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# Identifying the Factors Affecting Human Resource Productivity

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**ABSTRACT**

As one of Iran's key industrial sectors, the rubber manufacturing industry holds considerable potential for contributing to national economic development. Within this context, optimizing human resource productivity is essential for supporting both the sustainable growth and strategic goals of manufacturing enterprises. This study explores the dynamic factors affecting human resource productivity at the Atavil Tire Factory located in Ardabil Province, employing a system dynamics methodology to capture the complex interrelationships among key variables. To achieve this, simulation modeling was conducted using Vensim software, enabling the researchers to evaluate how various organizational factors interact over time. The simulation outcomes reveal a multifaceted relationship between job performance and productivity. While improvements in job performance are found to positively impact overall productivity levels, they concurrently result in heightened job-related stress among employees. This increase in stress, if not properly managed, can become a limiting factor, offsetting the gains achieved through performance enhancements. Consequently, the study underscores the importance of balancing performance improvement initiatives with effective stress management strategies. Addressing this trade-off is critical for fostering a healthy and productive workforce, particularly in high-pressure industrial settings. The findings offer valuable insights for factory managers and policymakers seeking to promote sustainable productivity growth within Iran's rubber manufacturing sector.

## 1. INTRODUCTION

In all countries, productivity and the optimal utilization of production factors have become a national priority. Societies worldwide have come to the conclusion that the survival of any community is impossible without paying attention to productivity. Among various dimensions of productivity, human resource productivity is considered one of the most essential prerequisites for achieving overall organizational productivity. Therefore, any effort toward improving organizational performance is meaningless without the active contribution of productive employees.

In recent years, discussions around productivity have gained considerable attention in both academic and social domains within the country. In today's fast-paced technological advancements and intense global competition,

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policymakers and managers increasingly recognize the "value of productivity" sometimes as a strategic tool and other times as a key objective. Despite this emerging recognition, the concept and culture of productivity improvement remain relatively new and underdeveloped in our country. Although nearly a century has passed since productivity was first discussed on an international scale, it has only recently received focused attention at the national level.

In the contemporary world, being ahead of the curve is the only viable strategy for sustained existence. This is precisely where the importance of productivity becomes more evident it involves proper planning and organization to achieve optimal outcomes from a set of activities. It also means attaining maximum possible profit through efficient and effective use of labor, energy, talents, and skills of the workforce [1].

Furthermore, in the global economy, most organizations cannot compensate for rising material, labor, and production costs merely by increasing the prices of their products. Enhancing the productivity of knowledge workers presents an opportunity for organizations to increase profitability by improving their production and processes rather than solely focusing on cost reduction [2].

Efforts to improve productivity are essentially efforts toward improving the quality of life for individuals and society as a whole. In the modern world, sustainable economic and social development necessitates a concerted and continuous effort to enhance productivity [3].

Among the various factors of production, human resources stand out as the only intelligent and coordinating element. As the primary driver for increasing or decreasing organizational productivity, human capital occupies a special and strategic position. This role becomes even more critical in service-oriented organizations, where human input is central to performance. A motivated, capable, and productive individual can optimally utilize other resources, realize various forms of productivity, and ultimately drive the organization forward. In contrast, an unmotivated and passive workforce leads only to stagnation and decline [4].

System dynamics is a methodology for studying and managing complex systems characterized by feedback loops. Such systems are present across numerous domains including business, economics, environmental science, energy management, urban planning, and other social and human fields [5].

Arta Tire Manufacturing Company (Goldstone), a large-scale and diverse production complex with a substantial workforce, is regarded as one of the leading manufacturing organizations in the northwest of Iran. To expand its production share in the national market and contribute to the country's economic growth, it is imperative for the company to improve productivity at the employee level. This study investigates the factors influencing labor productivity at Arta Tire (Goldstone) using the system dynamics approach.

## 2. LITERATURE REVIEW

The Japan Productivity Center defines productivity as "maximizing the use of physical resources, human capital, and other inputs in a scientific manner that results in lower production costs, market expansion, job creation, and improved living standards for all members of society." Nowadays, productivity is increasingly regarded not only as a performance metric but also as a mindset and rational perspective for sustained progress and improvement. In essence, it is a rational approach to managing activities effectively and efficiently, enabling individuals to perform better than before on a daily basis [6].

Undoubtedly, the process of human resource productivity is not influenced by isolated factors; rather, it is shaped by the interaction and combination of various elements. Since productivity is not an abstract concept and must have practical implications, organizational management plays a crucial role in creating an environment conducive to institutionalizing and enhancing productivity. Therefore, examining the determinants of workforce productivity is of special importance [7].

Numerous factors influence organizational productivity. These include human resources, machinery and equipment, raw materials, tools and supplies, methods, and procedures [8]. Improving productivity is not merely about doing things better but about doing the right things. Since no single cause can account for increased productivity, identifying the root causes of low productivity is essential. After diagnosing these causes, targeted

productivity improvement programs can be developed, involving changes in employee motivation methods, working conditions, systems, procedures, and technologies [9].

Typically, the primary concern of an enterprise is profitability. In the long term, profitability is heavily dependent on productivity. Enhancing productivity through reducing costs and increasing demand for products and services can significantly improve profitability and the competitiveness of institutions. Productivity thus affects an organization's capacity to compete in markets offering similar goods and services [10].

The most common indicator of labor productivity is the ratio of value added to labor input, which may be measured by the number of employees, total labor costs, or similar metrics [11].

Hashemi (2015), in a study titled An Investigation of Factors Affecting Human Resource Productivity in the National Iranian Oil Products Distribution Company – Tehran Region, found that organizational factors such as quality of work life and motivational systems significantly influence employee productivity, while factors such as information technology and employee empowerment had no significant effect. Individual, environmental, and job-related factors were found to be impactful on productivity enhancement [12].

The Japan Productivity Center identifies key factors affecting human productivity as fairness in distribution, participatory management, and employee training and empowerment. Additionally, factors such as operation speed, quality, unit cost, work flexibility, employee commitment, effective communication, awareness of productivity, satisfaction, quality of work life, and positive participation are considered as essential productivity indicators [13].

According to Savery (1998), the main factors influencing human productivity include continuous planning and updated technology, cooperation between employees and management, flexible work hours, managerial perspectives on productivity, wage and incentive systems, intelligence, effective leadership, training and empowerment, employee accountability, work commitment, and overall job and life satisfaction [14].

Steiner (1995) similarly identifies awareness of productivity, proper communication, employee commitment, work flexibility, unit cost, operational quality, operation speed, active participation, satisfaction, and work-life quality as key productivity indicators [13].

From the perspectives of Vroom and Kepner, critical factors influencing human resource productivity include job satisfaction, job knowledge, motivation (both financial and non-financial), the nature of the job, personal characteristics (e.g., job-person fit), fairness, profit-sharing, and quality of work life [7].

Job satisfaction is among the most influential factors in professional success, boosting both efficiency and personal well-being. It reflects a person’s positive perception of job conditions, the work environment, and the rewards received for efforts made [15].

Jian et al. (2014), in their article titled The Effects of Stress, Repetition, Fatigue, and Workplace Conditions on Human Error in the Construction Industry, concluded that lack of skill and experience among workers significantly increases the occurrence of human errors and rework. Conversely, skill and experience were shown to have a positive effect in reducing such errors [16].

Employee turnover intention is a precursor to actual turnover and is one of the major consequences of job dissatisfaction. Given the substantial costs associated with turnover, organizations must identify and address the causes to significantly reduce or prevent it [17].

Shirzad Kebria and Barazideh (2016), in their study titled Assessing the Productivity of Human Resources in Bank Melli Iran and Ways to Improve It, reported that ability, perception, organizational support, motivation, feedback, credibility, and adaptability of human resources were all in satisfactory condition [18].

Shojaei et al. (2016), in their article Factors Affecting Employee Productivity using structural equation modeling via SPSS and LISREL, concluded that human resources including both staff and managers are the most valuable assets of any organization. They emphasized the organization's responsibility to provide appropriate opportunities for employee growth and productivity [19].

Tavari et al. (2008), in their study Identifying and Prioritizing Factors Affecting Human Resource Productivity Using MADM Techniques, highlighted productivity as a crucial element for organizational survival. Using methods

such as AHP, SAW, TOPSIS, and ELECTRE, they concluded that managerial factors were the most influential, followed by individual, cultural, socio-psychological, and environmental factors [20].

Felihi Pirbasti and Rahbarinejad (2012), in their research titled Happiness and Labor Productivity in Iran: An Econometric and System Dynamics Approach, demonstrated that increased happiness significantly boosts workforce productivity. Their scenario analysis further showed that reducing household expenses decreases perceived happiness, whereas environmental pollution surprisingly increased happiness levels [21].

Mohammadzadeh and Sadeghi (2013), in their article Modeling and Analyzing Factors Affecting Human Resource Productivity in the Oil Industry Using a System Dynamics Approach Towards 2025, introduced a novel perspective by simultaneously considering both efficiency and effectiveness of employee activities. Their findings emphasized the need to halt workforce expansion to enhance efficiency, while also adopting supportive measures to improve employee motivation and job satisfaction to enhance effectiveness [22].

## 3. RESEARCH METHODOLOGY

This study is applied in nature in terms of its objective, and it employs both field-based and library-based data collection methods. The implementation process began with the identification of key variables through literature review and interviews with experts from the insurance company. Subsequently, causal loop diagrams and stock-and-flow diagrams were developed. The variables were then defined in the form of equations and entered into the Vensim software for simulation and analysis. Based on the results, relevant strategies and solutions were proposed.

The concept of System Dynamics was first introduced by Forrester and has significantly evolved over the past five decades [23]. This discipline provides a systematic approach to uncovering the nonlinear dynamic behavior of systems and examines how the structure and parameters of a system influence its behavioral patterns. The output of discrete system simulations using the system dynamics approach facilitates the design of effective policies to enhance performance and achieve higher levels of efficiency. A fundamental principle of this approach is that a system's structure governs its dynamic behavior. In other words, this methodology creates a visual representation of the system based on existing feedback loops and time delays to better understand the dynamic behavior of complex physical, biological, and social systems. This makes system dynamics a particularly effective tool under dynamic and real-world conditions [24].

Models developed using the system dynamics methodology consist of two primary components: causal loop diagrams (CLDs) and stock-and-flow diagrams (SFDs) [23]. Causal loop diagrams serve as tools to illustrate the causal relationships among a set of variables within a system. The presence of feedback in these relationships gives rise to causal loops, which can be broadly classified into two categories: reinforcing loops and balancing loops. Reinforcing loops correspond to positive feedback, while balancing loops represent negative feedback. Understanding the system's behavior over time requires simulating variable relationships in the Vensim software, where stock-and-flow diagrams serve as the operational equivalents of causal loops [25].

The dynamic modeling process employed in this study follows the framework proposed by Sterman at MIT, with its sequential stages illustrated in Figure 3 [26].

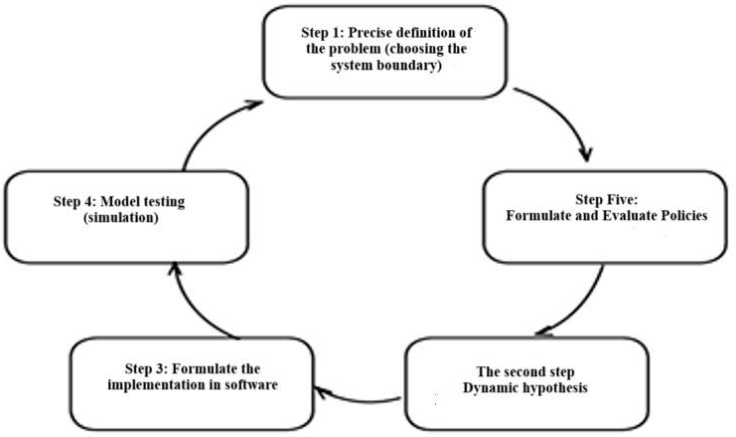


**Fig. 1.** The Five Modeling Steps in the System Dynamics Approach

## 4. MODELING AND ANALYSIS

### 4.1. Dynamic Hypothesis

Given the significance of human resources as a strategic asset for organizations, this study identifies and examines the key factors influencing human resource productivity. Productivity is considered the organizational essence that ensures sustainability and survival while serving as a mechanism for gaining competitive advantage. Accordingly, what enhances human resource productivity within organizations is the alignment and compatibility of employees' personalities, interests, and emotions with organizational roles and tasks. In such a scenario, job satisfaction, job performance, motivation, and accountability are improved, which ultimately leads to a direct and indirect increase in organizational productivity.

The foremost and most critical component of a nation's development is its human capital. Indeed, human resources form the fundamental infrastructure of any institution, organization, or country, serving as the driving force toward progress and excellence. Therefore, the dynamic hypothesis proposed in this study, based on the literature review, is illustrated in Figure 2. It suggests that job performance, through increased job satisfaction and organizational commitment, positively impacts human resource productivity.

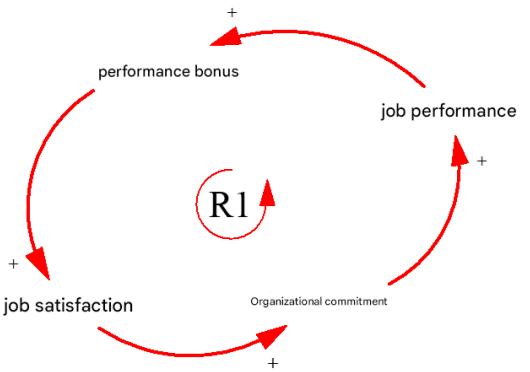


**Fig. 2.** The Reinforcing Loop of Job Performance Based on Job Satisfaction – R1 (Dynamic Hypothesis)

### 4.2. Causal Loop

The causal loop model, formulated in accordance with the proposed dynamic hypothesis, is presented in Figure 3.

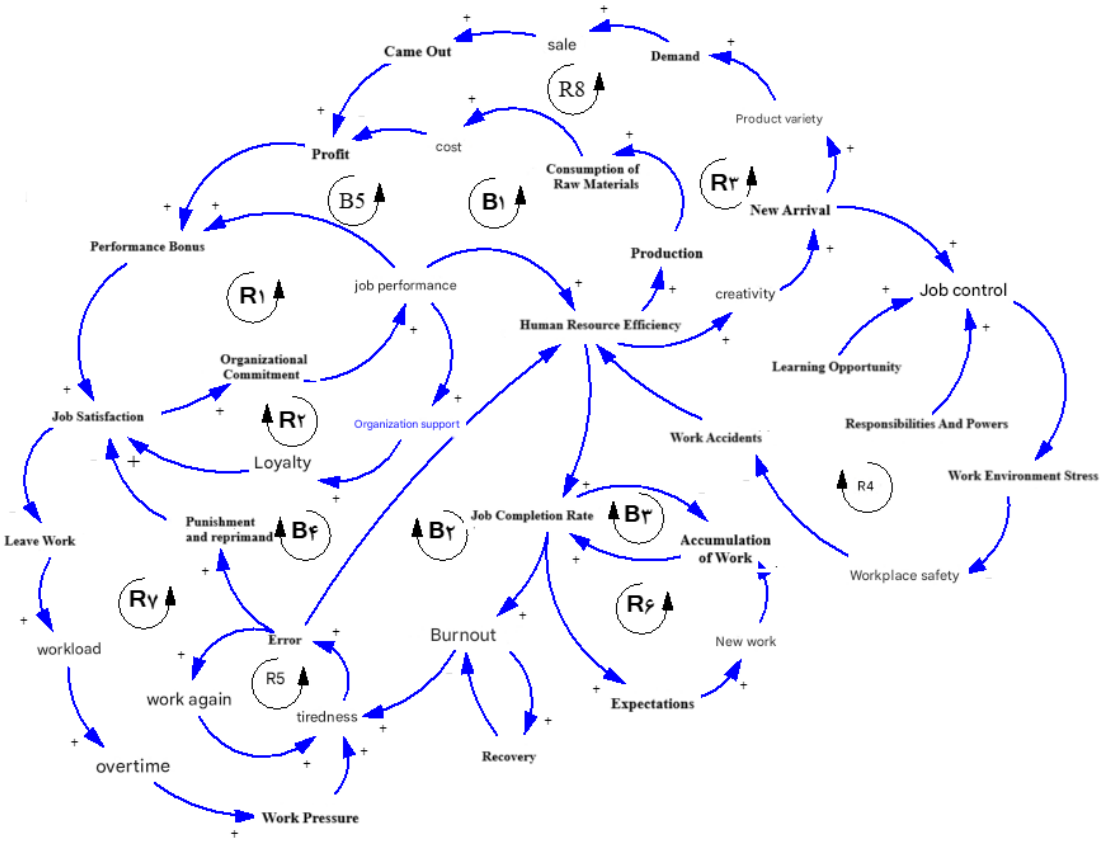


**Fig. 3.** The Causal Loop Diagram of the System Structure

### 4.3. Flow Diagram

Following the development of the system's causal structure, a flow diagram must be constructed to facilitate quantitative modeling and simulation. This involves formulating mathematical equations related to the variables and parameters of the model based on the company's data and interviews with experts and specialists within the organization under study. The resulting flow diagram is shown in Figure 4.

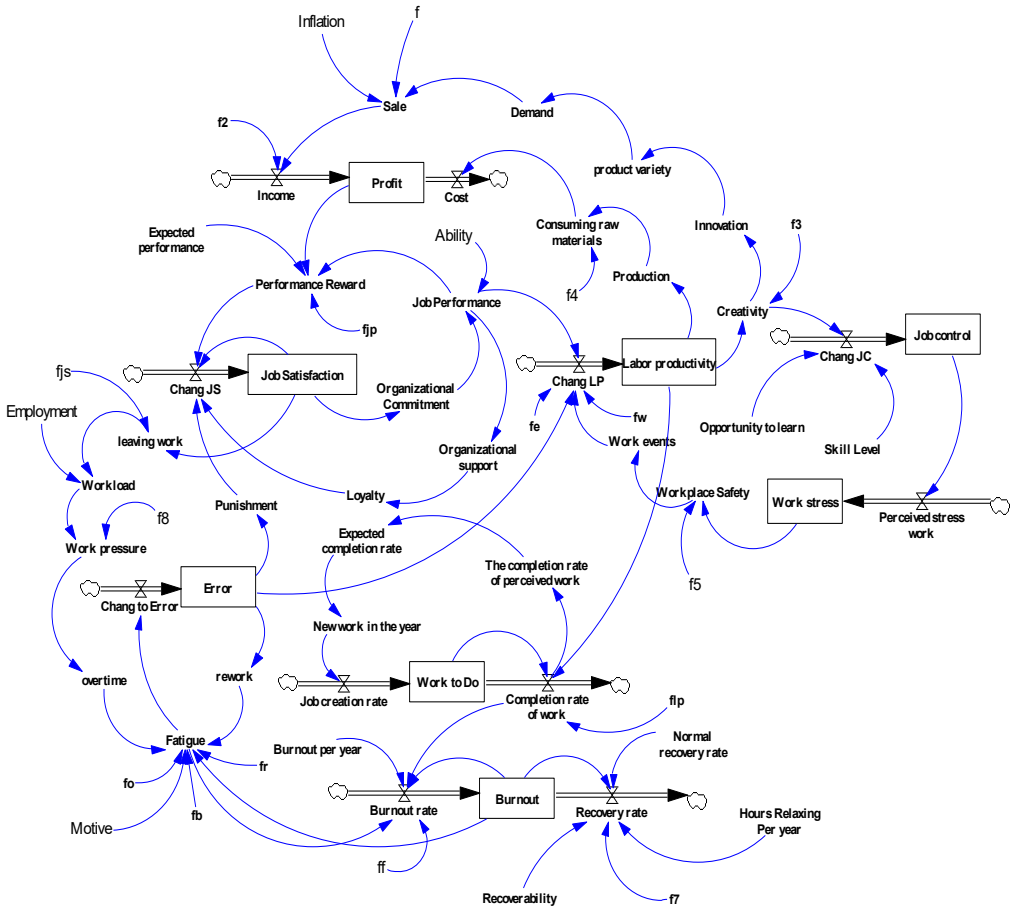


**Fig. 4.** Workflow (Stock-and-Flow) Diagram

### 4.4. Model Validation

The system dynamics approach can only be considered an effective analytical tool when it is capable of examining diverse processes and evaluating various scenarios and policies from a systems thinking perspective. To ensure the reliability of the results and evaluations, validating the model is a necessary and essential prerequisite.

Numerous tests have been proposed for validating dynamic models, which are generally categorized into two groups: structural tests and behavioral tests. In this study, structural validation tests have been employed [27].

The analysis of the validation results, and hence the confirmation of model accuracy, must be conducted prior to identifying key (leverage) variables. This is achieved by performing several structural validation tests on the model. One of the most important quantitative tests for validating system dynamics models is the boundary conditions test. In this test, the model is examined under extreme variations both maximum increases and maximum decreases of its variables and parameters, to evaluate how such changes affect the target variable, which in this case is public trust in life insurance.

As shown in Figures 5 and 6, when maximum increases are applied to parameters related to human resource productivity, the resulting value exhibits exponential growth. Conversely, when maximum decreases are applied to the same parameters, the value remains constant at its initial level and does not change throughout the simulation period.

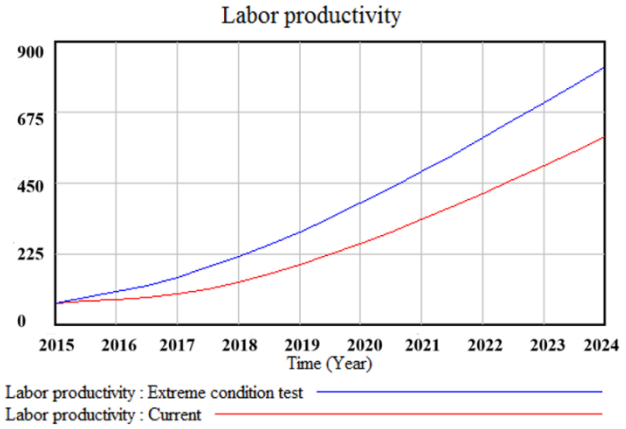


**Fig. 5.** Boundary Conditions Test on Human Resource Productivity (Increase in Factors)

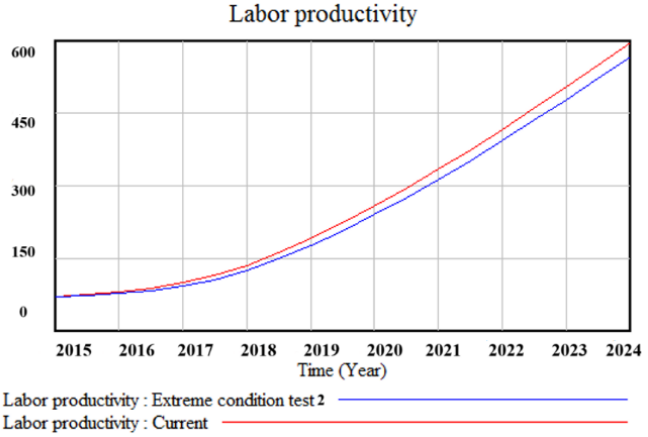


**Fig. 6.** Boundary Conditions Test on Human Resource Productivity (Decrease in Factors)

Based on the results of the validation tests, the model is confirmed to be capable of accurate simulation. Among the qualitative validation tests, the logical consistency of the equations and the dimensional compatibility of variables were also examined through interviews with a number of subject matter experts and specialists, and these aspects were likewise confirmed.

In the next step, various scenarios are simulated and analyzed using Vensim simulation software.

### 4.5. Identification of Leverage Points and Scenario Building

One of the key objectives of system dynamics analysis is to identify leverage points within the mechanisms generating the problem. Leverage points refer to decision-making and policy-setting nodes within the system where changes produce the greatest impact on the system's outcomes. These points are closely linked to the most influential factors contributing to the issue at hand [28]. Based on the developed model, the main leverage points are represented in the following scenarios:

#### *4.5.1. Scenario 1: Continuation of the Current State*

According to this scenario, no changes are made to the parameters or the structural configuration of the system within the studied organization. The model simply projects the likely outcomes if the current conditions persist.

#### *4.5.2. Scenario 2: Improvement in Job Satisfaction*

This scenario evaluates the impact of increased job satisfaction on human resource productivity. It involves increasing performance-based rewards and lowering the expected performance threshold, which leads to higher employee satisfaction. The scenario examines how these changes influence human resource productivity.

### *4.5.3. Scenario 3: Changes in Fatigue-Related Parameters*

This scenario assesses the influence of overtime, rework, job burnout, and motivation on employee fatigue. Enhancing motivation while reducing overtime, rework, and burnout is expected to lower fatigue and improve overall well-being. The impact of these changes on human resource productivity is analyzed in this scenario.

### *4.5.4. Scenario 4: Enhancement of Job Performance*

Considering that performance operates at the individual, group, and organizational levels, and that individual performance is influenced by factors such as ability, learning, personality, and perception [29], this scenario explores how increasing ability can improve job performance, and in turn, human resource productivity.

In this context, "ability" refers to employee empowerment, which encompasses administrative democracy and involving employees in organizational decision-making through practices like team-building, participation, and total quality management. Delegation of authority is also considered a core component of human resource empowerment [30].

### *4.5.5. Simulation Results of the Scenarios*

This section presents the results of the simulated scenarios, as illustrated in Figures 7, 8, 9, and 10.

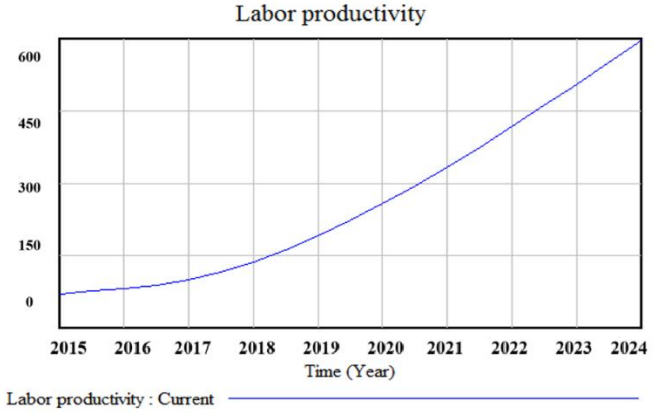


**Fig. 7.** Simulation of Human Resource Productivity in Scenario 1 (Continuation of the Current State)

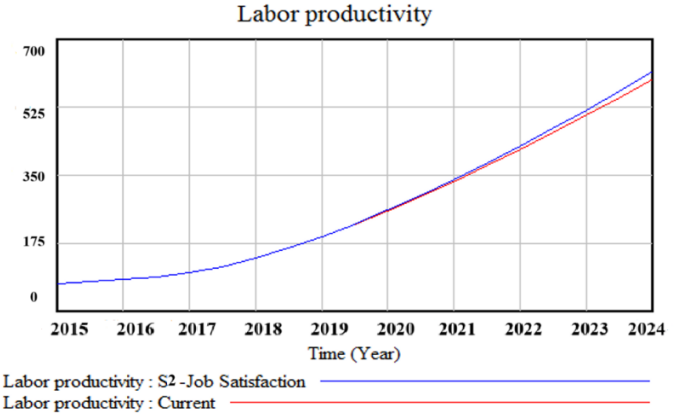


**Fig. 8.** Moderate Increase in Productivity Resulting from Improved Job Satisfaction in Scenario 2

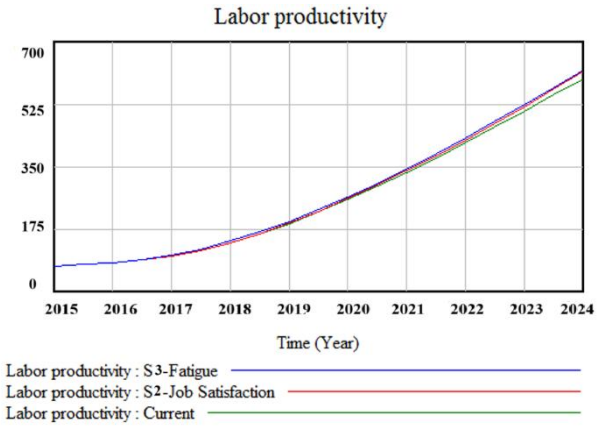


**Fig. 9.** Moderate Increase in Productivity Resulting from Scenario 3

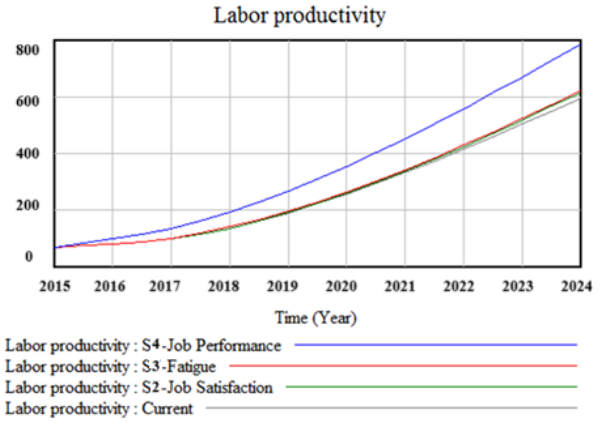


**Fig. 10.** Increase in Human Resource Productivity Due to Enhanced Job Performance in Scenario 4

## 5. DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

This study aimed to represent the underlying structure generating the issue of human resource productivity and to identify effective solutions by evaluating four distinct scenarios that represent different policies and decisions applied to the model, with the results simulated accordingly.

In Scenario 1, the continuation of the current state was examined, reflecting the prevailing trends within the factory under study. This scenario involved no changes to the system parameters and was designed to provide an understanding of the system's behavior and how the problem develops over time. The simulation results of this scenario serve as a forecast of the future status if current conditions persist and act as a baseline for comparing the effectiveness of other scenarios.

The results indicate that increasing performance-based rewards leads to higher job satisfaction, which in turn reduces job errors and increases job performance. Enhanced job performance contributes to higher human resource productivity, which subsequently fosters creativity (a factor that increases job control). This increased job control, however, raises employees' occupational stress, which reduces workplace safety and causes fluctuations in job burnout levels.

In Scenario 2, increasing job satisfaction parameters raised both job performance and performance rewards. However, this did not lead to a significant improvement in human resource productivity. Despite the common perception that increasing performance rewards and consequently job satisfaction might effectively boost productivity, the simulation results do not support this assumption. Therefore, enhancing job satisfaction alone is not considered an adequate solution to the specific issue of human resource productivity.

Scenario 3 analyzed the impact of increasing factors related to fatigue, such as motivation. The results show that this policy can significantly reduce rework, errors, reprimands, and punishments, thereby increasing job satisfaction. Nevertheless, these changes only yielded a minor improvement in human resource productivity.

In Scenario 4, increasing employee ability (empowerment) a key factor influencing job performance led to improved job performance. This improvement further increased job satisfaction, which reduced errors and ultimately produced a significant positive effect on human resource productivity. Increased productivity, in turn, enhanced production levels and gross revenue. However, the simulation results also suggest that while increased job performance boosts productivity, it simultaneously raises occupational stress, which may constrain rapid productivity growth.

Based on the analysis of these scenarios, it can be concluded that among the variables of job satisfaction, fatigue, and job performance, enhancing job performance exerts the greatest influence on human resource productivity.

**Declaration**

We acknowledge that we used ChatGPT to enhance the academic writing of our manuscript while ensuring the originality and integrity of our work.

**Transparency Statement**

The data supporting this study are available upon reasonable request to the corresponding author, subject to ethical and confidentiality considerations.

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**Declaration of Interest**

The authors declare that they have no competing interests.

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