



Association between psychosocial work environment and employee motivation depending on job hierarchy level

Andrey SMOLYANOV

ORCID: 0009-0002-9141-8957

St. Petersburg University, St. Petersburg, Russian Federation

Anders PAALZOW

ORCID: 0000-0002-5148-643X

Stockholm School of Economics in Riga, Rīga, Latvia

Katerina HELLSTRÖM

ORCID: 0009-0008-9083-8427

Stockholm School of Economics, Stockholm, Sweden

Tamara KINUNEN

ORCID: 0009-0002-7107-099X

St-Petersburg University, St Petersburg, Russian Federation

Svetlana GURIEVA

ORCID: 0000-0002-4305-432X

St-Petersburg University, St Petersburg, Russian Federation

Abstract. *Purpose.* The International Labor Organization considers workplace well-being to be a key factor determining the long-term effectiveness of the employing company and considers this concept to refer to all aspects of working life, from safety and workplace organization to work attitudes, psychological climate and work organization — that is, the psychosocial environment. The purpose of this study is to establish the existence and strength of the association between work motivation and the psychosocial working environment. *Methodology.* The study is based on E. Deci and R. Ryan's "Self-Determination Theory" and the "Danish Psychosocial Working Environment Questionnaire" was used. The survey involved 268 employees in a Russian company operating in the fast-food market was conducted. The reliability of the questionnaire is tested by standardized Cronbach's alpha coefficient and the association between the constructs being studied by linear regression model and random forest algorithm. *Findings.* The results reveal differences across groups on different levels of the job hierarchy. Ordinary workers have a simple structure of this association. The main psychosocial factor influencing their motivational self-determination is the opportunity for learning and development. For qualified specialists, along with this factor, the ability to perform and the lack of emotional complexity of work are important. The most complex association between work motivation and psychosocial working environment is among managers, for whom support and trust from colleagues, the level of independence, role clarity and other psychosocial factors are significant. *Originality.* The study's originality lies in exploring a previously unexamined association between constructs and adapting the instruments on a different sample from the one they were initially developed for. *Practical implications.* The results obtained can be used in designing and creating psychosocial environment in the organization that stimulates the increase of efficiency and productivity, as well as in employee development programs.

Keywords: psychosocial working environment, work motivation, random forest.

Introduction

The psychosocial working environment is the relationships and interactions between people in a work situation. The psychosocial working environment can be both stimulating and stressful (Nordic Council of Ministers [NCM], 2015). Employees' behavior is driven by their work motivation. Work motivation refers to the psychological reasons why individual employees engage in work activities. Employees with high levels of motivation perform better in their roles and can significantly improve organizational productivity (Kotera et al., 2022).

Employees' performance and motivation are significantly determined by the satisfaction of their psychological needs (Nordgren Selar, Falkenberg, Hellgren, Gagné, Sverke, 2020). According to the report "Labor Market Trends 2023", prepared jointly by international agencies Glassdoor Economic Research and Indeed Hiring Lab, the labor shortage that has developed in the global labor market during the Covid-19 pandemic will continue in the long term — mainly for demographic reasons. While salary and benefits remain top of mind, employees' need for "well-being" is becoming increasingly important in their choice of employer. According to Indeed Hiring Lab's study of 10 million people worldwide, 90% of respondents report a high importance of how they feel at work, and 80% of job seekers would be interested in data about wellbeing programs when considering the recruitment opportunities. According to Glassdoor Economic Research's 2022 U.S. study, employees who are satisfied with their jobs are half as likely to quit as those whose satisfaction is lacking (Indeed, Glassdoor, 2023). The International Labor Organization considers workplace well-being to be a key factor determining the long-term effectiveness of the employing company and considers this concept to refer to all aspects of working life, from safety and workplace organization to work attitudes, psychological climate and job management - that is, the psychosocial working environment (International Labor Organization; 2009).

The theoretical foundation for research of the psychosocial working environment includes both models of work stress and a few theories related to employee motivation. Key among them is the demand-control-support model (Karasek, 1998). This model, among other things, considers the dependence of stress and motivational factors affecting an employee on his position in the work hierarchy.

Although the psychosocial environment as a distinct concept has been studied over the past several decades (Rugulies, 2019), particularly with regard to its relationship with well-being and motivation (Sverke, 2009), most research in this area is related to health, rather than with employee behavior (Stansfeld, Candy, 2006; Nieuwenhuijsen, Bruinvels, Frings-Dresen, 2010).

Many similar studies are carried out in the Nordic countries, where instruments for assessing the psychosocial environment have been developed and applied on the state level (Pejtersen, Kristensen, Borg, Bjorner, 2010; Clausen et al., 2019; Clausen et al., 2023). Since several studies point to cross-cultural differences between population of different countries, the use of these tools may require not only translation into another language, but also their significant adaptation (Fey, 2005; Shabes et al., 2012). In this work authors offer their adaptation based on the Russian sample.

Employee behavior can be determined by a relatively small number of work environment factors (Navarro, Arrieta, 2010). A specially conducted large-scale study published in 2025, based on survey data from over a million respondents in Germany, the UK, and the US collected between 2010 and 2018, showed that modern machine learning methods (such as random forest and gradient boosting) demonstrate much better predictive performance than more standard approaches when determining predictors of behavior. Although human behavior and the factors influencing it appear to be non-linearly related, the identified sets of key determinants (without taking into account their weight in each specific case) differ little from those obtained in studies based on linear regression

(Oparina, Kaiser, Gentile, Tkatchenko, Neve, D'Ambrosio, 2025). Although the psychosocial environment and staff motivation have been researched extensively, there are still gaps in knowledge and understanding of the relationship between the two.

The purpose of this paper is to identify the most significant links between the factors of psychosocial working environment and work motivation based on quantitative research and to assess the difference of this relationship for different job hierarchy levels. The object of the study is a Russian commercial company. The reliability of the translated and adapted instruments has been verified by standardized Cronbach's alpha coefficient and confirmatory factor analysis. Association between the studied constructs was tested by linear regression model and random forest algorithm. The study revealed not only the existence of a relationship between the psychosocial working environment and work motivation, but also described its structure, which differs in complexity for different hierarchical groups of staff.

Theoretical framework

Despite the widespread use of the terms "psychosocial environment" and "psychosocial factors" in current research related to labor relations and scientific literature, their precise definition can be quite a challenge, as often, the same term is used for quite different phenomena, such as "work organization" and "personality and attitudes" (Rugulies, 2019). The Encyclopedia of Occupational Health and Safety, published by the International Labor Organization in 1998, equates the phrases "work organization" or "organizational factors" and "psychosocial work factors that can lead to stress" (International Labor Organization, 1998).

In a systematic review of scientific papers, the psychosocial working environment included factors such as: job demands, job control, peer and management support, career prospects, freedom in decision making, task variability/skill discretion, emotional demands, procedural fairness (fairness in dispute resolution and resource allocation), relational fairness (honesty, courtesy and attentiveness of supervisors towards employees), the balance between effort and reward (Nieuwenhuijsen, Bruinvels, Frings-Dresen, 2010).

The project supported by Nordic Council of ministers Psychosocial Working environment defines the psychosocial working environment as the part of the working environment that is relevant to the nature and content of the work and identifies the following as risk factors: workload; lack of time; lack of influence over one's own work; unclear or contradictory demands; high demands for attention; high emotional stress; high number of breaks; highly controlled or fixed work, monotony, lack of variety; high responsibility (for people or property); high information load, lack of information channels in the organization; organizational change; lack of breaks; technology and unclear division of labor. Activities to improve the psychosocial environment are seen as a way to achieve the goals of well-being, social policy, health, and to achieve a long and healthy labor life for every employee (NCM, 2015).

The study of the psychosocial work environment is based on a number of theories, such as the Job characteristic model (Turner, Lawrence, 1965), which links employee motivation and satisfaction with the job features: skill variety, task identity and significance of tasks, autonomy and feedback; The Michigan Model of Work Stress Management (Mark, Smith, 2008) explains the causal links between the employee's subjective perception and the stress caused by that perception; Warr's "vitamin" model (2017), which compares the effect of the work features with the effect of vitamins, some of which are always useful, while others begin to be harmful at some level of saturation. Now, the key concept among them is the demand-control-support model (Karasek, 1998), which links the psychosocial work environment and aspects of the employee's personality (Figure 1). It defines

control as the employee's control over his own performance and the application of his skills, rather than control over people.

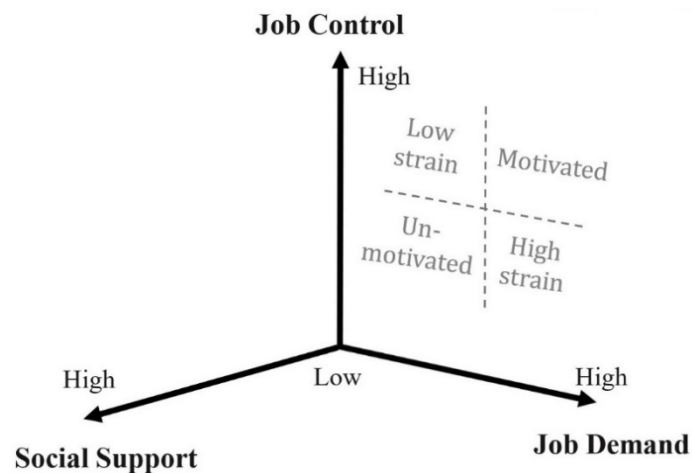


Figure 1. Karasek's demand-control-support model (adapted from Karasek, 1998)

This model is useful in understanding the importance of balancing the psychological demands on the employee with the decision-making freedom given to the employee and the social support he or she receives. If high (but not excessive) psychological demands are placed on an employee and he/she has a high level of control over his/her work process, such an employee will be motivated for professional growth. A low level of demand and control will create an “unmotivated” work environment and cause the employee to gradually lose previously acquired skills. The consequence of the combination of high demands on the employee and little discretion in making work-related decisions will be unfavorable psychological and related physical reactions — fatigue, depression, anxiety, and malaise. The significance of the impact of psychological demands and control on adverse reactions differs across employee levels — for managers and skilled professionals, demands are higher for managers and skilled professionals, and control is higher for employees, who are lower in the hierarchy (Kain, Jex, 2010). Thus, using the Karasek model, it is possible to link work motivation (considering the employee's position in the job hierarchy) with the influence of psychosocial working environment factors.

One of the most used theories on the basis of which it is possible to assess employee motivation is E. Deci and R. Ryan's self-determination theory (Ryan, Deci, 2015). It defines “self-determination” (or “autonomy”) as the ability to make and experience one's own choices. Central to the theory, which is built on the assumption that individuals are naturally and actively oriented toward self-organization and development, are the basic psychological needs — autonomy (the desire to feel self-initiated and control one's own behavior), competence (the desire for efficiency and effectiveness), and the need for interconnectedness with others (the desire for attachment or affiliation-based relationships) — and their role in motivation, well-being, and personal development (Gagné, Deci, 2005).

Human beings are constantly interacting dynamically with the surrounding social world, simultaneously trying to satisfy their needs and responding to environmental conditions that can both facilitate and hinder this. These interactions result in people becoming either enthusiastic and inquisitive or ineffective and isolated. At this point in self-determination theory, there are six mini-theories (Cognitive evaluation theory, Organismic integration theory, Causal orientation theory, Basic psychological needs theory, Goal content theory and Relational motivation theory) that together provide insight into human behavior (Figure 2).

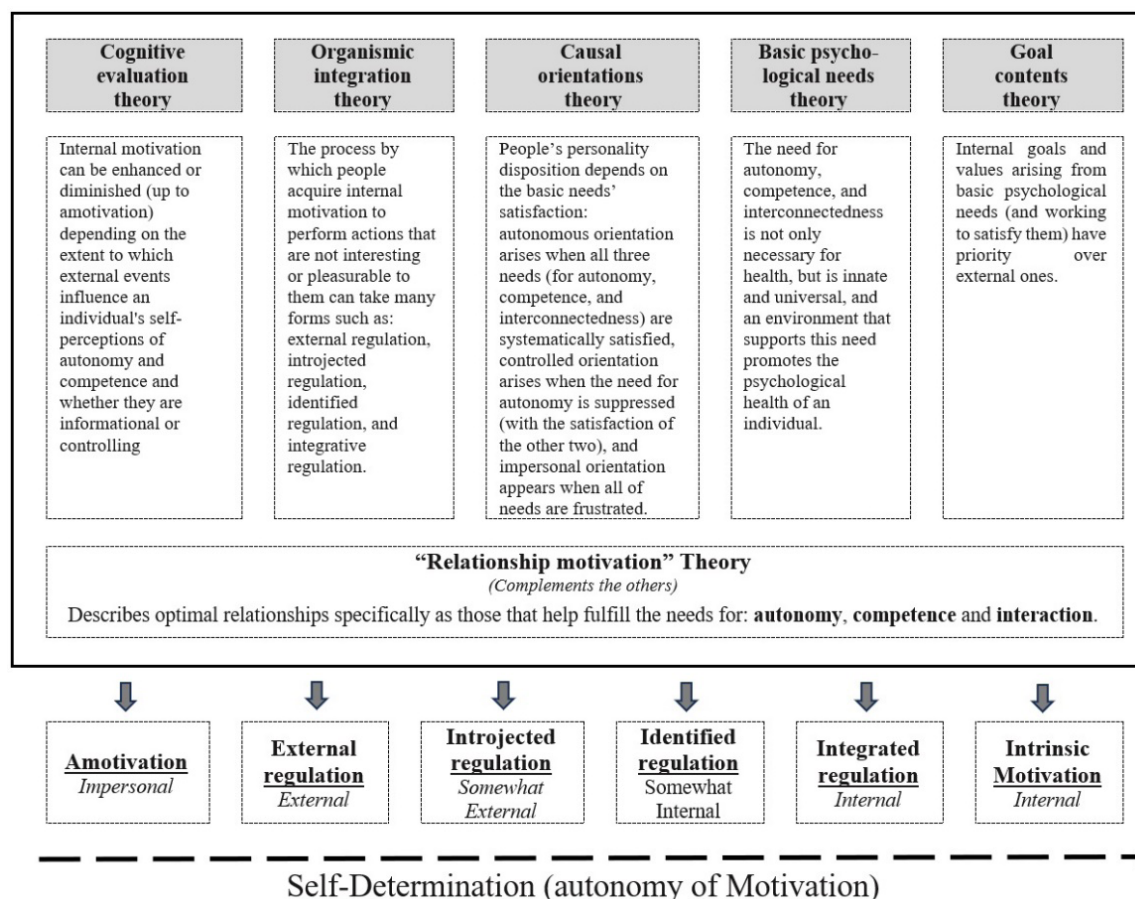


Figure 2. Self-determination theory (figure created by authors)

Self-determination theory distinguishes two types of motivation - internal, when the activity is done for its own sake, as it satisfies the interests of the employee (and is interesting to him) and external, when it is done for some other reason. External motivation is subdivided, in turn, into several subtypes, which can be arranged in the order the individual to acquire the purpose and value through them, as well as the outcomes of the work performed. At the lowest level is amotivation, in which the employee has no intention of acting at all or this intention is so passive that it often leads to counterproductivity or complete cessation of work. Next comes external regulation, where the employee is motivated only by rewards or the threat of punishment. Then comes the introjected regulation, when the activity is regulated by the presence of external rules, partially projected by the employee onto himself and causing, in case of non-compliance, the feeling of guilt or shame. Even higher is the identified regulation, when a person accepts the values and meaning of the activity as his own, and, finally, the integrative regulation, when these values and meaning become part of the employee's self-perception. It is not assumed that an individual's motivation, within their work activities, moves from one stage to another, rather their behavior depends on their existing experience and the surrounding working environment (Tremblay, Blanchard, Taylor, Pelletier, 2009).

Different types of motivation can be combined simultaneously in the same person, but its autonomous forms contribute more than others to the achievement of good performance by the employee. At the same time, internal motivation is more strongly related to the quality of work done, while external regulation is more strongly related to its quantity. Researchers distinguish four basic motivational profiles — a highly motivated profile containing predominantly autonomous forms of regulation (characterized by high levels of internal motivation, identified regulation and introjected

regulation, and slightly above average levels of external regulation), a moderately autonomous profile (characterized by low levels of external and introjected regulation and above average levels of identified regulation and internal motivation), a balanced profile (containing approximately equal levels of external regulation and introjected regulation), a balanced profile (containing approximately equal levels of external regulation and introjected regulation), and amotivated profile (when an employee is not motivated by meaning, guilt, pleasure or reward). Generally, employees with the first and second types of profiles show the highest productivity and well-being (Howard, Gagné, Morin, van den Broeck, 2016).

Among other theories of work motivation, in relation to this study, we can highlight Herzberg's "Two-factor" theory, which argues that job satisfaction is associated with its content, and dissatisfaction with its context, and McClelland's theory according to which workers are driven by three main social motives — the motive of achievement, the motive of belonging and the motive of power, and the intensity of these motives differs from person to person (Herzberg, Mausner, Snyderman, 1959; McClelland, 1988).

The aforementioned theories demonstrate both the complex nature and diverse factors of the constructs in question and the significant evolution in their study and understanding. Despite the existence of a large number and history of studies of psychosocial working environment and work motivation, as well as significant theoretical elaboration of these concepts, the relationship between them has not been practically studied before especially in terms of employee job hierarchy. At the same time, the establishment of this relationship and the study of its aspects could contribute to the development of both the theoretical basis and the development of practical recommendations aimed at increasing employee productivity and improving the performance of organizations. The purpose of this paper is to fill this gap.

Study design

Purpose

The purpose of this study is to examine the relationship between psychosocial working environment and work motivation of employees depending on job hierarchy level in an organization.

Main research question

The main question of the study is: What are the main factors (such as the employee's job status in the organization) and external factors (psychosocial work environment) that influence the level of employee motivation, and what is the relationship between them?

Hypotheses

The main hypothesis of the study is that there are internal and external factors that indirectly influence the level of employee motivation in the organization. An additional hypothesis of the study is that there is a dependence of the degree of relationship between various elements of psychosocial environment and motivation on the employee's level in the job hierarchy.

For testing the main hypothesis of the study, it can be presented as a mathematical model of the following form: $\text{Motivation} = \text{environment factor } 1 + \dots + \text{environment factor } N + \text{error term}$. This model was tested by conducting multiple linear regression analysis.

Study design

The study is carried out by a quantitative method. The data are collected by means of the "The Danish Psychosocial Work Environment Questionnaire", its scale corresponding to the factors of the psychosocial environment and the tool "Work Extrinsic and Intrinsic Motivation Scale". The

latter is measured to calculate a single indicator — self-determination index (used in the model as a dependent variable). To apply these questionnaires in a Russian-language sample, the authors translated their original versions from English (Clausen et al., 2019; Kotera et al., 2022), adapted the translation with the help of HR experts, and carried out a pilot translation validation, which included the calculation of Cronbach's alpha coefficient α and confirmatory factor analysis for each of the multi-item scales.

Additional hypothesis was tested by using factor variance analysis and by applying a statistical machine algorithm of random forest. The respondents were divided into hierarchical groups: those who have subordinates (managers), those who need special education and highly professional skills to perform their work (specialists) and those who lack both (ordinary employees).

Since distribution histograms of the variables' values demonstrated that the distribution of most of them is far from normal distribution, the non-parametric statistical methods were applied in the study.

Measures

Psychosocial working environment

For identifying psychosocial work environment factors, we use *"The Danish Psychosocial Work Environment Questionnaire"* (DPQ), developed in 2018 and used for mandatory working environment assessments in several Nordic countries, covers five areas (domains) of the psychosocial environment: Demands at work; Work organization and job content; Interpersonal relations: cooperation and leadership; Conflicts in the workplace and Reactions to the work situation. The DPQ consists of 119 items and allows for 38 dimensions (including 10 single questions), most of which are measured on scales from 0 to 100. An example of dimension and questions. Work pace: "Do you have to work fast?" Emotional demands: "Are you placed in emotionally demanding situation at work?" And so on.

The scale scores are calculated by recoding and averaging the item scores within each scale. For each scale, a score of 100 indicates the highest level of measurement. In multi-item scales, the scores for the selected answer option for each item are added up, and the resulting total score is divided by the number of items in the multi-item scale (Clausen et al., 2019). The first three domains of the questionnaire are used for direct measurements of psychosocial work environment factors, the fourth one reflects harassment issues, and the fifth one is used to measure how the respondents react to the psychosocial environment that has developed in their workplace due to the factors of the first four domains.

Within the framework of this study, the authors organized a translation of the questionnaire into Russian from its English version¹. The translation was carried out in several stages. In the first phase, the translation was done with the help of an expert in organizational psychology. In the second stage, the translation was checked by two experts — professional English to Russian translators. In the third stage, the translation was adapted with the help of three highly qualified human resources experts who also spoke English. The resulting Russian version was then back translated into English (using the machine translation system of DeepL SE) and compared with the source text to verify the absence of conceptual distortions. After that, the trial Russian version of the questionnaire was tested on eight employees (who gave their consent), who were asked to assess their difficulties in completing it and understanding the meaning of certain items to adjust them. Consensus discussion accompanied each stage of translation and corrections.

Work motivation

"Work Extrinsic and Intrinsic Motivation Scale" (WEIMS) is one of the best-known quantitative research instruments using self-determination theory as a framework. The original English-language

¹ Recommended by Danish authors for translation into other languages as well), available on the Internet resource https://www.sjweh.fi/download_online.php?abstract_id=3793&file_nro=1

WEIMS questionnaire contains six subscales (three questions each) corresponding to the constructs of self-determination theory — Internal motivation (IM); Integrative (INTEG), Identified (IDEN), Introjected (INTRO) and External (EXT) regulations; and Amotivation (AMO), was developed on the basis of the French scale “Blais Inventory of Work Motivation”, has been widely validated in different geographical and organizational settings, and has higher reliability and completeness compared to alternatives. When completing the questionnaire, the participants were asked to specify (on a Likert scale) the degree to which each of the 18 items corresponds to the reasons they are currently engaged in their work.

As a result, a single indicator, the W-SDI (“self-determination index”), is calculated. The index is calculated by multiplying the meaning of each subscale by the weight corresponding to the baseline level of self-determination. The formula for calculating W-SDI is as follows:

$$\text{W-SDI} = (3 \cdot \text{IM}) + (2 \cdot \text{INTEG}) + (1 \cdot \text{IDEN}) + (-1 \cdot \text{INTRO}) + (-2 \cdot \text{EXT}) + (-3 \cdot \text{AMO}).$$

The range of possible W-SDI scores is ± 24 using a five-point scale. The resulting total score reflects the relative level of self-determination of individuals. A positive score indicates a self-determined profile and a negative score indicates a non-self-determined profile (Kotera et al., 2022).

The translation of WEIMS into Russian was made by the authors of the study from the English version².

Sampling

The study involved 268 employees of a Russian private company (with a total staff of just under 850 people, which performs a full cycle of manufacture and delivery of fast-food products in a large region) belonging to all employment, gender and age groups.

Information was collected by respondents' self-completion of a Google form. The survey includes the DPQ and WEIMS questionnaires, supplemented by questions on age, gender and position in the company. A link to the online questionnaire was sent to all employees of the company via the HR dept. The data collection was stopped when the sample size is sufficient to examine the specified general population with 95% accuracy and $\pm 5\%$ confidence interval (Krejcie, Morgan, 1970).

The age ranged from 17 to 54 years (24% of respondents were under 22 years of age, 33% were 22 to 30 years of age, 30% were 30 to 40 years of age, and 13% were over 40 years of age). The sample consisted of 148 men (55%,) and 120 women (45%). The number of managers amounted to 56 persons (21%), specialists — 58 persons (22%), ordinary employees — 154 persons (57%).

Results

The study included the following steps: translation and adaptation of questionnaires, data collection, pilot validation of the questionnaires translation, verification of differences between sample average for hierarchical groups of employees, using the multiple linear regression for the confirmation of a link between the motivational self-determination index (dependent variable) and psychosocial environment factors (independent variables), as well as analysis of this link with random forest algorithm.

Descriptive statistics

The mean values, standard deviations and Cronbach's alpha coefficient (for each multi-items scales) were calculated for both questionnaires. The results are summarized in Table 1 and Table 2.

² English version available at https://selfdeterminationtheory.org/wp-content/uploads/2022/02/WEIMS_18item.pdf and was subjected to the same verification and adaptation procedure as the DPQ translation.

Table 1. WEIMS measurements results ($N = 268$, Cronbach's $\alpha = 0.77$)

Dimension (scale)	Item number	Median	Standard deviation	Cronbach's alpha
Intrinsic motivation (IM)	3	3.61	1.00	.81
Integrated Regulation (INTEG)	3	3.15	1.17	.86
Regulation through identification (IDEN)	3	3.10	1.07	.83
Introjected regulation of behavior (INTRO)	3	3.10	1.14	.79
Externally regulated behavior (EXT)	3	3.47	.84	.69
Amotivation (AMO)	3	2.11	.85	.51

Table 2. DPQ measurements results ($N = 268$, Cronbach's $\alpha = 0.81$)

Dimension (scale)	Item number	Median	Standard deviation	Cronbach's alpha
Domain: Demands at work				
Quantitative demands	4	41.32	17.83	.57
Work pace	2	56.48	2.31	–
Emotional demands	4	38.08	18.39	.74
Demands to conceal feelings	2	56.95	25.67	–
Cognitive demands	4	67.37	18.65	.71
Work without boundaries	4	54.01	17.35	.52
Domain: Work organization and job content				
Influence at work	4	6.91	19.81	.67
Influence on working hours	3	45.34	22.82	.64
Possibilities for development	4	52.17	25.67	.85
Role clarity	4	83.44	18.41	.87
Role conflicts	4	31.88	2.38	.73
Predictability	4	65.63	23.24	.82
Possibilities for performing work tasks	4	66.30	19.02	.68
Unnecessary work tasks	4	34.47	22.24	.79
Domain: Interpersonal relations: cooperation and leadership				
Social support from colleagues	4	72.34	21.65	.88
Cooperation between colleagues	4	68.21	22.12	.87
Trust between colleagues	4	67.05	21.10	.83
Social support from management	4	72.08	25.35	.93
Quality of leadership	4	69.01	25.61	.93
Cooperation with immediate supervisor	4	69.89	23.04	.90
Justice in the workplace	4	67.58	22.29	.90
Involvement of employees	3	61.19	26.18	.89
Changes in the workplace	4	48.37	33.86	.88
3-10 Recognition		61.38	28.23	–
Domain: Conflicts in the workplace				
Threats	1		1.08 %	
Violence	1		4.11 %	
Bullying	1		9.70 %	
Sexual harassment	1		4.85 %	
Discrimination	1		7.46 %	
Harassment	1		3.36 %	

Domain: Reactions to the work situation

Experience of meaning at work	4	61.64	24.39	.89
Commitment to the workplace	4	62.38	25.65	.90
Work engagement	9	61.11	21.19	.95
Job insecurity	3	33.83	26.04	.74
Self-reported stress	1	35.35	32.64	–
Job satisfaction	1	72.54	2.62	–
Overall assessment of the psychosocial working environment	1	69.14	23.30	–
5-8 Conflict between work-life and private life	3	4.55	3.07	.94

Validation of the Russian translation of the questionnaires

Internal consistency (homogeneity assessment) was checked by calculating the standardized Cronbach's alpha coefficient for both questionnaires (DPQ and WEIMS) and for each of their multi-item scales (with items deleted in turn) except for the DPQ Workplace Conflict domain scales. For most of the scales and questionnaires, Cronbach's α values ≥ 0.6 were obtained; when items were removed one by one, the alpha value for the corresponding scale decreased or increased only slightly, indicating a high level of consistency of the Russian translations used. The exceptions included the WEIMS Amotivation scale and the 1-1 "Quantitative demands" and 1-6 "Work without boundaries" DPQ scales for which α values < 0.6 were obtained. The reason assessment (involving HR experts and interpreters) revealed that the meaning of DPQ questions 1-1-1 "How often is it the case that you do not have time to complete all your work tasks?" and 1-6-1 "How often are you 'on-call' to be available for work outside of your normal working hours?" were ambiguous to the respondents (apparently caused by a significant cultural difference in attitudes towards the separation of working and personal time between Russian and Nordic respondents). As a result, it was decided to exclude these questions from the scales due to insufficient cultural adaptation of their translation into Russian. According to the human resource experts involved, reducing the above scales from 4 to 3 items generally did not affect their construct validity too much, while Cronbach's α increased to acceptable values (0.62 and 0.58, respectively). The results of the WEIMS "Amotivation" scale were considered satisfactory, as this scale is designed to measure rather dynamic indicators, the consistency of answers to its items is subject to emotional coloring. In the original French study, its alpha is also significantly lower than the values for the other scales (Tremblay, Blanchard, Taylor, Pelletier, 2009).

The results of the confirmatory factor analysis supply in Appendix A suggest that the Comparative Fit Index (CFI) is ≥ 0.90 , and the Standardized Root Mean Square Residual (SRMR) < 0.08 for all analyzed multi-item scales, which is evidence of satisfactory fit of the data. Root Mean Squared Error of Approximation (RMSEA) > 0.08 for all DPQ scales, which correlates with the validation results of the original methodology (Clausen et al., 2019). Thus, it can be concluded that the translations of the questionnaires used in this study showed satisfactory consistency and reliability.

Test of main hypothesis

A linear regression analysis was performed to test the hypothesis about the association between psychosocial working environment and employee' motivation. The "Self-determination index" (W-SDI) was used as a dependent variable, reflecting the motivation of respondents, calculated on the basis of WEIMS scale values.

24 values of the first three DPQ domains scales were used as independent variables (candidate predictors): “Demands at work” (scales 1-1...1-6), “Work organization and job content” (scales 2-1...2-8), “Interpersonal relations: cooperation and leadership” (scales 3-1...3-10), reflecting the factors of the psychosocial environment. The scales of DPQ domains “Conflicts in the workplace” and “Reactions to the work situation” were not included in the analysis because they reflect factors in the psychosocial working environment that are beyond the reasonable control and management of the organization.

The analysis is supposed to result in the following equation:

$$\text{W-SDI (Motivation)} = \beta_0 + \beta_1 \times \text{DPQ1-1 (factor 1)} + \dots + \beta_{24} \times \text{DPQ3-10 (factor 24)} + \text{error term}$$

Linear regression analysis requires, as a condition for its application, linearity of the relationship between the predictors and the dependent variable, as well as the absence of multicollinearity of the predictors (Flatt, Jacobs, 2019). To verify the linearity of the relationship, a visual inspection of the scatter plots (which did not reveal curvilinear trends and outliers) was done and a correlation analysis using Spearman's rank correlation coefficient between the values of the DPQ scales and the W-SDI (self-determination index) were performed, the results of which are summarized in Table 3.

Table 3. Correlations between DPQ scales and W-SDI self-determination index

DPQ	1-1	1-2	1-3	1-4	1-5	1-6	2-1	2-2	2-3	2-4	2-5	2-6
W-SDI	-.12	-.15*	-.24*	.04	.11	-.01	.25*	.20*	.54*	.12*	-.29*	.29*

DPQ	2-7	2-8	3-1	3-2	3-3	3-4	3-5	3-6	3-7	3-8	3-9	3-10
W-SDI	.36*	-.26*	.21*	.27*	.22*	.19*	.16*	.15*	.26*	.34*	.14*	.29*

No linear relationships were confirmed between the W-SDI and the DPQ scales: 1-1 “Quantitative demands”, 1-4 “Demands to conceal feelings”, 1-5 “Cognitive demands”, 1-6 “Work without boundaries”. To test the remaining scales for multicollinearity, a correlation matrix between them was constructed, as shown in Table 4.

Table 4. Correlations between DPQ scale values (Spearman's rank coefficient)

	1-2	1-3	2-1	2-2	2-3	2-4	2-5	2-6	2-7	2-8	3-1	3-2	3-3	3-4	3-5	3-6	3-7	3-8	3-9
1-3	.4*																		
2-1	-.1	-.1																	
2-2	-.1	-.1	.4*																
2-3	-.2*	-.1*	.3*	.3*															
2-4	.0	-.1*	.3*	.0	.2*														
2-5	.2*	.5*	-.2*	.0	-.1*	-.3*													
2-6	-.2*	-.4*	.2*	.1	.3*	.3*	-.5*												
2-7	-.3*	-.3*	.3*	.2*	.3*	.4*	-.4*	.4*											
2-8	.2*	.4*	-.1	-.1	-.2*	-.3*	.7*	-.5*	-.4*										
3-1	-.1	-.3*	.2*	.0	.2*	.3*	-.4*	.5*	.4*	-.4*									
3-2	-.2*	-.2*	.2*	.0	.3*	.3*	-.3*	.4*	.3*	-.4*	.7*								
3-3	-.1*	-.2*	.3*	.0	.2*	.3*	-.3*	.4*	.3*	-.3*	.7*	.7*							
3-4	-.1	-.2*	.2*	.1	.3*	.3*	-.4*	.5*	.4*	-.4*	.7*	.6*	.6*						
3-5	-.1	-.2*	.2*	.1	.2*	.3*	-.4*	.6*	.4*	-.3*	.5*	.5*	.5*	.8*					
3-6	-.1*	-.3*	.2*	.1	.2*	.4*	-.4*	.5*	.4*	-.4*	.6*	.5*	.5*	.8*	.9*				
3-7	-.2*	-.3*	.2*	.1	.3*	.3*	-.5*	.6*	.4*	-.4*	.6*	.6*	.6*	.8*	.8*	.8*			
3-8	-.2*	-.2*	.2*	.2*	.4*	.2*	-.3*	.5*	.4*	-.3*	.5*	.5*	.5*	.7*	.6*	.6*	.7*		
3-9	.0	.0	.2*	.2*	.2*	.2*	-.2*	.3*	.2*	-.1*	.3*	.2*	.3*	.4*	.4*	.4*	.5*	.5*	
3-10	-.3*	-.3*	-.2*	.2*	.1*	.4*	-.4*	.5*	.4*	-.3*	.4*	.5*	.5*	.6*	.6*	.6*	.7*	.7*	.4*

Scales 3-4 “Social support from management”, 3-5 “Quality of leadership”, 3-6 “Cooperation with immediate supervisor”, 3-7 “Justice in the workplace” have high correlation with each other.

Scale 3-5 was retained in further analysis as the most relevant to the task. As a further check for the absence of multicollinearity of the remaining factors in the analyzed model, the coefficients of tolerance (a value <0.1 indicates multicollinearity) and variance inflation (a value >10 indicates multicollinearity) were calculated as shown in Table 5.

Table 5. Tolerance and variance inflation (VIF) values

	Tolerance	VIF		Tolerance	VIF		Tolerance	VIF		Tolerance	VIF
1-2	.756	1.323	2-4	.726	1.377	3-2	.404	2.477	3-9	.708	1.412
1-3	.638	1.567	2-5	.437	2.291	3-2	.328	3.051	3-10	.406	2.466
2-1	.632	1.582	2-6	.481	2.077	3-3	.320	3.129			
2-2	.687	1.456	2-7	.602	1.662	3-5	.409	2.443			
2-3	.652	1.534	2-8	.487	2.052	3-8	.363	2.754			

The obtained values of the coefficients indicate the absence of multicollinearity of the studied factors, which allow us to expect the absence of corresponding distortions in the results of the analysis — distortion of the regression model coefficients and reduction of their accuracy estimates (Stade, von Bernstorff, Niestroj, Nachtwei, 2011).

All 17 variables listed in Table 5 applicable as candidate predictors. The backward elimination method was used to build the regression model. Finally, the model included five independent variables. The remaining candidate predictors were excluded from the model (one by one) due to insufficient significance (p -value > 0.05). The results of the linear regression analysis are summarized in Table 6.

Table 6. Results of multiple linear regression analysis

N = 268	W-SDI Adjusted $R^2 = 0.36669452$ $F(5,262) = 31.919$ $p \leq 0.0000$			
	β	Std.Err. of β	t(261)	p-value
Intercept	1.187922	1.294466	.91769	.359624
1-3 “Emotional demands”	-.034559	.016953	-2.03855	.042499
2-3 “Possibilities for development”	.106323	.011912	8.92602	.000000
2-5 “Role conflicts”	-.044960	.015852	-2.83630	.004920
3-5 “Quality of leadership”	-.036700	.014741	-2.48959	.013410
3-8 “Involvement of employees”	.039330	.015045	2.61420	.009461

The significance level of the model is $p \leq 0.0000$, indicating that it is statistically significant. The regression equation may be expressed as:

$$\text{W-SDI} = 1.187922 + 0.106323 \times \text{DPQ2-3} + 0.03933 \times \text{DPQ3-8} - 0.034559 \times \text{DPQ1-3} - 0.04496 \times \text{DPQ2-5} - 0.0367 \times \text{DPQ3-5}$$

To verify the quality of the constructed model, a graphical analysis of the residuals was performed (results are shown in Appendix B). The distribution of residuals on the chart is close to normal, which confirms the reliability of the calculation of regression coefficients. The absence of a significant deviation of the residuals' variation chart from a straight line indicates that the magnitude of the model error for both small and large values of the predictors will vary in the same interval.

The scatter plot (shown in Appendix C) was used to test homoscedasticity (constancy of variance across the regression line) and lack of autocorrelation (dependence of each successive value on previous values) of the residuals. This chart does not show any irregularities in the model; the errors are evenly distributed throughout the predicted range with no trends or cyclical fluctuations. The absence of autocorrelation was further tested using the Durbin — Watson criterion. The obtained value of $d = 2.031$ is in the interval $1.5 < d < 2.5$, indicating no autocorrelation (Schreiber-Gregory, Bader, 2018).

The sample size ($N = 268$) meets the requirements ($n > 50 + 8m$, and $n > 104 + m$, where m is the number of predictors) for multivariate regression models to assess their validity: $268 > 50 + 8 + 8 * 5 = 90$ and $268 > 104 + 5 = 109$ (Voorhis van, Morgan, 2007). Thus, the regression model constructed meets all the requirements for it (Flatt, Jacobs, 2019).

At the same time, it should be noted that the predictors included in the model explain only about 37% (moderate level) of the total variation in the self-determined motivation index of the sample of employees studied, while the remaining 63% is explained by other factors. This level of R^2 , although it confirms the presence of relationships between the analyzed constructs, seems clearly insufficient for unambiguous and practically applicable conclusions, especially considering the use of two different questionnaires in the study and the Cronbach's alpha values obtained during the validation of their translations. The size of the sample under study limits the application of a number of more sophisticated methods than the ones used (e.g. multivariate multiple regression).

Test of additional hypothesis

In order to identify differences between the sample averages and to search for dependencies in order to identify consistently distinguishable groups of respondents, the analysis of variance was conducted using the non-parametric Kraskel — Wallis criterion, which does not require normal distribution of the dependent variable and homogeneity of dispersions in the compared groups as conditions for its application. Position level (the employee's level in the job hierarchy) was used as categorical independent variable (factor). The dependent variable is the W-SDI (self-determination index calculated on the basis of WEIMS scale values). The results of this analysis are summarized in Table 7.

Table 7. Variance analysis results

Category	df	Significance level (p-value)						
		IM	INTEG	IDEN	INTRO	EXT	AMO	W-SDI
Position level	3	0.0000*	0.0000*	0.0000*	0.0042*	0.3170	0.4602	0.000*

Significance level values of $p \leq 0.05$ were found for W-SDI and most of the measurements (values of the WIMS scales corresponding to the types of motivations) on the basis of which this index is calculated. For this category, we can identify the following consistently distinguishable sets (groups distinguished by the presence/absence of subordinates and specialized knowledge required for the job) of respondents and assess their motivational profiles (Table 8), as well as check for pairwise differences between them using the nonparametric Mann — Whitney U -test (Table 9).

Table 8. Groups (motivational profiles) in the category "Position Level"

Group	n	Median scale values WEIMS						
		IM	INTEG	IDEN	INTRO	EXT	AMO	W-SDI
Managers	56	4.00	4.00	3.33	3.67	3.67	2.0	6.33
Specialists	58	4.00	3.67	3.33	3.17	3.50	2.0	6.00
Ordinary employees	154	3.33	3.00	3.00	3.00	3.33	2.33	2.67

The selected populations are independent samples with differing sets of mean values on the WEIMS scales.

The size of the obtained subsamples, especially for managers ($n = 56$) and specialists ($n = 58$), is not sufficient to make separate regression equations that meet the requirements for matching a sufficient sample size and the number of predictors.

Table 9. Mann — Whitney *U*-test results

Group	<i>p</i> -value ($p \leq 0.05$ confirms the presence of differences)						
	IM	INTEG	IDEN	INTRO	EXT	AMO	W-SDI
Managers	.3541	.0424*	.5689	.0512	.6179	.7424	.3023
Specialists	.0000*	.0000*	.0001*	.0013*	.1526	.2717	.0000*
Ordinary employees	.0003*	.0036*	.0012*	.2319	.4072	.4137	.0004*

Analysis using the random forest method

Based on the analyzed theoretical framework and the linear regression model, we can conclude that when studying the relationship between work motivation and factors of psychosocial working environment of employees, we should not exclude the possibility of nonparametric (or at least nonlinear) dependence between variables, as well as interdependencies between predictors.

To analyze the available data, it seems optimal to use the “random forest” algorithm, which has become a standard non-parametric statistical tool for classification and regression based on different types of predictors. This machine learning algorithm uses a random forest of decision trees and does not impose limitations on the sample size to be analyzed. Moreover, it does not require any prior assumptions about the form of the variables’ relationship (Probst, Boulesteix, Wright, 2018).

Since the set of admissible values that the dependent variable — W-SDI self-determination index — can take is finite (based on its formula), from the point of view of machine learning, the solved problem can be referred to classification problems, using the recommended parameters of algorithm execution corresponding to this class of problems, in particular, with the minimum node size equal to one and the number of decision trees in the forest equal to one thousand. Combining single trees into a forest provides an opportunity to significantly improve the quality of the classification and to make an assessment of the importance (contribution to the result) of the independent variables (Figure 3).

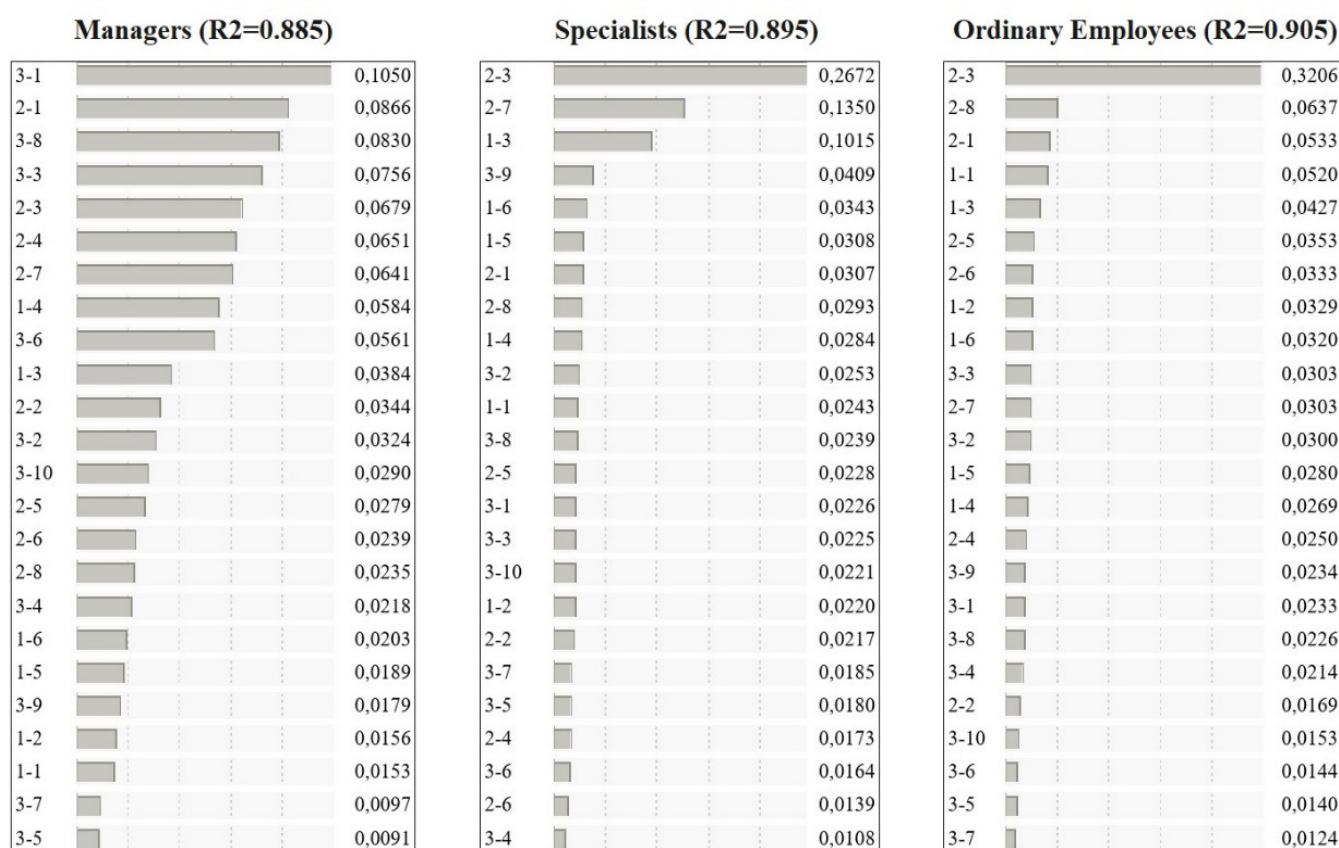


Figure 3. Weighting of predictors in the random forest model

The sets and weights of psychosocial environment factors influencing the motivational self-determination index differ considerably for different hierarchical groups of employees. For managers, the most significant factors include 3-1 "Social support from colleagues", 2-1 "Influence at work", 3-8 "Involvement of employees", 3-3 "Trust between colleagues" and a number of other factors. For specialists, there are three main factors: 2-3 "Possibilities for development", 2-7 "Predictability" and 1-3 "Emotional demands". For ordinary employees, the most significant factor is 2-3 "Possibilities for development", the rest are much inferior to it in weight.

Discussion

Checking the psychometric reliability (internal consistency) of the Russian translations of the questionnaires used revealed some cultural differences between their original audiences and the sample under study, especially in matters related to the division of working and personal time. Not too high consistency on several scales may indicate that respondents use socially desirable answers to the issues that are partially taboo for them. At the same time, the results obtained confirmed the possibility of using the translations of both questionnaires in the Russian-speaking sample. It should be remembered that when calculating the correlation between the values of scales from two different questionnaires, the reliability of the result is calculated as the product of their Cronbach's alphas — that is, if $\alpha < 1$, it may decrease significantly (Vergunov, Nikolaeva, Bobrova, 2019).

The results of linear regression analysis show a statistically significant positive relationship between the index of motivational self-determination and such factors of psychosocial working environment as "Possibilities for development" and "Involvement of employees", while "Emotional demands", "Role conflicts" and "Quality of leadership" are negatively related to self-determination of employees. In addition to the above-mentioned constructs of psychosocial environment, we should not rule out the influence of "Social support from management", "Cooperation with immediate supervisor" and "Justice in the workplace" (factors excluded from the regression model due to their collinearity) on motivation — their role is likely to be similar to the "Quality of leadership". At the same time, the linear regression model has a moderate level of determination — predictors explain only slightly less than 37% of the total variation in the motivational index of self-determination. This is quite consistent with Warr's "vitamin" model and Karasek's "requirements-control" model, which view the process of the influence of the working environment on the employee's personality as complex and nonlinear.

The analysis of variance confirmed differences between all hierarchical groups of respondents (identified on the basis of "Position level"). In this category, the most significant differences of the analyzed features are observed between the groups "Ordinary employees" and "Managers", as well as "Ordinary employees" and "Specialists", while the groups "Managers" and "Specialists" are generally similar to each other in structure and level of motivational self-determination and differ significantly only in the level of integrative regulation.

In line with Dacey and Ryan's "self-determination theory", the level of internal motivation of employees depends on their self-perceived autonomy and competence. The results of this study are fully consistent with this statement of theory — the observed average self-determination index of employees is as high as their level in the job hierarchy. In the structure of self-determination of "Managers", the internal motivation and integrative (assimilated) regulation prevail, but the levels of introjected (internalized) regulation and external motivation are also higher in them than in other groups. The group "Specialists" has the same level of internal motivation as "Managers", but the results of measurements of external motivation and other types of regulation are lower for them. In

the “Ordinary Employees” group, measurement levels are lower on all motivational scales with the exception of amotivation.

The results of application of the random forest algorithm revealed the presence of differences in the structure of motivation of the groups of employees selected on the basis of the analysis of variance, practically for all analyzed groups. The main differences are observed in the category “Position Level” (for the groups identified in the categories “gender”, “age” and “nature of work” the differences are less significant). The group “Managers” has the most complex structure of motivation - the greatest influence on the index of self-determination of this group is exerted by such factors of psychosocial environment as (in descending order of importance): “Social support from colleagues” (11%), “Influence at work” (9%), “Involvement of employees” (8%), “Trust between colleagues” (8%), “Possibilities for development” (7%), “Role clarity” (7%), “Possibilities for performing work tasks” (6%), “Demands to conceal feelings” (6%) and “Cooperation with immediate supervisor” (6%). These predictors together determine more than 66% of the result of the model built, but none of them is decisive. The structure of specialists’ motivation is much simpler — the main factor influencing their self-determination is “Possibilities for development” (27%), “Predictability” (14%) is in the second place, and the third place is taken by “Emotional demands” (10%). Self-determination of ordinary employees is more than 32% determined by “Possibilities for development”, other factors contribute to it much less. The revealed structure of motivation of different hierarchical groups fully corresponds to Herzberg’s two-factor theory of motivation — as the employee’s job position increases, a number of factors become hygienic for him. Although the analysis of variance showed not too big differences in the strength and structure of motivational self-determination of the members of the “Managers” and “Specialists” groups, the factors of the psychosocial environment affecting their motivation, as identified by random forest algorithm, are significantly different. This fact can be explained from the point of view of McClelland’s theory, according to which employees are driven by the needs of achievement, affiliation and power. In contrast to managers, the achievements of specialists are mainly related to the perfection of their narrow professional competencies, through which they develop affiliation to the relevant group and the power of the “key staff member”.

Thus, the obtained results suggest that both stated hypotheses of the present study — that there is a relationship between psychosocial working environment and motivation of employees of the organization and that the degree of relationship between various elements of psychosocial environment and motivation depends on the level of the employee in the job hierarchy - are confirmed, but, in addition to the factors of psychosocial environment, motivation is determined by other reasons. It can also be concluded that ordinary employees the structure of the influence of psychosocial environment on motivation is the simplest, while for specialists and, especially, for managers it becomes more complicated.

Conclusion

Our study confirmed the findings of other researchers that employee behavior can be determined by a relatively small number of factors, and that modern machine learning methods specifically designed to identify nonlinear and interactive effects do not provide much advantage over more traditional linear regression models when studying well-being predictors.

During the quantitative research aimed at establishing the relationship between the factors of the psychosocial environment of the organization and the work motivation of its employees, the hypotheses put forward were convincingly confirmed both in terms of existence of the relationship itself and in terms of dependence of the strength of this relationship on various factors of the working

environment for different steadily distinguishable groups of employees. The Russian translations of the DPQ and WEIMS questionnaires used in the study showed satisfactory reliability, and the use of the random forest statistical algorithm along with multiple linear regression analysis allowed us to significantly increase the level of model determination.

The authors have identified and demonstrated links between the level of self-determination (the level of combination of external regulation and internal work motivation) of organizational employees and, for example, such factors of their psychosocial working environment as emotional complexity of work, opportunities for training and development, role conflicts, quality of leadership, and job involvement. Specific factors and the strength of their influence on this or that form of motivation turned out to be most dependent on the level of the employee's position in the job hierarchy.

Determination of the priority type of labor motivation for a particular group of employees, development of autonomous forms of motivation through the impact of appropriate psychosocial factors on its open wide opportunities for organizations to improve the effectiveness of their activities.

The pilot Russian translations of the DPQ and WEIMS methods made in the course of this work can (with caution, due to the need for validation on a larger sample) be used by other researchers. The conclusions drawn are universal and can be used in various organizations in the implementation of projects to improve efficiency and productivity, the creation of a talent pool, selection of candidates for certain positions and other HR management tasks. At the same time, the limitations of our study leave still a sufficient number of questions related to the issue addressed in it and requiring additional research — for example, questions about changes in the strength of the relationship between psychosocial factors and motivation over time, its dependence on the structure and industry of the organization, etc.

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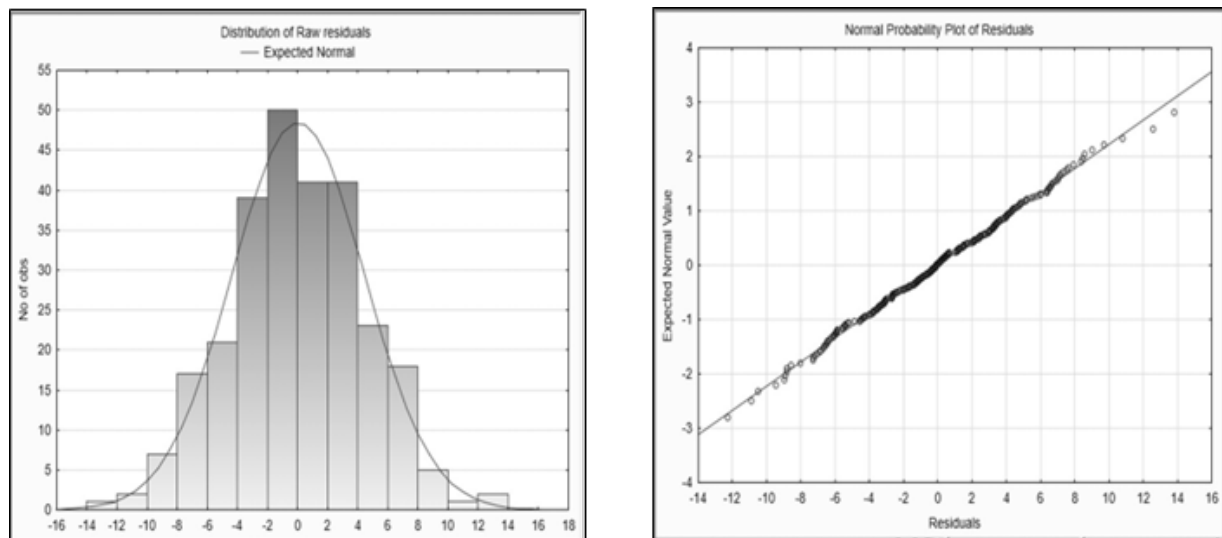
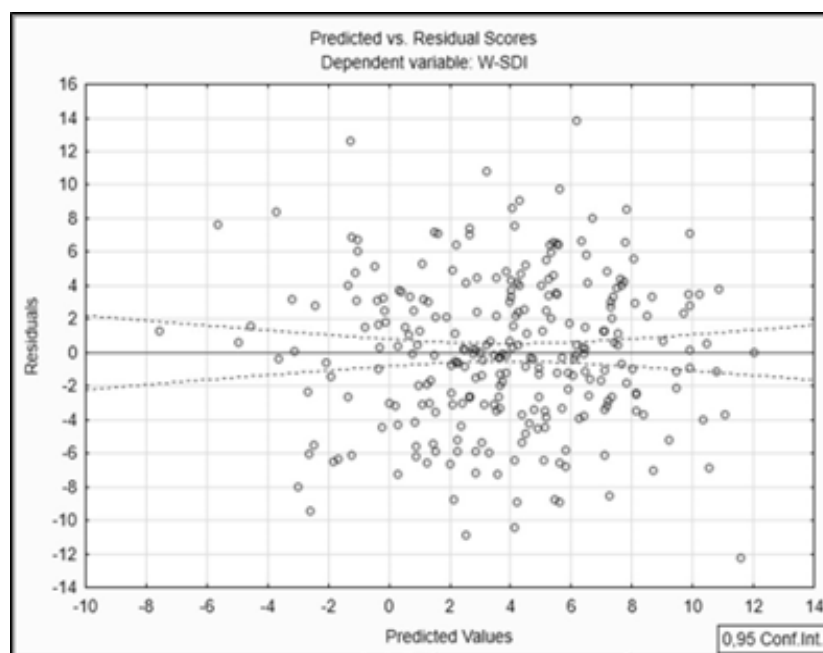
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Appendix A. Confirmatory factor analysis results

DPQ Dimension (scale)	Items number	χ^2 / df	CFI	RMSEA	SRMR
Domain: Demands at work					
Quantitative demands	4	8.5 / 2	.952	.110	.036
Work pace	2	-	-	-	-
Emotional demands	4	14.9 / 2	.955	.155	.038
Demands to conceal feelings	2	-	-	-	-
Cognitive demands	4	16.3 / 2	.928	.163	.044
Work without boundaries	4	8.1 / 2	.929	.107	.037
Domain: Work organization and job content					
Influence at work	4	6.1 / 2	.977	.087	.031
Influence on working hours	3	0	1	0	0
Possibilities for development	4	2.5 / 2	.961	.186	.031
Role clarity	4	9.8 / 2	.984	.120	.020
Role conflicts	4	12.8 / 2	.951	.142	.037
Predictability	4	1.5 / 2	.978	.126	.026
Possibilities for performing work tasks	4	1.4 / 2	1	0	.013
Unnecessary work tasks	4	15.1 / 2	.957	.156	.033
Domain: Interpersonal relations: cooperation and leadership					
Social support from colleagues	4	41.5 / 2	.939	.272	.045
Cooperation between colleagues	4	4.2 / 2	.996	.064	.014
Trust between colleagues	4	33.2 / 2	.932	.241	.053
Social support from management	4	14.2 / 2	.986	.151	.017
Quality of leadership	4	1.2 / 2	.990	.124	.012
Cooperation with immediate supervisor	4	1.4 / 2	1	0	.006
Justice in the workplace	4	65.8 / 2	.909	.345	.046
Involvement of employees	3	0	1	0	0
Changes in the workplace	4	4.8 / 2	.995	.072	.013
Recognition	1	-	-	-	-
Domain: Reactions to the work situation					
Experience of meaning at work	4	2.4 / 2	.999	.028	.009
Commitment to the workplace	4	1.7 / 2	.987	.127	.016
Work engagement	9	145.9 / 27	.942	.128	.033
Job insecurity	3	0	1	0	0
Self-reported stress	1	-	-	-	-
Job satisfaction	1	-	-	-	-
Overall assessment of the psychosocial working environment	1	-	-	-	-
5-8 Conflict between work-life and private life	3	0	1	0	0
WEIMS Dimension (scale)	Items number	χ^2 / df	CFI	RMSEA	SRMR
Intrinsic motivation (IM)	3	0	1	0	0
Integrated Regulation (INTEG)	3	0	1	0	0
Regulation through identification (IDEN)	3	0	1	0	0
Introjected regulation of behavior (INTRO)	3	0	1	0	0
Externally regulated behavior (EXT)	3	0	1	0	0
Amotivation (AMO)	3	0	1	0	0

Appendix B. Graphs of Multiple regression residuals distribution**Appendix C. Scatter plot of Multiple regression residuals**

Психосоциальная рабочая среда как фактор трудовой мотивации — роль положения сотрудника в должностной иерархии

СМОЛЬЯНОВ Андрей Витальевич

ORCID: 0009-0002-9141-8957

Санкт-Петербургский государственный университет, Санкт-Петербург, Россия

ПААЛЗОВ Андерш

ORCID: 0000-0002-5148-643X

Стокгольмская школа экономики в Риге, Рига, Латвия

ХЕЛЛСТРЁМ Катерина

ORCID: 0009-0008-9083-8427

Стокгольмская школа экономики, Стокгольм, Швеция

КИНУНЕН Тамара Александровна

ORCID: 0009-0002-7107-099X

Санкт-Петербургский государственный университет, Санкт-Петербург, Россия

ГУРИЕВА Светлана Дзахотовна

ORCID: 0000-0002-4305-432X

Санкт-Петербургский государственный университет, Санкт-Петербург, Россия

Аннотация. Цель. Исследование направлено на установление связи между факторами рабочей пси-хосоциальной среды и трудовой мотивацией. Методология. Исследование проводилось с использованием переведённых авторами зарубежных методик количественной оценки факторов психосоциальной среды и мотивационного индекса самодетерминации работников — «Датского опросника психосоциальной среды» и «Шкалы внутренней и внешней мотивации». Выборка включала 268 сотрудников одной из российских организаций, работающей на рынке изготовления и доставки пищевой продукции быстрого приготовления. В неё вошли представители из всех половозрастных и должностных групп. Результаты. Проверка надёжности и адаптация русских переводов опросников, проведённая путём вычисления стандартизованного коэффициента α -Кронбаха, выявила некоторые культурологические различия между североамериканскими и российскими респондентами. Особенно это касается их отношения к разделению рабочего и личного времени. Связь между исследуемыми конструктами была подтверждена построенной линейной регрессионной моделью. Так как предикторы, включённые в данную модель, объясняют лишь около 37% вариации зависимой переменной, а современные теории мотивации указывают на её сложную структуру, для более глубокого понимания влияния на мотивацию психосоциальных факторов, был использован алгоритм «случайного леса». Применение данного метода значительно — до 90% — увеличило детерминацию модели и позволило использовать её для анализа различных социально-демографических групп работников. Выводы. Полученные результаты не только подтвердили наличие взаимосвязи между психосоциальной рабочей средой и трудовой мотивацией, но и выявили значительные различия в её структуре и силе для групп, относящихся к разным ступеням должностной иерархии (возраст, гендерная принадлежность и характер выполняемой работы оказались заметно менее значимы). Рядовые работники имеют достаточно простую структуру данной связи. Основным психосоциальным фактором, оказывающим влияние на их мотивационное самоопределение, является возможность для обучения и развития. Для квалифицированных специалистов, наряду с данным фактором, важны возможности для выполнения и отсутствие эмоциональной сложности работы. Самая сложная структура связи — у руководителей, для

которых важны поддержка и доверие со стороны коллег, уровень самостоятельности, ясность роли и другие психосоциальные факторы. *Практическое значение.* Полученные результаты могут быть использованы для проектирования и создания в организации психосоциальной среды, стимулирующей повышения эффективности и производительности труда, а также при разработке программ группового и индивидуального развития персонала. *Оригинальность.* Оригинальность исследования заключается в изучении ранее не изученных связей между конструктами и адаптации инструментов на выборке, отличной от той, для которой они были изначально разработаны.

Ключевые слова: психосоциальная рабочая среда; трудовая мотивация; случайный лес.