

Professional Stress and Organizational Working Conditions of Space-Rocket Industry Employees as the Factors Determining Their Activities Productivity

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Abstract. In the article the features of professional stress of space-rocket industry employees which is a current problem and a serious threat not only to do essential harm to their health but also to have a negative impact on productivity in the industry in general are considered. In the article the characteristics of the organizational working conditions increasing the risk of occupational diseases and substantial characteristics of professional stress of the employees participating in the rocket-space equipment production are analysed. The recommendations formulated in the article can be used for management of the professional stress of space-rocket industry employees and prevention of its negative consequences as well as for various actions directed to labour process improvement in this industry.

1. Introduction

The problem of stress in our time is one of the urgent, especially in dynamic, economically developed countries with a complex of problems in the environmental, social, economic spheres and intense rhythm and living conditions. Numerous studies in the field of stress show that the experience of this state has a negative impact on the functioning of all physiological and psycho-physiological systems of the body and sharply limit the possibilities of professional activity. Professional stress is a diverse phenomenon which is expressed in mental and physical reactions to intense situations in the labour activity of a person [1]. Long stress impact leads to such adverse effects as decrease in general mental body stability, emergence of sense of dissatisfaction with activity results, a tendency to refusal of task performance in situations of increased requirements, failures and defeats.

Due to set out above, identification of interrelation of professional stress and organizational working conditions of space-rocket industry employees is relevant as it allows developing practical recommendations as well as the system of preventive actions to deal with professional stress, to stabilize the labour state and to minimize negative stress impact on work productivity of an organization in general. Stress is a tension condition arising when adaptive possibilities of a person don't correspond to his load index and causing activation and reorganization of adaptive resources of mentality and body [2]. The leading psychological characteristic of stress is tension.

According to S. Kasl the professional stress depends also on possibility of a person to be implemented in a labour activity and on nature of stimulation (possibility to meet human needs in the labour process) [3]. From the point of view of organizational management and psychology of management, the most important thing is that the author of the theory of stress, G. Selye associated with the concept of distress, and that has

a negative impact on a person, therefore the study of work-related stress is of particular importance for the efficiency of production of rocket and space technology. This kind of stress is called industrial or professional. Occupational stress is considered as a set of characteristics, including both stressors associated with work, and personal characteristics of a person, and stressors affecting outside work.

A. I. Kulikov [4] notes that as a result of long impact of professional stressors the following negative dynamics can appear: a chronic stress – depletion of personal resources – burning out or professional deformation of a person. Thus, the scientist recognizes that prolonged occupational stress can lead to persistent negative personality changes.

The main role in emergence of a professional stress is played by social and psychological factors and organizational conditions of a labour activity. The latter means that employers can help reduce stress by clearly defining the roles and responsibilities of employees, involving them in making decisions related to their work, improving organizational communication, and organizing reasonable work schedules. Environmental factors include a schedule, a work rate, work safety, a route to work and back, kind of work and its influence on contractors [5]. Personal factors determine how a certain individual reacts to potential stress sources. They are work efficiency, resistance to nervous and physical activities, patience, self-esteem, health and others. Irrespective of a source, stresses at work have serious consequences not only for an employee but also for an organization. Professional stresses influence employees' health (sick-lists and treatment cost billions of rubles [6]).

They distinguish direct and indirect costs that an organization may incur as a result of the professional stress of its employees [7]. To direct include: absenteeism, lack of workplace due to illness, reduced productivity, deterioration of work quality, accidents, overspending of materials and components due to marriage, additional cash costs and unforeseen downtime. Indirect costs are: deterioration of the socio-psychological climate in the team, low motivation to work, loss of activity, dissatisfaction with themselves and the results of their work, conflicts at work, mistakes in management decisions, irritability and aggressiveness of employees, distortion of information and lost opportunities.

2. Objectives and tasks of analysis

The research object is activities of the Joint Stock Company "Space Rocket Centre Progress".

The research subject is the level of professional stress and organizational working conditions of employees in the Joint Stock Company "Space Rocket Centre Progress".

The research problems which are to be solved for identification of the professional stress reasons are:

- to determine the employees' professional stress level in the head workshop where rockets are built and the workshop where aggregates and nodes are made;
- to reveal organizational working conditions in these workshops and their employees' attitude to them;
- to determine what is the greatest stressor for these employees;
- to reveal availability of statistically significant relations between the professional stress level, organizational working conditions in these workshops and stressors.

3. Research fundamentals

We conducted our research on the basis of the State Scientific and Production Rocket and Space Center "TsSKB-Progress", which is an enterprise for the development, production and operation of medium-class launch vehicles and automatic spacecraft. The employees of the head workshop where rockets are built and the workshop where aggregates and nodes are made (72 persons in all, among them 22 employees hold the leading posts of various levels) participated in the research. The research was carried out in several stages.

At the first stage we conducted a research of the professional stress level by means of the technique "Professional Stress Assessment" (K. D. Weismann's questionnaire [8]). Based on the received results the stress level for each examinee was determined. Further on stress indexes the general selection was divided into three groups on expressiveness level – "low", "medium" and "high".

"Group 1" with the low professional stress level consists of 12 examinees (4 managers, 8 contractors) that makes up 16,7% of examinees' general selection. "Group 2" with the average

professional stress level consists of 42 examinees (8 managers, 34 contractors) that makes up 58,3% of examinees' general selection. "Group 3" with the high professional stress level consists of 18 examinees (10 managers, 8 contractors) that makes up 25% of examinees' general selection.

For convenient perception of the data, for the group's names and the joint selections the notation "stress level" /position was used: Thus, we received the following options of groups (11 groups in all): Group 1 – Managers: they are managers with the low professional stress level (4 employees); Group 1 – Contractors: they are contractors with the low professional stress level (8 employees); Group 1 – all employees with the low professional stress level – managers and contractors (12 employees). By analogy the same options are for groups 2 and 3. Managers are all heads in the selection (22 employees), and respectively / Contractors are all contractors in the selection (50 employees).

Table 1. The Summary Table of Average Stress Indexes of the Technique "Professional Stress Assessment" for the Examinees' Groups and the Grouped Position Data.

Group	Employees' Number	Stress
Group 1 – Managers	4	1,32
Group 1 – Contractors	8	1,27
Group 2 – Managers	8	2,25
Group 2 – Contractors	34	2,27
Group 3 – Managers	10	3,69
Group 3 – Contractors	8	3,69
Group 1	12	1,28
Group 2	42	2,27
Group 3	18	3,69
Managers	22	2,73
Contractors	50	2,34

The analysis of the results renders that in general the managers' stress level (2,73) is higher, than contractors' level (2,34), however Mann-Whitney's criterion didn't reveal significant differences in these groups.

The analysis of the results on the workshops is provided in Table 2.

Table 2. Professional Stress Level (%).

Stress level	The head workshop		The aggregates and nodes workshop	
	Managers	Contractors	Managers	Contractors
Low	3	14	8	8
Medium	11	50	11	45
High	17	5	11	17

Apparently from Table 2 the head workshop managers have a higher stress level than the managers of the aggregates and nodes workshop. For the contractors the return tendency is noted.

At the second stage we studied organizational conditions and employees' satisfaction with work and professional development by means of Meier's questionnaire [9] which consists of two components – employee's estimate of factors (prefix "O" in scales names) and importance estimate (prefix "Z" – from 25% to 100%). By means of this questionnaire the following factors are studied: colleagues(1), chief(2), activities(3), working conditions(4), organization and management(5), development(6), payment(7), protected workplace(8), working hours(9). The respondents chose one of four answer choices: yes, rather yes, rather no, no. The received results are provided in Table 3.

Table 3. The Summary Table of the Questionnaire Average Indexes on Studying of Organizational Conditions, Satisfaction with Work and Personal Professional Development.

Group	n	Z(1)	Z(2)	Z(3)	Z(4)	Z(5)	Z(6)	Z(7)	Z(8)	O(1)	O(2)	O(3)	O(4)	O(5)	O(6)	O(7)	O(8)	O(9)
Gr.1 – Man.	4	2,5	8,8	16,3	5,0	15,0	12,5	8,8	11,3	52,8	49,5	35,3	63,5	52,5	37,3	73,5	50,0	50,0
Gr.1 – Con.	8	8,8	10,0	11,3	5,0	9,4	9,4	14,4	11,9	53,5	40,4	25,3	35,0	47,8	42,6	54,5	50,0	40,6
Gr.2 – Man.	8	8,1	10,0	13,8	10,0	10,6	8,8	10,0	8,8	66,6	57,1	44,1	56,8	61,5	56,0	53,8	50,0	56,3
Gr.2 – Con.	34	8,8	9,9	10,1	10,1	10,4	3,1	16,2	11,3	70,7	50,7	61,6	62,1	56,0	60,2	50,6	49,3	49,3
Gr.3 – Man.	10	8,5	12,5	11,5	5,5	13,0	8,5	9,5	11,0	61,2	34,7	54,2	59,3	36,8	43,8	62,2	50,0	37,5
Gr.3 – Con.	8	8,1	15,6	10,6	5,6	13,8	8,8	8,8	8,8	51,6	37,4	39,8	60,0	35,1	53,0	34,0	28,1	50,0
Group 1	12	6,7	9,6	12,9	5,0	11,3	10,4	12,5	11,7	53,3	43,4	28,6	44,5	49,3	40,8	60,8	50,0	43,8
Group 2	42	8,7	9,9	10,8	10,1	10,5	4,2	15,0	10,8	69,9	51,9	58,3	61,1	57,1	59,4	51,2	49,4	50,6
Group 3	18	8,3	13,9	11,1	5,6	13,3	8,6	9,2	10,0	56,9	35,9	47,8	59,6	36,1	47,9	49,7	40,3	43,1
Managers	22	7,3	10,9	13,2	7,0	12,5	9,3	9,5	10,2	61,6	45,5	47,1	59,1	48,6	47,0	61,2	50,0	46,6
Contractors	50	8,7	10,8	10,4	8,6	10,8	5,0	14,7	11,0	64,9	46,9	52,3	57,4	51,4	56,3	48,5	46,0	48,0

Apparently from Table 3 for the managers with the low professional stress level the following factors have the greatest index: payment (73,5%) and working conditions (63,5%), and activities (35,3%) and development (37,3%) have the smallest index. For the contractors with the low professional stress level payment (54,5%) and colleagues (53,5%) have the greatest index, and activities (25,3%) have the smallest index. For the managers with the medium professional stress level colleagues (66,6%) and organization and management (61,5%) are important, the other all factors are approximately identical. For the contractors with the medium professional stress level colleagues (70,7%), activities (61,6%), working conditions (62,1%) and development (60,2%) are important. For the managers with the high professional stress level colleagues (61,2%) and payment (62,2%) are important. For the contractors with the high professional stress level working conditions (60,8%) are important. In general, employees with low levels of occupational stress are oriented towards salaries, with medium ones — towards colleagues and working conditions, and with high levels — they do not prefer any factor. And for managers, and for performers are important colleagues.

We determined the importance of differences in groups by means of Mann-Whitney's criterion. Statistically significant distinctions were revealed on the following indicators:

- importance of "colleagues", "payment" and assessment of "activities" – between the managers with the low professional stress level and the contractors from the same group;
- importance of "activities", "development" and "payment", and assessment of "activities" – between the managers with the medium professional stress level and the contractors from the same group;
- assessment of "activities", "development", "payment", "protected workplace" – between the managers with the high professional stress level and the contractors from the same group;
- importance of "activities", "development", "payment" and assessment of "payment" between all managers and all contractors.

Statistically significant distinctions among the managers were revealed on the following indicators:

- assessment of "development" has bigger index for the managers from group 1 than for the managers from group 2;
- importance of "colleagues" has bigger index for the managers from group 3 than for the managers from group 1, assessment of "chief" and assessment of "organization and management" – on the contrary;
- importance of "working conditions", assessment of "chief", assessment of "organization and management", assessment of "working hours" are more important for the managers of group 2 than for the managers of group 3.

Statistically significant distinctions among the contractors were revealed on the following indicators:

- importance of "working conditions", assessment of "colleagues", assessment of "activities", assessment of "working conditions" and assessment of "development" are higher in group 2 than in group , and the importance of "development" – on the contrary;
- importance of "chief", assessment of "activities", assessment of "working conditions", assessment of "development" are higher in group 3 than in group 1 and, on the contrary, importance of "payment", assessment of "payment" and assessment of "protected workplace" are higher in group 1;
- importance of "chief" and importance of "development" are higher in group 3 than in group 2 and, on the contrary, importance of "working conditions", importance of "payment", assessment of "colleagues", assessment of "chief", assessment of "activities", assessment of "organization and management", assessment of "payment", assessment of "protected workplace" are higher in group 2.

At the third stage we studied stressors in the examinees' life by means of V. A. Rozanova's technique [10], which allows us to estimate the degree of stress that an employee receives from conflicts, overloads, scope of work and tensions with management.

Significant distinctions are revealed:

- between the managers and the contractors of group 3 on the indicator "scope of activity" (are higher among the managers);
- between all managers and all contractors on the indicators "conflict", "overload", "integrated stressor indicator" (are higher among the managers);
- between the managers of group 1 and group 3 on the indicators "conflict", "scope of activity" and "integrated stressor indicator" (are higher in group 3);
- between the managers of group 2 and group 3 on the indicators "conflict", "scope of activity", "tensions with management", "integrated stressor indicator" (are higher in group 3);
- between the contractors of group 1 and group 2 on the indicators "conflict" and "tensions with management" are higher in group 1 and on the indicator "scope of activity" – in group 2;
- between the contractors of group 1 and group 3 on the indicators "overload", "scope of activity" and "integrated stressor indicator" (are higher in group 3);
- between the contractors of group 2 and group 3 on the indicators "conflict", "tensions with management", "integrated stressor indicator" (are higher in group 3).

4. Aspects of rational material choice

The correlation analysis of the researched interrelations (Spirman's coefficient of rank correlation) allowed to reveal the following statistically significant relations: the professional stress indicator positively correlates with the importance indicators "protected workplace" ($R_s=0,39$) and assessment of "activities" ($R_s=0,33$) and negatively correlates with assessment indicators "chief" ($R_s=(-0,36)$) and "organization and management" ($R_s=(-0,32)$).

The statistical analysis of correlation relations between the professional stress indicator and the scale indicators of vital activity stressors on all experimental selection of employees allowed revealing the following statistically significant relations:

The professional stress indicator positively correlates with the vital activity stressors "overload" ($R_s=0,39$) and "scope of activity" ($R_s=0,37$) and the integrated indicator of vital activity stressors ($R_s=0,45$).

The statistical analysis of correlation relations between the questionnaire indicators on studying of organizational conditions, satisfaction with work and personal professional development and the scales of the "activity stressor" test on all experimental selection of employees allowed revealing the following statistically significant relations:

Such questionnaire indicator of organizational conditions, satisfaction with work and personal professional development as importance of "development" positively correlates with the vital activity stressor indicator "conflict" ($R_s=0,33$).

Such questionnaire indicator of organizational conditions, satisfaction with work and personal professional development as assessment of "colleague" is negatively interconnected with the vital activity stressor indicator "conflict" ($R_s = (-0,33)$).

5. Conclusion

Thus, it is possible to draw a conclusion that the stress arising on a workplace is a current problem and serious threat which can do essential harm to employees' health as well as negatively affect work effectiveness of an organization. The managers who are responsible for resulting effect have a bigger stress than the managers who are responsible for intermediate result. Employees with the high professional stress level especially sharply experience the danger to lose their workplace, negatively estimate content of their labour activity and its discrepancy to their abilities perceiving at the same time their overload with insignificant and boring details (more among managers).

The negative interrelation between the professional stress level and assessment of "chief" and "organization and management" says that employees with low professional stress indexes are satisfied with respect and interest in their opinion from their direct administration; atmosphere in work collective; management, cooperation organization between divisions, how planning and informing are implemented by management, opportunity to participate in problem discussion of their organization.

The positive interrelation between the importance of "development" and the activity stressor indicator "conflict" allows saying that the more significant importance of development for employees is, the more stressful the relations with higher management are. The negative interrelation between assessment of "colleagues" and the activity stressor indicator "conflict" shows that the more the employees are satisfied with fellow workers, the more pleasant, solid and helpful they are estimated and the less the conflict in the interpersonal relations with them is expressed.

The results received by us supplement the results received by us in the satellite workshop [10]. The fight against professional stress shall be based as the complex process with employees' and management's participation in it.

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