Exploring The Influence Of Human Factors On Organizational Productivity: A Multidimensional Analysis

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ABSTRACT:
Background: Human factors can have a significant impact on Productivity in organizations. It is, therefore, necessary to understand the psychological and sociological processes involved comprehensively. This study analyses the multifaceted nature of Productivity and its interrelationship with other factors to explore in-depth the intricate relationship between human variables and managers.

Method: Constructs and latent variables provide the theoretical basis for deeply analyzing how human factors influence Productivity. Structural equation modeling (SEM) is an essential tool that can be used to test causal relationships and confirm or deny hypotheses archaeologically. Through SEM, accurate data are used to verify the theoretical models. For example, how are individual, group, and organizational factors operationalized as predictor variables of Productivity?

Results and Analysis: Factor analysis is used to identify the latent variables for human dimensions (individual, group, organizational) and Productivity. Factor rotations reverse varimax reveal a psychological factor in psychosocial and structural Productivity. The SEM and clay content analysis has established a causal connection between these three factors and productivity measurement. This provides empirical support for our proposed model.

Conclusions: In summary, this study has constructed a causal framework linking human variables with organizational Productivity. It highlights the psychological, psychosociological, and structural dimensions of human influence. Operationalization for individual factors, group factors, and managerial background, without which it may have to be standardized across groups, as in the work by Hudson and Knighten (1999).

Keywords: Productivity, human factors, meta-theory of society, structural equation modeling (SEM), latent variables, Organization-driven performance.

INTRODUCTION:
The relationship of human factors with the effectiveness and Productivity of organizations has been investigated by numerous authors (Faccio et al., 2023; Rana & Arya, 2024; Tate & Yang, 2024). Quantifying its impact requires understanding complicated psychological and sociological processes. An organization is productive when it converts its inputs into outputs at the lowest feasible cost, achieving its goals in terms of quality and quantity. Accordingly, "The organization tends to the best possible combination of production factors (labor, land, and capital, to which management is

added) to obtain the product at the lowest cost, with the most incredible possible quality, the best customer service, and to earn as much profit as feasible (Sima et al., 2020).

When examining the ideal or balanced mix of resources, Productivity is the outcome of coordinating and articulating technology, human resources, organization, and systems. It highlights that specific traits and behaviors of the individual impact the Productivity of an organization. They also discovered that psychological aspects have a significant role in the workplace. Several authors have investigated the systemic approach to Productivity and the impact of individuals on it. The fact that the producing act necessitates human participation and a sustained socio-working interaction suggests the presence of a psychological element in its execution (Bansal et al., 2021; Liu et al., 2024; Webster & Haut, 2024).

EFO questionnaire was used to identify the requirements corresponding to human factors impacting Productivity in the judgment of those consulted. The EFO Questionnaire's questions were modified for the study's purpose to align them with the consultation's goal. Five (5) experts were given the questionnaire as part of a pilot test to determine the pertinence and relevance of the criteria. As a result of their incorporation, the requirements for "Recreation and wages and salaries" and "Evaluation by external institutions" were removed, leaving the final 30 criteria on the applied questionnaire (Liu et al., 2024; Webster & Haut, 2024; Zhu et al., 2024).

Literature Review

The researcher emphasizes that the human aspect is the most significant factor because it is present throughout the entire production act. Education and training boost Productivity, whereas human capital is essential to an organization's success and develops into a lasting competitive advantage that yields the best return on investment. I have found that the company's employees' perceived Productivity grows due to the training it offers. The results show that job happiness is associated with highly productive employees and that employees' attitudes toward their work are related to the value of the reward they will receive for their performance (Bansal et al., 2021; Beede et al., 2020).

Especially in highly productive workers, work attitudes are correlated with the belief that effort is rewarded. Numerous authors concur that Productivity is multifaceted and that it is more practical to employ methods other than the conventional ones, which rely on objective measures or indicators rather than subjective measurement techniques based on the participants' opinions (Liu et al., 2024; Webster & Haut, 2024; Zhu et al., 2024). No scale is available to assess Productivity subjectively, and its reliability and validity have been accepted and tested, according to the authors of various works consulted. Numerous techniques, including Likert and Confirmatory Factor Analysis, have been employed as multidimensional scales (Beede et al., 2020; Kaplan et al., 2021).

Numerous people-related factors, such as motivation and job satisfaction, participation, learning and training, communication, work habits, work environment, work, attitudes and feelings, decision-making, conflict resolution, ergonomics, leadership and management style, organizational culture, communication, training, and rewards, are said to affect Productivity (Cai et al., 2019; Salvendy & Karwowski, 2021).

These processes produce outcomes in individuals and the organization, such as identification and a sense of belonging, which can impact management behavior and, consequently, the organization's outcomes (Madaio et al., 2020).

The distinction between one dimension and the other can be hazy due to their interrelationships. Thus, one must remember that some factors in one dimension may indirectly affect others and vice versa (Chang et al., 2020)(Alzoubi et al., 2022).

Table 1: Concepts and Definitions

Concept	Definition	Reference
Human Factors	Factors related to individual characteristics and behaviors that impact organizational Productivity.	Faccio et al., 2023; Rana & Arya, 2024; Tate & Yang, 2024
Productivity	The ability of an organization to efficiently convert inputs (labor, land, capital) into outputs (goods or services) while achieving quality and quantity goals.	Sima et al., 2020

Table 2: Human Factors Affecting Productivity (Literature Review)

Factor	Reference
Education & Training	Bansal et al., 2021
Job Satisfaction	Bansal et al., 2021; Beede et al., 2020
Work Attitudes	Bansal et al., 2021

Motivation	Cai et al., 2019
Participation	Cai et al., 2019
Communication	Cai et al., 2019
Work Habits	Cai et al., 2019
Work Environment	Cai et al., 2019
Decision-Making	Cai et al., 2019
Conflict Resolution	Cai et al., 2019
Ergonomics	Cai et al., 2019
Leadership & Management Style	Cai et al., 2019
Organizational Culture	Cai et al., 2019
Rewards	Cai et al., 2019

Additionally, it was established that the factors could be categorized as human factors and relate to an individual's or a group's performance as they interact within an organization, enabling them to be divided into three categories: individual, group, and organizational. To gather more information and a more accurate approximation of the fact under research, the results of this inquiry allowed for the selection of the factors to be investigated for the objectives of this investigation, for which other instruments would be used. To ascertain the contributions of each of these components, we plan to use factor analysis to identify the causal linkages between the factors chosen as human factors with substantial impact on Productivity (Koschig et al., 2021).

We frequently investigate constructs, which are nonphysical, abstract ideas. Constructs are fictitious things that we create to explain observable behavior; they are ideas that have the additional significance of being expressed or adopted with a specific scientific goal. Latent variables or factors are the names of the constructs. They are theoretical constructions or abstract phenomena that can only be measured inferentially through indicators because they cannot be directly witnessed. Variables are observable once operationally defined, while constructs cannot be observed (Fane & Weeraratna, 2020; Glikson & Woolley, 2020; Shin, 2021).

HYPOTHESIS-TESTING SYSTEM:

The causal links created in this work can be enhanced and are adaptable to being studied for the phenomenon under research, given that the SEM approach allows for confirming the proposed causal theories. Figure 1 depicts the proposed hypothesis schematically, with one-way arrows denoting a direct relationship and two-way arrows meaning a correlation (Zhang et al., 2020).
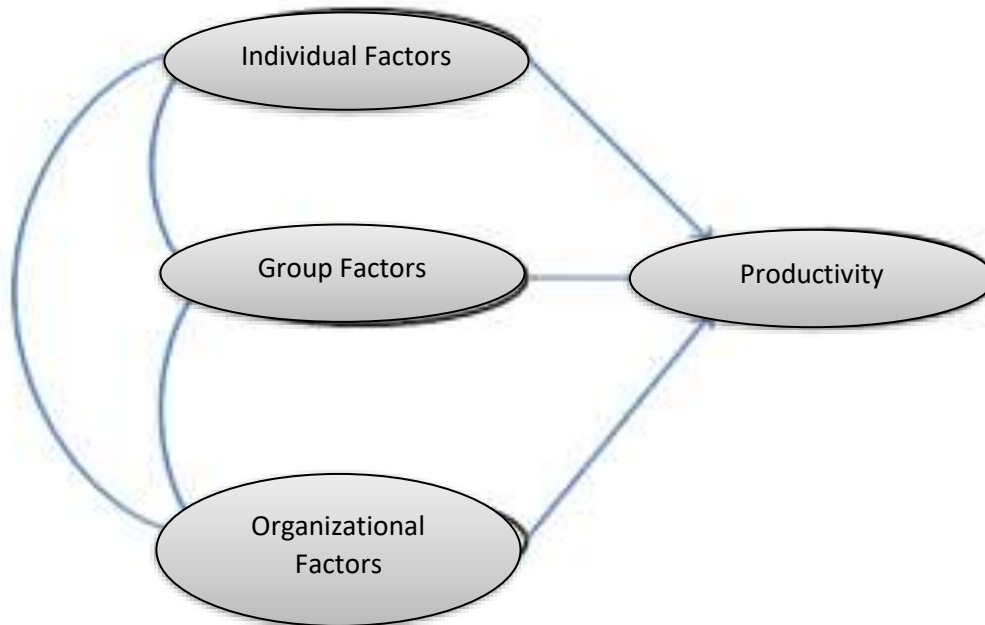
Figure 1: Productivity Relationship Model Vs Factors

Assuming that: Individual Factors = FACT_IND; Group Factors = FACT_GRU; Organizational Factors = FACT_ORG; and Results Factors (Productivity) = PRODUCTI;

Table 1: The equations that express the variables are	
FACT_GRU = f(FACT_IND, FACT_ORG) +	(1)
FACT_IND = f(FACT_GRU, FACT_ORG) + e_1	(2)
e_2FACT_ORG = f(FACT_IND, FACT_GRU) + e_3	(3)
PRODUCT = f(FACT_IND, FACT_GRU, FACT_ORG) + e_4	(4)

FACT_IND, FACT_GRU, and FACT_ORG are independent variables, and PRODUCT is a variable that depends on them, according to the issue description. The dependent variable is an "endogenous latent variable," and the independent factor is an "exogenous latent variable," according to the SEM theory. Each has visible characteristics or related indicators (Roberts et al., 2022).

METHODOLOGY:
The methodology employed in this study is centered around a multifactorial model tailored to optimize Productivity in the electricity generation process, contextualized explicitly within the framework of Pakistan's energy landscape. The study sought inspiration from previous research in Venezuela's hydroelectric power plants (Rodríguez & Guerrero, 2020) and aimed to adapt a similar work methodology using Pakistani-specific inputs.

First, the researchers established a sample of employees at hydroelectric plants throughout Pakistan, designed to include not only wage workers or technicians but all staff types. To select participants, a set of standards was established to ensure that every stratospheric operator would have a say. In total, 200 people were chosen to participate in this survey. The main instrument for primary data collection was the Employee Feedback and Opinion Questionnaire (EFO). This is an updated version of (Danni et al 2021;) and is a practical tool to measure various aspects of organizational function satisfaction working environment. It is also invaluable when testing productivity-related factors in hydroelectric power generation.

Each participant was given the EFO questionnaire and clear instructions on how to fill it out. Every effort was made to ensure that the entire process was open and confidential so that participants would be able to answer in all frankness. The questionnaire required answers in terms of CENs on several dimensions of productivity improvement, such as leadership efficiency, resource allocation, and worker motivation. After this stage of data collection ended, the most rigorous techniques of analysis were applied. Quantitative data analysis used statistical techniques to identify correlations, and trends in India the dataset has been noted.

Also, the findings from our analysis are placed in the context of literature and best practices in energy management. A similar analysis brought forth individual prescriptions. This comparative approach permitted us to create actionable insights tailor-made for Hydroelectric power station employees in Pakistan. Two hundred (200) employees in operational or support roles at hydroelectric plants in Pakistan were given the updated EFO questionnaire (Danni et al., 2021).

GENERAL MODEL OF SYSTEMS OF STRUCTURAL EQUATIONS:
The method of choice for determining the linear causal relationships that are the basis of constructs in structural equation modeling. The causation-based structural model does not establish causation but does help the empirical researcher in particular conflicts of causal hypothesis with evidence. Therefore, if causal beliefs conflict with the data in covariances or

correlations between variables, whether this statistical risk can be disproved is a question. This suggests that the causal theories propagated in a model can be proven or not inconsistent with data using this technique (Matheson et al., 2019).

A researcher may compare the model he advocates with those proposed by other theory builders in an industry over and over at different times. The model that fits best with binding facts gained afterward is the one that should be adopted. If the model fits well, then the relationships suggested in it are confirmed, and the model is valid. Otherwise, these relationships are untenable. By nature, observable variables indicate factors and concepts in SEM (Yong et al., 2020).

MODEL VALIDATION:

This method is used to check the theoretical model suggested by the hypothesis. As a device that combines structural models with estimated parameters and the model itself, performing multiple OLS regressions jointly is usually considered appropriate and effective in such cases. SEM allows us to represent unobserved ideas in these relationships and determine the magnitude of assessing process error. It also enables us to evaluate many interrelated dependence relationships. Statistical software programs, like SPSS's AMOS, can carry out this kind of multivariate analysis.

The data acquired were evaluated using the same statistical program, SPSS Statistics 17.0, used for the previous Factor Analysis to confirm the existence of latent variables and their causal linkages. Following the theoretical explanation (the presence of Individual, Group, Organizational, and Results Factors), a predetermined number of factors (four) were assigned for which the Principal Components approach was used to extract the components using Varimax rotation (Budhwar et al., 2022).

After confirming the SEM analysis's relevance, the causal analysis was conducted using the proposed model. Parsimony was utilized to reduce the number of variables required to pose the model because there were restrictions on the number of variables the student edition of the software could support (Cheng & Hackett, 2021).

RESULTS AND ANALYSIS:
FACTOR ANALYSIS:

The extraction of four factors was carried out using the principal components method in SPSS, taking into account what was stated in the theoretical framework as they are expected to obtain three human dimensions (individual, group, and organizational), as well as results dimension (organizational) associated with Productivity, to know the units or sizes underlying the variables. To establish whether a factor analysis was appropriate for the dataset, the KMO was considered (0.78), making it possible to condense the empirical variables into fewer factors or components. Similarly, the individual KMOs found in the diagonal of the anti-image matrix were examined, with values less than 0.50 being disregarded (Cheng & Hackett, 2021).

Similar to the last example, a high proportion of the diagonal numbers close to 0.0 show that the factor analysis is proceeding. The correlation matrix's Determinant, Determinant = 5.45E-011, indicated highly elevated intercorrelations between the variables. To evaluate commonality, we first eliminated five components whose extraction was less than 0.50, with the remaining four factors accounting for 59.609 percent of the variation in the data. (Cheng & Hackett, 2021; Sarstedt & Danks, 2022)

After performing a Varimax rotation, it was discovered that the first component (Factor1) contains all the elements (6) that were determined to be traceable to the person and labelled with an "I" to make them easier to identify in the study., they load six elements (marked with a "G" at the beginning of the label) that are attributed to people when they interact in groups in the second factor (Factor 2). They load the factors that relate to the organizational structure and affect the individual into the third component (component 3). It is crucial to note that while training and injury rates are not considered in Factor 3, theoretically speaking, they are structural elements. The organization's production is related to the fourth factor, the final one (Abdullah et al., 2020).

It might be said that the four factors represent four latent variables or constructs identified by the meaning shared by the variables that compose them, depending on the theoretical or substantive approach underpinning the factors assessed. The six variables I_ABS (absenteeism), I_INT (internalization of objectives), I_PAR (participation), I_MOT (motivation), I_SAT (job satisfaction), and I_ROT (rotation), all related to the individual's psychological factors or internal factors of the person, in this way researcher perceives what is happening to him and how researcher responds to environmental stimuli, explain Factor 1 from the Rotated Components Matrix. This enables us to hypothesize that Factor 1 constitutes a latent variable defined by the mentioned observable variables, which we shall refer to as Individual Factors (Santana et al., 2020).

Besides, G_REC (Recreation), G_COH (Cohesion), G_MOR (Moral), and G_CON (Conflict) relate to psychosocial elements that an individual feels interacting or socializing with others in organizations with similar objectives. This suggests that factor 2 is a latent variable formed by the mentioned observable variables, or what we may call Group Factors (Richards, 2022).

O_HAB (interpersonal management skills), O_FLE (flexibility), O_ENF (emphasis on results), O_GES (information and communication management), O_SUE (wages and salaries), O_FOR (education and development), O_ACC (accident rate), and O_CAL (quality) refer to structural factors of the organization that affect an individual's performance. Similarly, factor 3 is explained by these same factors. Hence, we can confirm that Factor 3 is a latent variable comprising the mentioned observable variables, which we will refer to as Organizational Factors (Malik et al., 2020). O_PRO (Production) and O_CRE (Growth), O_EFI (Efficiency) These all relate to the results obtained as a direct product of organizations finished with desired objectives; employees manage resources at hand and make decisions associated with them. This is the last factor to be explained in this survey. This means we can anticipate that Factor 4 is a latent variable, refer to it as Productivity, and explain it by the observable variables just mentioned (Farndale et al., 2020).

MODEL ANALYSIS

We studied the causal linkages between the latent variables obtained to ascertain the current cause-effect correlations after establishing latent relationships embedded in the set of observable variables and groupable by theoretically supported constructs. The model specs are displayed in Table 2.

Table 2: Model				
Latent Variables	**Label**	**Type**	**Effects**	**Observable Variables or Indicators**
Individual Factors	FACT_IND	exogenous exogenous	Direct in PRODUCT Covariance between FACT_GRU and FACT_ORG	I_PAR I_MOT I_SAT
Group Factors	FACT_GRU	exogenous	Direct in PRODUCT Covariance between FACT_IND and FACT_ORG	G_REC G_COH G_MOR
Organizational Factors	FACT_ORG	exogenous	Direct in PRODUCT Covariance between FACT_IND and FACT_GRU	O_HID O_FLE O_FOR
Result or Productivity Factors	PRODUCT	Endogenous		R_PRO R_EFI

After completing numerous runs to match the parameters to the acceptability zones, the model was finally configured. Figure 2 displays the standardized solution obtained by running the data in the program. Table 2 displays the main settings. The incremental fit indices, which show model acceptance, support the global appropriate indices' conclusion that the model fits the data relatively well. Table 2 displays these matches (Farndale et al., 2020).
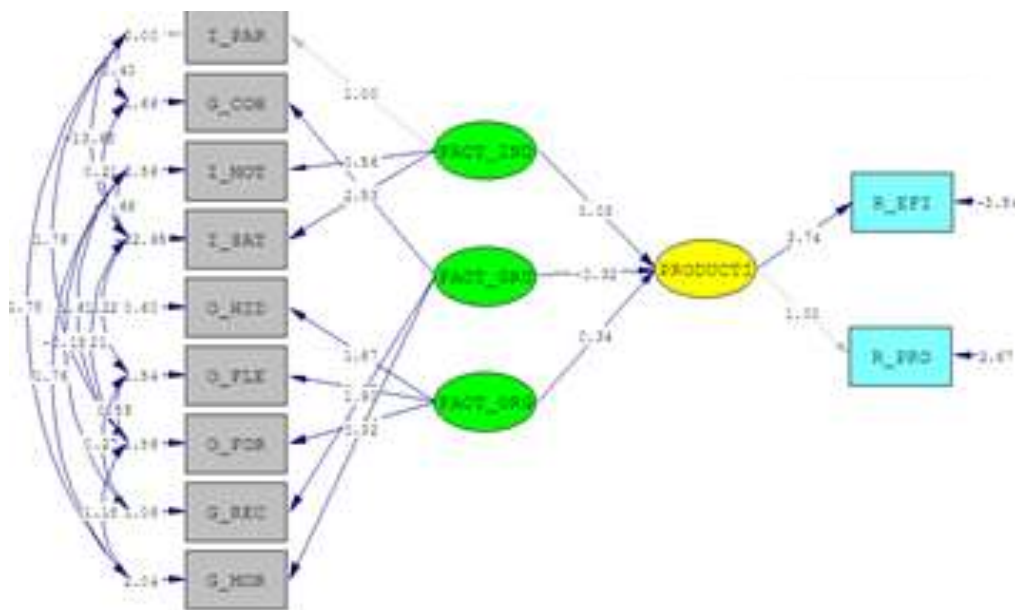

Figure 2: Shows standardization of the suggested model's solution.

Table 3. Model Modifications			
Statistical	**Acceptance value**	**model value**	**Conclusion**
NFI	>"0.95"	0,954	Regular
NNFI	>0,95	0,981	Acceptable
Razón χ^2/gl	<2	1,547645	Acceptance
RMSEA	<"0,05"	0,0544	Reasonable error
CFI	>0,95	0,976	Correct estimate
GFI	>0,90	0,925	Acceptable
AGFI	>0,90	0,912	Acceptable

IF	>0,95	0,988	Acceptable
CN	>200	227,432	Acceptable
PGFI	>0,90	0,643	Non-Acceptance

Figure 3 displays the plot of standardized residuals that are very close to the acceptability line, which might be fixed by incorporating other variables into the model that haven't been taken into account because of the restrictions of the software used for the student version (Stankevičiūtė & Savanevičienė, 2021).
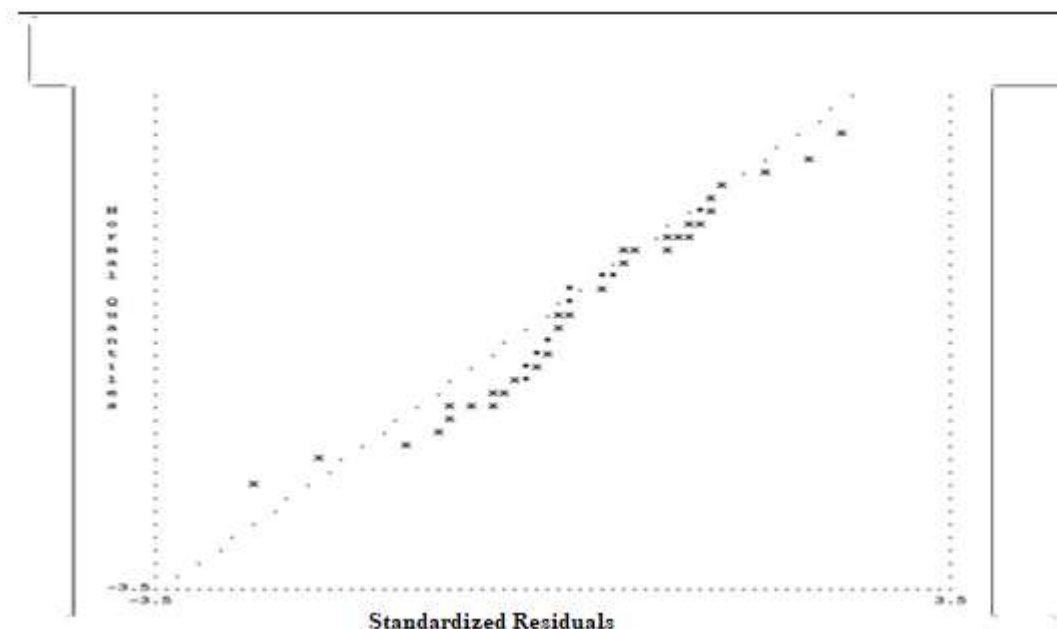

Figure 3: A Qplot of the suggested model's standardized residuals

DISCUSSIONS

This study Establishes the link between human factors and organizational effectiveness/productivity, highlighting the complexity of quantifying its impact. Defines Productivity as achieving goals with optimal resource allocation. Emphasizes the role of individual characteristics and organizational structures in Productivity. It also mentions the limitations of traditional productivity measurement methods. The literature review discusses various perspectives on human factors impacting Productivity, including psychological and sociological aspects. Highlights the importance of education, training, job satisfaction, and perceived rewards for employee productivity. Acknowledges the multidimensional nature of Productivity and the need for subjective measurement techniques. The proposed model with three latent variables (Individual Factors, Group Factors, and Organizational Factors) influencing a fourth latent variable (Productivity) explains the rationale behind using Structural Equation Modeling (SEM) to test the causal relationships in the model. The study methodology uses a modified EFO Questionnaire on 200 employees from Pakistani hydroelectric plants. It further explains the data analysis methods, including factor analysis and SEM, using SPSS software. Results and analysis present factor analysis results, identifying four factors corresponding to the proposed latent variables. Discusses the model fit indices, suggesting a relatively good fit between the model and the data. Analyzes the standardized solution and model modifications, highlighting areas for potential improvement.

Conclusion (not explicitly provided, but can be inferred). This study provides evidence for the influence of human factors (individual, group, and organizational) on Productivity.

CONCLUSIONS:

The proposed model had causality, which was discovered. The data analysis yielded a latent structure of four elements, the first three of which were dimensions of the Human Factor and the fourth of Productivity. According to the theory, these factors were Individual elements, Group Factors, Organizational Factors, and Results Factors. It was established that the issues under consideration have psychological, psychosocial, and structural dimensions. The causal links between the previously described constructs and Productivity were found using the reference theory and the model's outputs.

Among the individual factors affecting Productivity are motivation, participation, and job satisfaction. The model is approved based on the global and incremental adjustment indices, keeping in mind that it had restrictions due to the number of variables the student's software could accept. The outcomes acquired are only a portion of a broader inquiry. The findings of an ongoing research paper will contain the model with more variables that adhere to the principle of parsimony and adjustments.

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