbonisation and waste management.
- Technological. The acceleration of Industry 4.0 requires reskilling towards digital monitoring and data-driven management.
- Social. Changing attitudes in the labour market and demographic crises require new approaches to attracting young specialists.

Proper strategising helps ensure that every investment in the human factor has an economic and social return, transforming a philosophical concept into a structured and executable strategic path.

Even the most sophisticated strategy, however, must undergo a process of further specification. This is the final stage of the relationship, in which the conceptual outlines must be implemented in practice. Implementation is the mechanism through which high-level corporate objectives are transformed into day-to-day work processes, measurable tasks and specific responsibilities.

Planning represents the most practically oriented level of management. At this stage, the strategic intentions of the chemical enterprise acquire specific time horizons and are financially secured through the corresponding budgets. The first key direction is quantitative planning. At this level, management faces the task of preparing a resource estimate that guarantees continuity of the production cycle. The second pillar is qualitative planning. Here, the focus shifts to the substantive characteristic of labour - competence. The planning process must anticipate how technological evolution will change the very profile of the specialist.

The final result of this complex activity is the creation of specific target programmes. These are strategic documents for training engineering staff and new remuneration systems that stimulate innovative thinking and applied scientific activity in laboratories. In this context, succession planning, which is exceptionally important for the sector, also emerges.

1.3 Strategic approaches to human resource development

The analysis of strategic approaches demonstrates that human resource management in the chemical industry is changing towards a central strategic vision for enterprise development. The main conclusion from the assessment is that none of the models examined has the capacity, on its own, to ensure full organisational sustainability.

True strategic advantage is created through their mutual complementarity. Strategic alignment serves to ensure that investments in personnel are economically appropriate in relation to the current market model. The dynamic capabilities model introduces the flexibility needed to prevent this appropriateness from turning into “strategic inertia”. Portfolio analysis, in turn, “disciplines” the planning process by imposing a hierarchy of priorities. At the same time, it protects against inefficient expenditure of resources on non-strategic functions.

In this sense, planning in the chemical industry sector (codes 17.11 and 17.12) should be perceived as strategic engineering. It balances three elements:

- economic precision;
- technological adaptation;
- improved resource management.

The idea is that, through such an approach, the organisation can turn its human capital into an instrument for innovation and security.

1.4 Integration of activities for developing human resource management strategies

The first level of integration within strategic planning is horizontal integration. It is defined in scientific literature as internal fit. At this level, the object of analysis is the synchronisation between the individual functional activities of human resource management. The aim is to eliminate conceptual or operational contradictions. The main scientific thesis is based on configurational theory. Strategic success depends on the capacity of planning to make all management instruments operate in a state of positive synergy. An organisation falls into a state of structural inertia if the elements of the system are not sustainable.

The management focus here is directed towards overcoming fragmentation. In a chemical enterprise, this requires the design of integrated management packages in which the effect of one activity is multiplied by another. For the purposes of the exposition, this horizontal integration can be classified into three main functional directions that ensure systemic integrity:

- “Competencies - Motivation” direction. If the plant’s strategic vision is oriented towards product innovation, the training plan must be linked to remuneration policies. When the pay system is not strategically configured to reward intellectual risk and the acquisition of new knowledge that is scarce in the sector, it is impossible to create innovative capacity.
- “Technology - Safety” direction. In the specific context of the chemical industry, integration takes on the character of management safety.

Technological renewal plans are linked to occupational safety plans. Every new production unit requires the design of specialised occupational safety qualification programmes, because technology and safety are two sides of the same planning process.

- “Assessment - Development” direction. Integration ensures that performance appraisal results directly feed succession plans.

The question, however, is whether internal consistency is sufficient. On its own, it provides order, but it does not answer the question of economic efficiency. A methodological instrument is needed to measure how these activities affect the plant’s financial result. This necessitates a transition to mechanisms of quantitative and qualitative integration through specific strategic indicators.

The transition from horizontal consistency to measuring real economic efficiency in contemporary strategic management is achieved through the implementation of the Balanced Scorecard. In this case, the instrument is viewed primarily as a mechanism for vertical and functional integration. It transforms abstract strategy into specific operational objectives. The main scientific thesis here is that the development of human capital should be embedded in the structure of the production and financial indicators of the chemical enterprise (codes 17.11 and 17.12) through the logic of cause-and-effect relationships.

More specifically, the three directions are as follows:

- Technological security. Reducing the frequency of production accidents and the response time in crisis situations.
- Operational efficiency. Accelerating production cycles and reducing the share of production defects.
- Quality control. Improving the physico-chemical characteristics of the final product, thereby increasing customer satisfaction.

In contemporary strategic planning, the integration of management activities is practically impossible outside a high-technology information

environment. Advancing the planning process requires discontinuing practices based on isolated databases. A transition to enterprise resource planning (ERP) systems is important. The main scientific thesis here is that strategic integration is a function of information connectivity. Human capital data must therefore remain in constant connection with the organisation's production schedules and financial flows.

The management focus in this digital architecture falls on specialised human resource information systems (HRIS).

It can be seen how the technological environment turns traditional strategy into an "intelligent system". Digital integration enables management to monitor the organisational structure in real time. It provides the three requirements of contemporary planning: precision, speed and objectivity.

1.5 Trends or challenges in human resource management in companies manufacturing pulp, paper and paperboard

The theoretical review carried out makes it possible to formulate conclusions regarding the current state and future prospects of the sector:

1. Digital transformation and the concept of "Industry 5.0". Production processes are undergoing comprehensive digitalisation. This requires a change in the competency profile of chemistry specialists. In contemporary smart manufacturing, there is a much greater need for the ability to manage digital twins and interpret data from sensor networks in real time. For strategic planning, this creates a specific challenge related to how the renewal of human resources should be designed and implemented without disrupting the continuity of production cycles. Digitalisation requires a transition to flexible planning. Software skills are becoming part of technical expertise.
2. The demographic problem and the risk of losing know-how. The second strategic challenge is associated with demographic imbalances and

increasing intellectual migration. The sector is experiencing a certain ageing of its engineering and technical staff, creating a risk of interrupted succession. Operational knowledge is often concentrated among employees approaching retirement age, without a system being available for its transfer. In this context, succession planning becomes a mechanism for organisational survival. The challenge is to establish the chemical industry as a desirable field for career development, offering not only attractive remuneration but also participation in an innovative and high-technology environment capable of competing with the "lighter" sectors of the economy.

3. The "Green Deal" and the transition to a sustainable industrial strategy. The third conclusion is linked to the imperatives of the environmental pact and strict sustainability regulations. They require a complete reformulation of business strategies, which automatically calls for the definition of new strategic roles. The market is experiencing a shortage of specialists in decarbonisation, energy efficiency and circular chemistry. Such personnel are not available as a ready resource and must therefore be systematically "built" within the companies themselves. This confirms the thesis of the present dissertation regarding the need for an integrated and innovative approach to human resource development (HRD), in which the planning of new environmental competencies is linked to investment plans for modernising production capacity.

The consolidated analysis shows that traditional fragmented planning models are no longer capable of responding to these complex challenges. A new approach is needed, based on:

1. Horizontal linkage between the enterprise strategy and the individual development direction of each specialist.

2. High-technology integration of information flows through ERP and HRIS systems.
3. Scenario flexibility for responding to external shocks (regulatory or energyrelated).

CHAPTER TWO. EMPIRICAL STUDY OF STRATEGIC PLANNING AND HUMAN RESOURCE DEVELOPMENT IN ENTERPRISES MANUFACTURING PULP, PAPER AND PAPERBOARD

2.1 Research aims and tasks of the study

The study seeks to analyse:

- the operational aspects of management;
- the strategic and behavioural models of SMT.

The main aim of the empirical study is to establish the current state and degree of development of HR strategies in business organisations under codes 17.11 and 17.12. The scientific interest is directed towards establishing the degree of linkage between production and technological plans and workforce provision plans. Achieving the formulated aim requires the following specific research tasks:

1. Identification of the leading concept of senior management.
2. Assessment of the level of strategic alignment.
3. Analysis of the integration mechanisms and the information support of planning.
4. Examination of readiness to implement technological innovations and AI in planning functions.
5. Identification of the specific sectoral barriers to the reproduction of human capital.

2.2 Working hypotheses

In designing the empirical study and with a view to achieving the objectives set, the following working hypotheses were formulated:

- Hypothesis 1 (H1). The “technological gap” in management functions. A clear disproportion is assumed to exist between the stated strategic importance of human capital and the actual level of digital support for the processes of its planning and development. Confirmation of this hypothesis would indicate certain deficiencies in the technological infrastructure that limit the transformation of HRM from an administrative into a strategic function.
- Hypothesis 2 (H2). The structural determination of succession. The choice of mechanisms for knowledge transfer and organisational memory in the sector is assumed to be determined to a greater extent by external systemic shortages, such as the lack of qualified young personnel. The hypothesis places emphasis on the reactive nature of succession planning.
- Hypothesis 3 (H3). The compensatory role of internal organisational training. The main barrier to sustainable workforce provision is assumed to be the insufficient quality of vocational education outputs. This forces business organisations to invest in resource-intensive non-formal training to make up for the shortfall, shifting the focus from strategic development to the acquisition of basic qualifications.

Given the sample size (N = 16), the formulated hypotheses are tested through a combined qualitative-quantitative analysis of logical dependencies. These are presented in cross-tables. In this context, the statistical significance of the results is interpreted as a persistent trend relevant to the expert community in sectors 17.11 and 17.12. Without claiming universal representativeness beyond the scope of the sector studied, the results also have high diagnostic value for the state of planning processes.

2.3 Methodology of the empirical study and sample characteristics

A qualitative research design is applied, relying on the method of in-depth semi-structured interviews. The method of purposive expert sampling is used. The sample is constructed by selecting respondents with leading competence and strategic influence over planning processes. The study covers three main management profiles that form a "structure of strategic alignment":

1. Executive directors.
2. Human Resources Directors.
3. Production Directors / Technical Directors.

The empirical basis of the study comprises 16 semi-structured in-depth interviews. This volume is based on the scientific principle of "theoretical saturation", whereby additional data cease to generate qualitatively new scientific results. Taking into account the high market concentration in Bulgaria's pulp and paper sector (determined by 25 structurally significant organisations), the sample covers a set of enterprises generating the main share of value added in the industry. This ensures a high degree of reliability, precision of the conclusions and representativeness of the identified trends for the purposes of strategic planning.

Research instrument and structure. The principal research instrument is an interview guide comprising 12 questions structured into four logical blocks:

- Block I. Management philosophy and conceptual attitudes.
- Block II. Implementation of planning in the sector.
- Block III. Methodological synchronisation.
- Block IV. Forecasting and technological adaptation.

2.4 Data analysis - presentation of results and statistical estimates

The result of the initial stage of the analysis is that the sector is in a state of "transition in words". SMT already has the necessary theoretical knowledge and understands that complex technology requires serious engineering skills, without which expensive equipment remains inefficient. Planning systems, however, remain "locked" in the trap of short financial horizons and quarterly reporting.

The study divides the enterprises in the sector into two groups:

1. Companies in which the understanding of people as the most important asset is permanently embedded in the way they operate through specific performance measures.
2. Companies in which the individual is still viewed merely as an object of bureaucratic management with short planning horizons. Their efforts are directed mainly towards securing quick profits and liquidity.

The study results, however, lead us to be rather cautious in our expectations as to whether Bulgarian manufacturing managers are ready to stop merely counting "hours worked" and start measuring "the value created by people's knowledge". Long-term planning in Bulgaria's pulp and paper industry is still finding its way, torn between habits inherited from the past and the contemporary requirements of a knowledge-driven economy.

In Bulgarian pulp and paper manufacturing, the view that technology determines everything still prevails. Business strategy is perceived as a "hard" domain, reduced solely to the management of money, machinery, buildings and market position. At the same time, planning for people is pushed to the periphery as a secondary, supporting activity. There is a lack of connection within planning itself. It is carried out step by step and separately rather than being mutually connected and closed in a cycle.

In Bulgarian pulp and paper manufacturing, the "Green Deal" is still widely viewed as an external threat to survival and an administrative burden rather than as an opportunity for long-term improvement. Workforce planning remains blocked in a last-minute mode of action, beginning only after a problem arises. Senior management lacks a perspective on how environmental rules can be turned into a competitive advantage by developing team competencies. The study identifies a serious management risk. The absence of environmental thinking in current development plans creates the risk of a shortage of knowledgeable and

capable people precisely when European rules begin to exert their strongest pressure on business. A striking management contradiction is present: the environmental protection strategy and employee training plans exist entirely separately from one another. This planning mismatch obstructs the sustainable development of organisations under codes 17.11 and 17.12.

The sector also shows insufficient depth in translating production objectives into plans for people. Funds for specialist development are widely treated as a bureaucratic consequence or as a “necessary evil” in company budgets. This state of affairs reveals a major time lag: the most modern digital production systems coexist with outdated planning methods.

The practical analysis demonstrates that the absence of financially supported staff replacement plans leads to a gradual loss of “technological memory”. The results highlight the urgent need to incorporate formal mentoring programmes and instruments for documenting knowledge into overall development plans. Otherwise, the industry faces a striking contradiction: modern machinery and equipment are operated by people without a basic understanding of the nature of the chemical processes. Experience and skills should be treated as an object of deliberate long-term planning and preservation.

It follows logically that the barriers in Bulgarian pulp and paper manufacturing have reached a level at which workforce selection planning has fallen to the level of “survival planning”. Organisations find themselves in a situation of forced uniform behaviour. They simultaneously become corporate “training centres” and providers of social support in an attempt to compensate for mistakes and the absence of adequate state policy.

The results of the empirical study fully support the hypothesis that the main obstacle to HR development going forward is the extreme shortage of trained people and labour. This comprehensive impediment demonstrates the need to propose entirely new models of interconnection and joint work between the state

and private business. Work-based learning and the provision of special corporate scholarships for pupils and university students have already become a necessary condition for the survival of the entire industry. Without these measures, every long-term plan remains without the people needed to implement it. It therefore becomes merely a list of administrative intentions on paper, with no real possibility of bringing new machinery and technologies into operation.

The scientific conclusion from the study is that Bulgaria's pulp and paper industry exhibits a lack of methodological continuity and succession between production-technological levels and final financial indicators with regard to HR management. This serious shortage of precise measures makes long-term human resource planning extremely vulnerable in terms of its survival within the company structure. Under conditions of increasing market uncertainty, the complete inability to demonstrate, through specific value indicators, the added value of a well-trained engineer has negative consequences. In such a scenario, funds allocated for improving qualifications are the first to be cut and become a "victim" of the overall reduction in corporate budgets.

The data show the existence of completely separate and isolated "standalone automation units" in Bulgaria's pulp and paper industry under codes 17.11 and 17.12. A clear technological divide and duality can be observed. Production capacities and equipment are at an exceptionally high level and fully digitalised. By contrast, the systems for managing the human capabilities and knowledge surrounding them remain essentially entirely non-digital and traditional.

The hypothesis regarding the urgent need to introduce strict and consistent rules of action throughout the planning process is confirmed. The empirical study demonstrates that it is necessary to build a comprehensive software architecture ensuring full data connectivity. Otherwise, human resource planning will remain permanently trapped in management driven solely by intuition and improvisation. This profound "information disconnect" between the immediate production process and the personnel development centre is a central issue in the study.

The scientific conclusion from the analysis of two-dimensional distributions is unequivocal: increasing the objectivity and speed of personnel assessment processes is a mandatory prerequisite for successfully transforming knowledge management into a strategic function. As long as verification and assessment are perceived by employees and management solely as an administrative obligation, the mechanisms for transferring experience between generations will remain “hostages” to subsequent action and temporary, unsustainable solutions. One example is the deliberate retention of already retired employees.

The present study confirms that contemporary industrial management requires a reliable instrument for “in-depth insight”. It must identify and point to the next generation of chief technologists and specialists long before the shortage of trained personnel develops into a full-scale production crisis for the enterprise.

The empirical data collected confirm the thesis that industry has invested in technical and machinery resources but has allowed a deficit to emerge in business intelligence (BI) software within the management mindset. The manufacturing sector is currently in a specific state of “digital transition”, in which managerial understanding of human resource development visibly outpaces the current technical reality in companies.

The empirical data identify an exceptionally strong barrier to the introduction of innovation in planning. A comparatively small proportion of leading managers in the industry demonstrate forward-looking thinking by viewing AI as an effective means of releasing employees’ intellectual capacity through the automation of routine planning tasks. The overwhelming majority, however, interpret the new technology solely through the lens of risk. It is regarded as a threat to computer-network security and the confidentiality of corporate data, or simply as an investment with an entirely unproven subsequent return.

These market circumstances and the existing state of affairs constitute a serious planning deficiency. They threaten the global competitiveness of domestic manufacturing enterprises. Leading global companies are already actively introducing predictive models into day-to-day management in order to achieve lasting reductions in employee turnover. In our environment, the major opportunities offered by AI still remain within the realm of theoretical discussion. The study carried out demonstrates the urgent need to subsequently design a "stepwise scheme for developing intra-organisational trust" among management.

The empirical study supports the thesis that, in order to achieve intraorganisational flexibility, enterprises under codes 17.11 and 17.12 must make a major management "turn". This turn requires a transition towards comprehensive employee development "for future trials and challenges".

2.5 Conclusions

On the basis of the processed data, the following main conclusions can be formulated:

1. Confirmation of hypothesis H1. The collected data fully demonstrate the existence of "planning rigidity" and strongly expressed traditionalism in the sector. The prevailing approach to budgeting through the simple carryforward of past expenditure, combined with the treatment of HR solely as an administrative cost rather than as a principal productive force, demonstrates that planning in this industrial sector is insufficiently oriented towards the future and strategy. The initial assumption of a "disconnect" between the technical level of technological equipment and the general planning culture is fully confirmed.
2. Confirmation of hypothesis H2. The study reveals informational and scientific self-isolation. The absence of automated data exchange between direct production systems and personnel management activities, combined with distrust in existing employee assessment systems, demonstrates that

personnel development in the industry is undertaken only in fragmented form and at local level rather than being managed systematically and centrally. The assumption regarding a shortage of analytical software is confirmed.

3. Confirmation of hypothesis H3. The detailed analysis of the existing barriers demonstrates that the external market and social environment imposes a model of "planning for survival" on companies under codes 17.11 and 17.12. The scientific proposition is confirmed that manufacturing business organisations are forced to internalise within the company activities normally inherent to formal educational institutions in order to compensate for systemic deficiencies in labour supply on the labour market.
4. Transformation of the overall competency profile. The final results of the study demonstrate the need to build a new type of specialist possessing the so-called "Triad of the Future":
   - adaptability;
   - diversity of technical skills;
   - computer and digital literacy.

This state of affairs requires a rapid transition to long-term planning of the workforce's overall "readiness and capacity for rapid response" to changes in production.

CHAPTER THREE. METHODOLOGICAL ASPECTS OF DEVELOPING HUMAN RESOURCE DEVELOPMENT STRATEGIES IN BUSINESS ORGANISATIONS MANUFACTURING PULP, PAPER AND PAPERBOARD

3.1 Innovative methods for assessing human resource potential

The innovative essence of the proposed model is based entirely on combining the expert view of the direct manager with the indisputable and precise numerical trail that each worker leaves in real time within the MES. The proposal is to use the now well-established applied expertise matrix. It is considered an appropriate option for "managing" MES-HR synergy. It serves to standardise and cross-check subjective human judgement against precise technological facts.

The scientific argument in favour of this combination and mutual embedding is compelling. Through it, assessment is transformed into a continuous review of personnel preparedness. This ensures that the planning department has access to what may be called "filtered data". These indicators become the only genuine basis on which a business organisation under codes 17.11 and 17.12 can build sustainable long-term strategies for targeted training and accelerated planned succession in management positions.

The innovative essence of this matrix is based entirely on the close interweaving of the direct manager's personal expert judgement with the indisputable and precise numerical trail that every employee/worker creates, or respectively leaves, in real time within the manufacturing execution system (MES).

This additional analytical layer enables planning activity to develop under conditions of impartiality. The thesis is advanced that the applied expertise matrix should under no circumstances become an end in itself as an assessment of human labour. Rather, it should be perceived as a long-term development roadmap. It provides the "structure" of objectivity upon which SMT must carefully build human understanding and empathy.

In this way, the proposed applied scientific assessment approach becomes a continuously developing environment for managing accumulated knowledge. It participates in the continuous shaping and building of human resources. It constantly aligns the expectations and goals of the company under codes 17.11

and 17.12 with the actual aptitudes and strengths of the individual. This fine balance between technological precision and the leadership intuition of managers is the formula for building long-term strategies in the pulp and paper industry.

3.2 Integration of data-mining technologies into strategic human resource management

The essence of the proposed scientific innovation centres on combining data from human resource information systems (HRIS) with current production records from the direct factory level (MES). Through the practical application of mathematical sequences of actions for extracting hidden knowledge, the business organisation under codes 17.11 and 17.12 gains real opportunities to identify complex relationships. These deep connections usually remain invisible to traditional operational reporting.

The most important element in the applied scientific approach proposed here is the introduction of predictive models for workforce threats and risks. A new sequence is proposed that examines the multidimensional interrelationships among the influencing factors.

The second basis of the proposed applied scientific approach is directly aimed at overcoming information fragmentation through the comprehensive design of a system comprising a “Shared database where all information is in one place”, or, consequently, a “Common digital space in which everything is connected”.

To eliminate this problem, we propose a scientifically grounded model for bidirectional knowledge exchange in which computer systems at the shop-floor level itself (MES) begin to exchange information in real time with systems in the HRM department. In this way, personal subjectivity and time delays are removed. These are generally characteristic of the actions of middle-level managers.

An innovative element in this architecture is the concept of the “Employee Digital Twin”. Within the methodology, it has the meaning of a mathematical and

behavioural model that aggregates the individual's "digital footprint". In the specific environment of the chemical industry under codes 17.11 and 17.12, it is a means of achieving a high speed of response to sudden technical shocks or sharp market fluctuations. When data about people are as timely as data about the machines themselves, the company builds a particular "immune defence" against stagnation.

The combination of knowledge-extraction technologies proposed in this part brings an end to the previous era of fragmented information "silos" in heavy industry. By successfully transforming big data into smart data and by comprehensively constructing digital representations of human experience, we provide SMT with a management toolkit. This integrated approach simultaneously answers the question "what exactly is happening in production" and fully reveals the cause-and-effect relationships, clarifying "why exactly it is happening".

3.3 Application of artificial intelligence in the human resource planning process

In response to the concerns identified, a conceptual transition towards a model of "assistive" artificial intelligence is proposed. The scientific position here is that, in the complex environment of the chemical industry under codes 17.11 and 17.12, AI should function as an intelligent support system rather than as an autonomous actor with the right of final arbitration. Specifically, this includes:

- multidimensional filtering;
- pattern recognition;
- scenario simulation.

The scientific rationale is directed towards placing contemporary technology at an entirely new level - as a decision-support system (DSS).

Once the cognitive framework of this complementary cooperation between human beings and technology has been outlined, it is essential to analyse how this

“augmented AI” is transformed into concrete algorithms for the flexible and continuous improvement of production teams. This leads to the direct applied expression of predictive sequences of actions and their demonstrated capacity to balance the complex triad of resources (people, time, technologies), which is the subject of the next focal point of the exposition.

The second main aspect of the proposed applied scientific approach is directed towards overcoming existing doubts regarding the “unevenness” of chemical processes. This major challenge is addressed by introducing predictive algorithms for the comprehensive improvement of the so-called “Triad of Industrial Resources”. Within this scientific model, the correct solution to the important equation lies between three evolving variables: production intensity, technical reliability of assets, and the availability and condition of human capacity. The essence of this approach lies in developing algorithms for predictive capacity planning. AI simultaneously performs passive monitoring of attendance and analyses complex correlations. The important innovative element here is the so-called intelligent matrix for dynamic reallocation. It enables a transition towards flexible management in heavy industry under codes 17.11 and 17.12.

For the purposes of the scientific study and the subsequent verification and confirmation of the proposed applied scientific approach, a forecast was developed to assess the potential positive results and consequences of the future introduction of the dedicated AI for dynamic and continuous planning. The comprehensive integration and mutual embedding of AI systems within heavy industry under codes 17.11 and 17.12 is a prolonged and long-term process. The conclusions are therefore based on expert simulation of situations as well as on a detailed comparative review against leading global achievements in similar capital-intensive industries.

On the basis of this expert analysis, the following arguments can be derived:

- resource efficiency through forecasting;

- reduction of production risk and cognitive improvements;
- acceleration of the investment cycle.

3.4 Model for flexible human resource management - development and validation

The original model proposed in the present dissertation was conceived and designed from the outset as a complete and integrated logical system. Its purpose is to combine and mutually embed, within a single framework, data from direct production and personnel levels, to eliminate personal bias in assessment completely, and to improve the competencies of the enterprise's available human resources to the highest possible degree.

Given the focus on agility, heavy industry and the stepwise approach (from data to AI), the following name is proposed - the HIRA model. The acronym stands for: H - Hybrid (combining human experience and machine data); I - Intelligent (using predictive analytics); R - Resilient (protecting the planning process); A - Agile (allowing flexible response). The HIRA model is designed specifically to operate under conditions of high technological criticality and low tolerance for errors. More specifically:

- Validation function. Intended to serve as a "digital corrective" to subjective judgement. It provides a mechanism for automatically comparing appraisal results with operational data from MES/ERP systems. This ensures that every planning decision is based on "demonstrated contribution" rather than hierarchical preference.
- Simulation function. Enables the planning department to run "virtual scenarios" for personnel reallocation before their actual implementation. This includes forecasting the effect of rotating multifunctional teams on the specific consumption of energy and raw materials.
- Protective function. Focused on identifying cognitive overload and "technological stress". By monitoring response times to system signals, the

model performs an early-warning role for potential accidents caused by the human factor.

- Evolutionary function. Intended to manage “hidden potential”. It simultaneously records current skills and identifies signs of adaptive capacity required for future stages of the enterprise’s digital transformation.
- Optimisation function. Searches for the “golden mean” between capacity utilisation and team readiness in order to achieve maximum yield with minimum overtime.

Taking into account the conservatism of management towards radical technological interventions identified in the empirical part of the dissertation, particularly towards AI, a stepwise approach to implementing the model is proposed:

- Stage I - Organisational improvements. Introduction of logical datavalidation algorithms that support human decision-making without displacing it. The focus here is on analytical discipline and eliminating information “silos”.
- Stage II - Digital support. Integration of predictive tools for monitoring cognitive workload and potential.
- Stage III - Cognitive automation (Perspective). At this stage, after the company has accumulated trust in the system and “cleaned” its data, the introduction of AI elements is permitted as a navigator for complex planning simulations.

The model is based on three fundamental elements that define its functional integrity:

1. Diagnostic block (Input level). Establishing potential through “clean data”. This block is responsible for the “hygiene” of information in the planning system. Its scientific task is to eliminate subjective noise (emotional

judgements, personal preferences, hierarchical pressure), which often "distorts" the real state of human capital.

2. Operational block (Process level). Flexible reallocation and simulationbased planning. This is the "engine" of agility. In this block, decisions are made regarding real-time personnel allocation in accordance with the technological needs of the plant/industrial complex.
3. Strategic block (Output level). Forecasting succession and leadership impact. The third pillar is directed towards the organisation's future resilience. It addresses the question of knowledge succession.

To confirm the applied value of the proposed original model, a projective validation was carried out. In the first stage, a "stress test" of the diagnostic block was performed by comparing the appraisal records of 35 employees with actual logs of their contribution over a six-month period. The results confirmed the presence of "subjective noise" in more than 20% of cases. If the model were used, this would be corrected automatically by the algorithm. In the second stage, the Operational block was tested by simulating a sudden interruption of the production process (an accident). The expectation is that the model would propose an optimal reallocation of teams in approximately 45% less time compared with the traditional method of "manually" searching for available personnel.

The validation results demonstrate that the proposed model transforms the human resource management function into an active diagnostic and strategic centre.

3.5 Conclusions and proposals

As a result of the theoretical study carried out and the original HIRA model developed for HRM under conditions of industrial digitalisation, the following main conclusions and applied proposals can be formulated:

1. Transformation of the planning concept. It has been demonstrated that under the conditions of Industry 4.0/5.0, human resource planning in the

chemical industry under codes 17.11 and 17.12 must evolve from a periodic administrative act into a continuous flow of data. Integration between production systems (MES) and HR platforms is the determining factor in eliminating information “silos”.

2. Validity of the HIRA model. The original HIRA model developed provides a resilient framework that balances technological precision and the human factor. The model responds to management’s distrust by introducing a stepwise approach that allows the organisation to adapt gradually to digital tools.
3. Objectivity through Cross-Check analysis. The introduction of a comparative audit procedure between “soft” appraisal data and “hard” production indicators makes it possible to substantially reduce subjective managerial noise. This transforms the HR function from a supporting into a diagnostic function.
4. Predictive risk prevention. The inclusion of a cognitive workload index and a technical flexibility index enables a transition to predictive personnel rotation. This reduces the likelihood of errors caused by the “human factor”.
5. Economic and operational feasibility. The projective validation of the model demonstrates the potential to reduce direct labour costs (overtime and downtime), thereby ensuring a high ROI on digital management tools.

On the basis of the results obtained, the following steps are proposed for implementation in enterprises in the sector:

1. Creation of a Unified Information Space. Company SMTs should initiate software-integration projects between production servers and HR software, ensuring automated exchange of real-time productivity data.
2. Implementation of an “Employee Digital Twin”. Employees’ electronic records should be restructured to include dynamic parameters for

multifunctionality and the history of technical contribution beyond the standard job description.

3. Training middle management to work with HIRA. Specialised training should be conducted for shift supervisors and shop-floor managers on interpreting predictive signals and working with the model's arbitration matrices, with the aim of overcoming the "cognitive barrier" to new technologies.
4. Pilot testing of the predictive rotation module. It is recommended that the algorithm for monitoring cognitive workload initially be implemented at the most critical production nodes, where the risk of environmental and technological accidents is highest.
5. Revision of succession strategies. Algorithmic findings regarding "hidden potential" should be used to identify successors for important engineering positions at least three years before the retirement of the current experienced specialists.

CONCLUSION

The present dissertation offers a scientific and practical solution to important problems associated with strategic workforce planning under the conditions of a digital economy. The main aim of the study, set at the outset, has been achieved. The tasks have been addressed through the consistent derivation of theoretical and practical evidence for the needs of strategic HRM.

The principal conclusions of the scientific study can be summarised as follows:

- a mismatch between theory and practice in strategic HRM;
- a lack of connectivity between software systems;
- predominantly fragmented planning without a strategic perspective;
- a need for new objective assessment methods;

- a need for data-mining technologies and AI.

The research carried out demonstrates that the working thesis formulated at the beginning is fully confirmed. The introduction of an innovative and flexible approach to the long-term strategic management of people improves the staffing of processes. This enhances strategic competitiveness and guarantees a stable future for industrial companies under codes 17.11 and 17.12 in Bulgaria.

Looking to the future reveals that the present scientific work does not bring the research to an end, but opens the door to broader horizons. The methodology developed has the potential to extend beyond the framework of pulp and paper manufacturing and to serve as a basis for digital transformation in other sectors of heavy industry as well. The future development of this scientific field will be associated with an even deeper integration of technologies, in which AI will create automatic strategic development plans for each individual employee.

IV. STATEMENT OF THE SCIENTIFIC AND APPLIED SCIENTIFIC CONTRIBUTIONS OF THE DISSERTATION

First. On the basis of a critical analysis, the challenges facing the strategic management of human resources in business organisations manufacturing pulp, paper and paperboard have been systematised and identified. A conceptual framework has been theoretically substantiated for the transition from reactive to flexible strategic planning, taking into account the three drivers of change - digital transformation, demographic imbalances and the requirements of the "Green Deal".

Second. A comprehensive empirical study was conducted through interviews in enterprises in Bulgaria's pulp and paper industry (Classification of Economic Activities codes 17.11 and 17.12), through which the scientific hypotheses in the dissertation were statistically supported. Deficiencies in personnel management were identified, including "planning rigidity", the gap between the technological level and HR planning, the lack of linkage between ERP and HRIS systems, and the specific external barriers to workforce provision. The need for a new profile of specialists in the industry, based on the "Triad of the Future", was substantiated.

Third. An original HIRA model for human resource management was developed, integrating data from production systems (MES) with HR environments. The model incorporates a comparative audit procedure between appraisal data and production indicators, as well as predictive indicators for personnel rotation based on cognitive workload and technical flexibility. Through projective validation in enterprises in the sector, its operational and economic feasibility was demonstrated and practical guidelines for its implementation in the industry were defined.

V. LIST OF PUBLICATIONS BY THE DOCTORAL CANDIDATE

Articles

1. Marinov, M. “The Strategic Role of Human Resource Management for Sustainability in Chemical Enterprises.” E-Journal VFU, 24/2025, 757-767, ISSN 1313-7514, DOI: https://doi.org/10.53606/evfu.24.757-767
2. Marinov, M. “Strategic Human Resource Planning through the Hybrid Intelligent HIRA Model.” E-Journal VFU, 26/2026, 257-276, ISSN 1313-7514, DOI: https://doi.org/10.53606/evfu.26.257-276

Conference papers

1. Marinov, M. “Human Resource Development Strategies in Business Organisations.” In: International Scientific Forum “Global and National Business Transformations - Proactive Management, Financial-Accounting and Planning Solutions”, 25-25 October 2024, Svishtov, Tsenov Academic Publishing House, pp. 264-268, ISBN 978-954-23-2513-0.
2. Marinov, M. “Trends and Challenges in Human Resource Management in Companies in the Chemical Industry.” In: International Scientific Forum “Corporate Solutions for Economic Development - Strategic Planning, Reporting and Sustainability”, 24-25 October 2025, Svishtov, Tsenov Academic Publishing House, pp. 120-125, ISBN 978-954-23-2609-0.

VI. STATEMENT ON FULFILMENT OF THE NATIONAL REQUIREMENTS UNDER THE REGULATIONS FOR THE IMPLEMENTATION OF THE ACT ON THE DEVELOPMENT OF THE ACADEMIC STAFF IN THE REPUBLIC OF BULGARIA

Indicator	Points
Group of indicators A. Indicator 1. Dissertation for the award of the educational and scientific degree "Doctor".	
"DEVELOPING STRATEGIES FOR HUMAN RESOURCE DEVELOPMENT IN BUSINESS ORGANISATIONS IN THE CHEMICAL INDUSTRY".	50
The dissertation has been discussed and a defence procedure has been opened.	
Group of indicators G. Sum of indicators 4 to 10.	
7. Articles and papers published in non-indexed peer-reviewed journals or in edited collective volumes.	
Marinov, M. "The Strategic Role of Human Resource Management for Sustainability in Chemical Enterprises." E-Journal VFU, 24/2025, pp. 757-767, ISSN 1313-7514, DOI: https://doi.org/10.53606/evfu.24.757-767	10
Marinov, M. "Strategic Human Resource Planning through the Hybrid Intelligent HIRA Model." E-Journal VFU, 26/2026, pp. 257276, ISSN 1313-7514, DOI: https://doi.org/10.53606/evfu.26.257276	10
Marinov, M. "Human Resource Development Strategies in Business Organisations." In: International Scientific Forum "Global and National Business Transformations - Proactive Management, Financial-Accounting and Planning Solutions", 25-25 October 2024, Svishtov, Tsenov Academic Publishing House, pp. 264-268, ISBN 978-954-23-2513-0.	10

Marinov, M. “Trends and Challenges in Human Resource Management in Companies in the Chemical Industry.” In: International Scientific Forum “Corporate Solutions for Economic Development - Strategic Planning, Reporting and Sustainability”, 2425 October 2025, Svishtov, Tsenov Academic Publishing House, pp. 120-125, ISBN 978-954-23-2609-0.	10
Total number of points - sum of indicators 4 to 10	40
Required number of points - sum of indicators 4 to 10	30

VII. **DECLARATION OF ORIGINALITY OF THE DISSERTATION**

The dissertation, comprising 160 pages and entitled “Developing Strategies for Human Resource Development in Business Organisations in the Chemical Industry”, constitutes the author’s own scientific work. It uses the author’s ideas, texts and visualisations through graphs, diagrams, tables and formulas, while observing all requirements of the Copyright and Neighbouring Rights Act through proper citation and reference to the ideas and data of other authors, including:

1. The results achieved in the dissertation and the contributions derived from them are original and have not been borrowed from research and publications in which the author did not participate.
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3. Scientific results obtained, described and/or published by other authors are duly and comprehensively cited in the bibliography.

Date: 26.08.2026

Doctoral candidate: _____

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