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APPLYING ERGONOMICS PRINCIPLES IN MANAGING DEVELOPMENT PROJECTS FOR UTILITY SERVICE PROVIDERS

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ABSTRACT

In this study, the application of ergonomics principles in managing development projects for utility service providers (USP) is proposed. Based on the analysis of previous work, the need to increase the efficiency of managing USP development projects through ergonomic resource utilization is determined. The implementation of ergonomics principles that can be applied in the process of realizing an improved method of forming a dynamic organizational structure for managing USP development projects is discussed.

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Introduction.

The dynamic development of technology and techniques requires continuous improvement of work organization, working hours, and workplace arrangement [1]. One of the main aspects of their development is the growth of high-tech industries and the strengthening of enterprises' innovative orientation. The housing and utilities sector requires not only the provision of quality housing and utility services but also timely problem-solving arising during customer service [2]. Therefore, it can be argued that the emergence of ergonomics is driven by scientific and technological progress and its impact on human life in the "human-technology-environment" system [3]. In human life, people are exposed to various hazards, which are usually understood as phenomena, processes, or objects capable of causing harm to human health directly or indirectly, i.e., causing various undesirable consequences [4].

The latest research analysis.

The success of managing development projects for utility service providers (USP) depends on timely and high-quality risk management. In the study [5], a conceptual model of risk management for USP development projects was developed, taking into account the identified peculiarities of managing these projects [6].

The authors in the study [7] proposed a risk management method for USP development projects, which includes the following stages: formation of a registry of USP development projects; identification of limitations for USP development projects; implementation of management automation and decision-making algorithms in USP development project management; application of a process approach in risk management and decision-making in USP development project management; construction of a dynamic organizational structure for managing development projects; implementation of benchmarking in USP development project management; adjusting USP priorities

concerning the implementation of development projects in real-time; increasing the efficiency of risk management by directing the main resources with minimal risks and the most significant economic result into USP development projects.

In the study [8], it was noted that the effective work of utility service providers is closely related to the development projects they implement. A dynamic organizational structure is an essential component of risk management for development projects. The necessary components of such a structure's functioning were described: multidimensional and entrepreneurial orientation, working with competencies, a communication plan, labor resource management, virtualization, and the use of remote work forms.

Considering the above, it becomes clear that there is a need to apply ergonomic principles in the activities of USPs.

Ergonomics [4] is the science of adapting job duties, workplaces, objects, and work objects, as well as computer programs for the safest and most efficient performance of employees, taking into account the physical and mental characteristics of the human body.

Organizational ergonomics [3] aims to optimize socio-technical systems, including their organizational structure, policy, and processes. Organizational ergonomics deals with communication, labor resource management, activity design, work time design, teamwork, new labor organization paradigms, virtual organizations, remote work, and quality management.

Ergonomics does not study the working environment and other aspects as such; these are subjects of other sciences. For ergonomics, the impact of the environment on the efficiency and quality of human activity, work capacity, and physical and mental well-being is essential. Ergonomics defines optimal environmental load values – both for individual indicators and in combination. The interrelated ergonomic design of "human-machine" and "human-environment" systems is an indisputable requirement for optimizing human activity and conditions, typical for ergonomics [3, 4].

The author developed a methodology for integrated management of deviations in projects in the work [9], allowing the project manager to manage integrated, systemically, all causes of deviations (risks, changes, problems, conflicts, stress, crises) in the project at once. The results of this research provide tools for developing models and methods of risk management for development projects but do not take into account the peculiarities of USP activities.

In works [10, 11], the author proposed models of integrated risk management for scientific project conflicts in the context of behavioral economics, specifically a conceptual model based on the "Change Management Iceberg" model, which allowed integrating methodologies such as project management, stakeholder theory, risk management, HR management, conflictology, and behavioral economics. Moreover, systemic and cognitive models allow for assessing the impact of various factors, including personnel risks, conflicts, and behavioral economics factors, on each other and the scientific project as a whole. These studies serve as an example of how to integrate approaches to managing USP development project teams and assess the impact of various factors on them.

In works [12, 13], the authors developed and investigated models and methods for forming teams for educational projects aimed at professional development. Specifically, they created a conceptual model of creativity parameters and personnel risks for members of such project teams; a mathematical model for determining the "degree of trust" among team members, enabling the assessment of creativity parameters and personnel risks for members of these project teams; and a method for forming teams considering creativity parameters and personnel risks of such team members. The results of these studies provide tools for developing indicators to assess the effectiveness of the competencies of USP development project team members.

Risk management for USP development projects should contribute to increased efficiency in managing these projects by implementing management automation and decision-making algorithmization; prototyping possible alternative solutions; A/B testing and selecting the best solution; introducing a process approach to risk management and decision-making; building a dynamic organizational structure for managing development projects; and implementing benchmarking [5, 7]. From the above, it follows that, in particular, at the stage of building a dynamic organizational structure for managing development projects, there is a need to increase team management efficiency by applying ergonomic principles to ensure successful planning and implementation of the mentioned projects.

The purpose of this study is to investigate the principles of ergonomics for their application in managing USP development projects.

Object of study. Management processes of USP development projects.
Subject of study. Application of ergonomic principles in managing USP development projects.

The research paper main body.

According to the conceptual model of risk management for USP development projects [5] and the improved method for forming a dynamic organizational structure for managing these projects [7, 8], it can be argued that after modernizing the organizational structure for USP management, an important second component in terms of significance, according to the author, is the application of ergonomic principles (Fig. 1). This is due to the fact that a significant component of efficiency is the ergonomic use of USP resources, making this topic relevant.

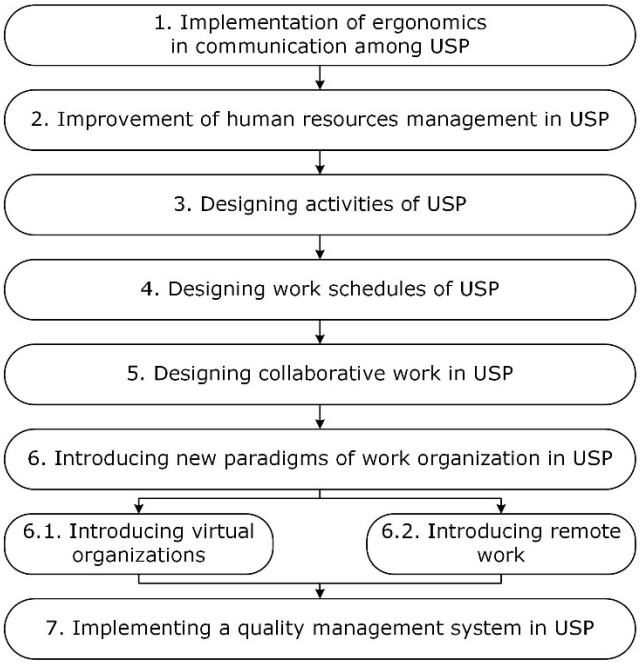

Fig. 1. Stages of implementing ergonomics principles in managing USP development projects

The implementation of ergonomics principles in managing USP development projects includes the following stages:

1. Implementation of USP communication ergonomics: Communication is an activity in which one person achieves understanding from another, and the activity of the other person demonstrates an understanding of what was in the mind of the first. Business correspondence, negotiations, interpersonal, intergroup, public, mass, and political communication are considered communication. Communication issues traditionally pose challenges in USPs. Management often has little understanding of technical difficulties at the local level and how services are provided. It is highly desirable to address these shortcomings. Processing feedback from subscribers is also an important component. Insufficient communication gives rise to rumors within and outside the USP, provoking turbulence in information exchange.

USP top management should conduct regular meetings not only with the organization's management but also personally meet with the workers performing the tasks. Information circulates within the USP simultaneously in different directions:

– Downward communication (top-down) - from the manager to subordinates, including assigning specific tasks to subordinates regarding work performance; announcing news about the organization's activities; providing feedback to subordinates based on performance results; informing about personnel changes, reorganization, and changes in the organization's policy;

– Upward communication (bottom-up) - from subordinates to the manager, including obtaining reliable information about the progress and final results of work; providing feedback to the manager about received tasks; studying subordinates' opinions on issues of interest; obtaining an idea of

improving the organization's activities; reporting on work performance and problems encountered during work; requesting consultations on issues of interest; complaints and suggestions from subordinates;

– Horizontal communication is created for the coordination and integration of employees from different departments of the same hierarchical level to achieve the organization's goals. It contributes to the increased efficiency of using all types of organization's resources;

– Diagonal communication is carried out by employees from departments of different hierarchical levels. It is used when communication between employees of the organization by other means is complicated.

Communication planning should be based on stakeholders' information needs and the available assets of the organization. Properly planned communication enhances the efficiency and effectiveness of the organization, including reducing information noise, distorting information quality, and minimizing resource losses on data clarification.

The scheme for improving communication within the USP and with consumers is shown in fig. 2.

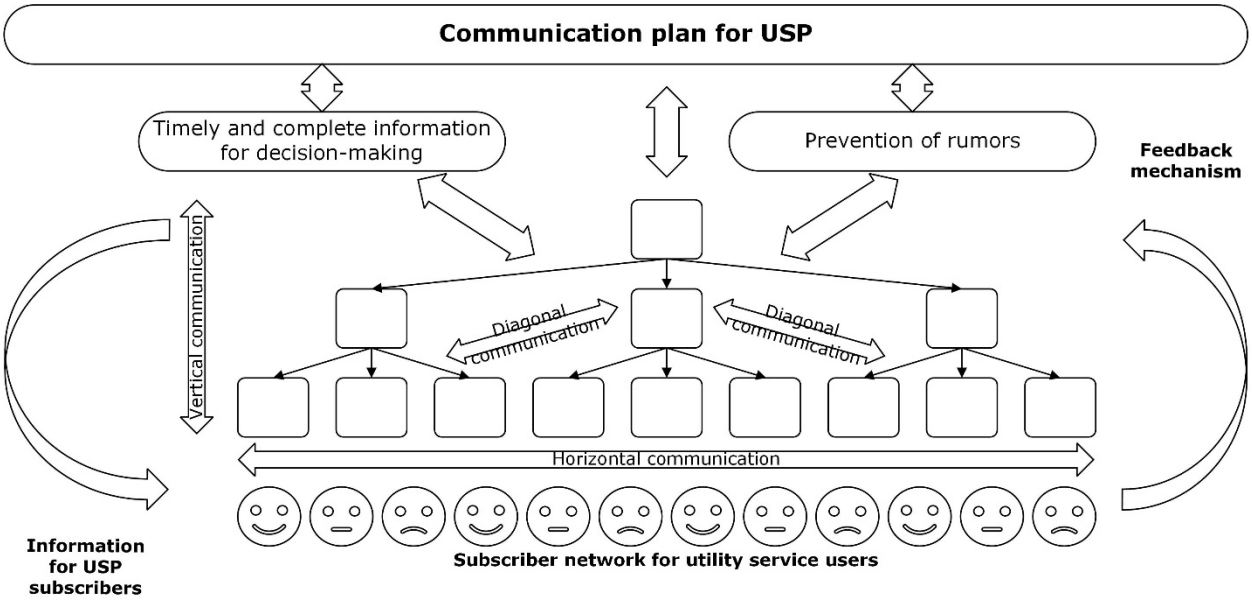

Fig. 2. Improving communication within USP and with consumers

Addressing communication issues within USP will help solve the following problems:

1) Consumer values will be prioritized, and customer trust will increase;

2) The quality of consultations and services provided can be tracked;

3) It will be easier to adhere to the company's mission and strategy;

4) Decision-making quality will improve, as USP employees will receive timely and complete information for making work decisions. There will be no time wasted on searching for information, and even more so – no effort will be spent on comparing often conflicting information;

5) Decision-making speed and action coordination will increase;

6) Identifying unnecessary expenses will be easier;

7) Risk management will significantly improve;

8) It will be easier to work with the most critical tasks for projects and adhere to their deadlines;

9) Identifying new growth directions and, as a result, the content of possible development projects will be easier;

10) Integration of development project results into USP activities will be simplified;

11) Interaction with geographically dispersed USP divisions will improve;

12) It will stimulate more effective learning and internships within USP;

13) The number of rumors and gossip within and outside USP will decrease;

14) The synergy of USP's project activities with the functional aspect will improve.

2. Enhancing labor resource management in USPs. This stage is necessary for improving their interaction with each other and increasing overall work efficiency. It is another aspect under which the activity of USPs needs to be examined. This will work in synergy with the aforementioned models and methods (fig. 3).

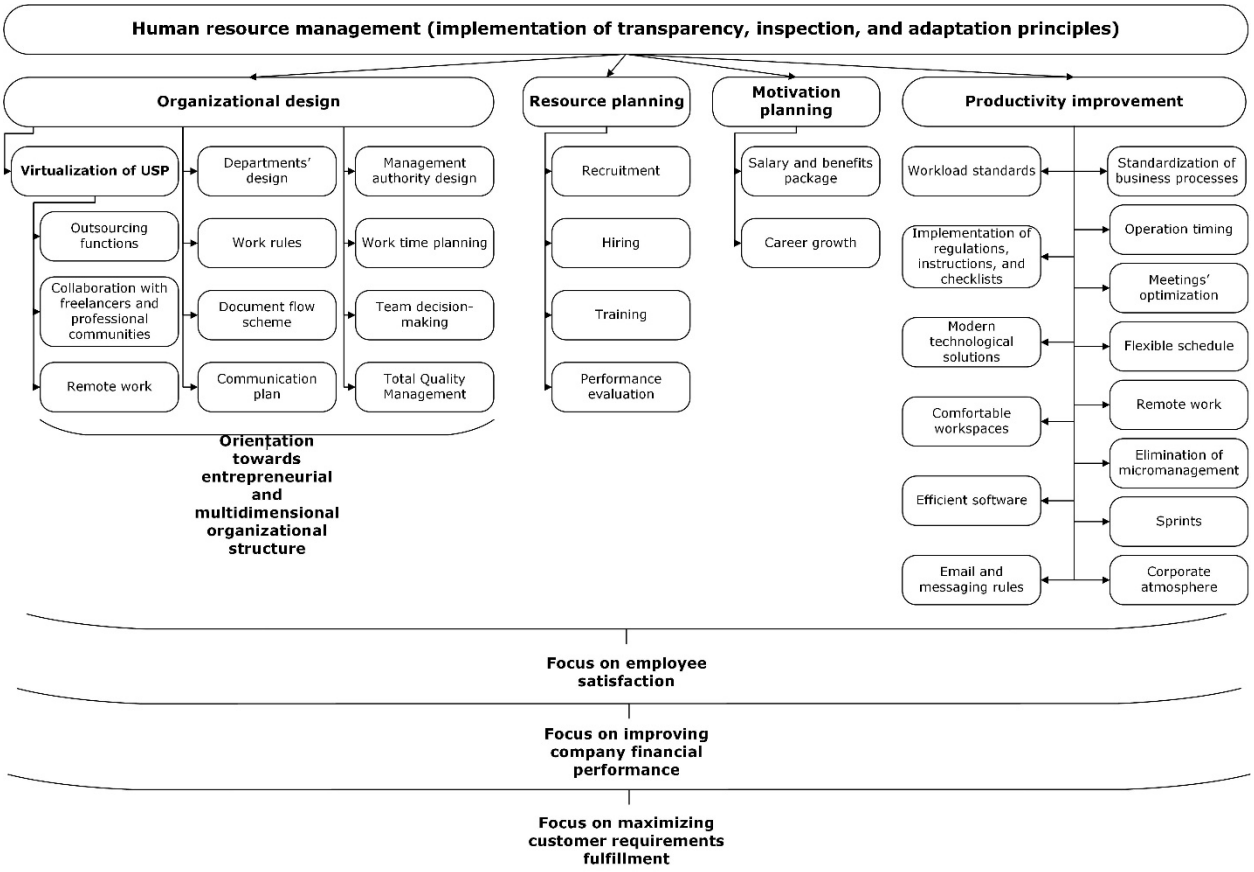

Fig. 3. Scheme for improving labor resource management in USPs

Labor resource management is a practical activity and a component of the enterprise management system aimed at the effective use of employee potential for achieving the company's goals while taking into account the interests of the employees. Components of labor resource management [8, 10, 13]:

1) Resource planning. Managers must identify the need for necessary labor resources, considering the organization's objectives. Planning consists of several stages: assessment of available resources, evaluation of future needs, and development of a program to meet these needs.

2) Staff recruitment (candidate selection). This involves creating reserves of potential candidates for available positions and recruiting according to needs. The number of available workforces, turnover, dismissals, and retirement are taken into account. Recruitment is carried out through advertisements or with the help of employment agencies. Recruitment can also be done internally by promoting employees within the organization (career planning).

3) Selection of the most acceptable employees from potential candidates. Those with the best qualifications for a particular position are chosen. Education, experience, professional skills, and personal traits should be considered (this is not always adhered to in USPs). Staff selection is carried out through tests and interviews. These methods involve evaluating abilities for specific activities, intelligence level, self-confidence, and interpersonal skills.

4) Determining wages, social packages, and benefits. This encourages individuals to achieve the organization's desired goals. It is determined based on market wage analysis, organization profitability, and specific working conditions. The social package and benefits include meals at the

workplace, training within the company, various subscriptions, sick leave payments, vacations, health insurance, pension provisions, payment for employees' children's education, etc.

5) Vocational guidance and adaptation. The labor resource development program includes employee skill enhancement. This stimulates growth in labor productivity in the organization, and thus – increased revenue for USPs. Professional orientation and staff adaptation are the first steps in improving work efficiency. The adaptation process involves adjusting to a new environment and understanding its importance within the organization. It includes learning specialized skills for more effective work in a specific USP.

6) Training in labor skills. To maintain high labor productivity, USPs should pay attention to improving the competence of their labor resources, including the development of special training programs, employee training, and retraining. Training is conducted when a new employee joins the organization, upon promotion, or in the absence of necessary skills for performing a specific job.

7) Evaluation of labor activities. Determines how effectively duties are performed. This allows for identifying the most promising employees. Evaluation of activity results is necessary for the implementation of administrative, informational, and motivational management functions.

8) Promotion or demotion, transfer, or dismissal. Determined by the administrative function. It involves promoting those who can effectively perform their duties in a new position; transferring to another position or demoting when an employee fails to fulfill their duties. The informational function provides employees with information about work efficiency. The motivational function aims to motivate a person to do good work through rewards or promotions.

9) Training of managerial personnel – involves developing a training program for managers. The organization must identify which managers have the necessary skills for a particular position. Training is carried out through lectures, courses, seminars, business games, etc.

10) Labor productivity characterizes the degree of fertility of people's labor activities and the production of labor products. It is measured by comparing labor results in terms of the volume of achieved results with the costs of achieving them. Labor productivity can be managed in various ways: determining the optimal number of personnel and labor regulation; increasing labor efficiency through enhanced motivation and technological growth of employees.

3. Designing USP activities. At this stage, it is necessary to describe all the business processes of USPs and systematize them into a certain standard. Nowadays, USPs, especially state and municipal ones, are mostly lagging in this matter.

Organizational design is the activity of forming separate departments and management apparatus in the form of a set of positions for managers, specialists, and technical performers, who help the head of the organization to manage it. Empowering them with the necessary authority, creating management mechanisms, and conditions for their functioning.

Before starting work on organizational design, it is necessary to clarify the nature of internal and external relations, the number and general characteristics of management objects, the number of divisions, their staffing and functions, territorial location, and interconnections.

Designing management authority. It refers to the set of official rights and duties to independently make decisions, give orders, and perform certain actions for the benefit of the organization. It is granted to a department or a separate position in connection with the performance of assigned functions.

Designing divisions. The most critical document regulating the distribution of rights, duties, and responsibilities is the regulations on divisions and job descriptions. The basis for their composition is the analysis of the content and scope of functions and performed work.

The above-mentioned structuring of interaction will give an impetus to the modernization of USP management: it will broaden the horizons of employees, and significantly improve their work efficiency (Fig. 3).

4. Designing the working time of USPs. Working time is the time of work, passive and active labor. It is measured in hours, days, etc. In state and municipal USPs, working time is considered more from a legal aspect than from pragmatic efficiency. Issues regarding the duration, composition, regime, and accounting of working time are regulated. Moreover, progressive working time regimes,

in the author's opinion, include flexible schedules, and remote and home-based work, which are provided for by Articles 60, 62-1, and 62-2.

Working time is considered as the time established by law or based on an agreement between the parties, during which employees, according to the rules of the internal labor regulations, must perform their labor duties under an employment contract.

The time tracking function is essential for companies providing professional services. Efficient time tracking helps managers gain a more accurate understanding of profitability, workload management efficiency, work progress, and data transparency. This is extremely useful for USPs. There are often cases when only a few specialists actively work on eliminating an emergency, while a dozen employees and vehicles are involved. The rest simply waste their time "staying" at the facility.

The ability to track time for each project separately allows USP managers to better understand how employees spend their time and the actual costs of performing specific tasks.

Nowadays, time tracking is carried out digitally using various timer programs for automatic time accounting. However, in some cases, employees must enter the number of hours spent on a task or project manually. Statistically, time tracking at an enterprise contributes to increased profitability. It is especially important for organizing the workday and overall work planning – calendar task planning in a project management system assigning performers and deadlines; monitoring actual time expenditures – time is tracked by the project; control over project schedule execution. To ensure that the actual time expenditures on tasks do not exceed the planned expenditures. The search for ways to compensate for lost time at the expense of other project tasks is carried out.

Even when working on internal projects where the customer is another department, the issue of profitability remains just as relevant. When making decisions about prioritizing internal projects, many different factors must be considered, but the main ones are the expected project benefits and expected costs.

By comparing the time spent on performing similar tasks, it is possible to understand which employees work more productively. This helps with salary increases, bonuses, or promotions planning.

In USPs, it is believed that most of the work they perform is too custom and cannot be generalized. However, based on the LLC "MASTERGAZ", the methodology of chronometry and labor standardization for technical specialists proves that on large numbers, these are quite predictable and clear criteria. They can be measured, and it is necessary to work with them. They are the basis for the ergonomic construction of enterprise work logistics (Fig. 3).

5. Designing collective work for USPs. It is difficult for one person to achieve success without the support of others. In most organizations, teamwork is the foundation, with each member possessing complementary knowledge, skills, qualifications, and performance indicators. In a team, people coordinate their actions and labor efforts to achieve a common goal and rely on each other to obtain specific results through joint efforts.

Collective work allows colleagues to exchange experiences, thoughts, ideas, and emotions. The tension in work affects each participant, and success is also joyfully experienced. Joint activities involve continuous learning for the entire team, considering existing experience.

If collective work is organized more systematically and USP workers pay conscious attention to it, results will not be long in coming. Modern municipal or state USPs consist of groups of teams, united by communication through familial or historically formed ties. Often, such mini teams with common interests find themselves in confrontation with each other. With the current pace of change and the need to adapt, it is essential to work out criteria for interaction as a single organism with constant variables.

Collective work, generally understood as collaboration, is cooperation aimed at achieving a shared, collective, and defined goal.

Developing projects in the housing and utilities sector involves many people. A crucial role is played by the project team's coordination and each member's readiness to actively engage in the work.

Collective work methods perform two functions: they help form the project team and activate the group's innovative potential.

Higher USP management should understand the necessity of the above and embark on continuous work in this direction (fig. 3).

The author also considers it highly appropriate to adapt short, specific results of collective work planning to the specifics of USPs. In the IT environment, they are known as sprints. In LLC "MASTERGAZ," sprints lasting 1-2 weeks demonstrated high efficiency.

A sprint [16] is a short time interval (no longer than four weeks) during which a team performs a specified amount of work. They should be short enough for the team not to lose concentration and long enough to deliver significant work results. Currently, most teams work with one- or two-week cycles. Sprints are the basis of Scrum (a methodology for actively solving tasks) and Agile (a set of principles).

6. Implementing New Work Organization Paradigms for USPs. Historically, USP employees have worked exclusively in offices and adhered to a specific schedule (usually 08:00 - 17:00). This imposes certain limitations on employee selection and their ability to perform specific tasks. Creative professions (modern designers, IT specialists, and even call center workers) now predominantly exist in remote collaboration formats.

6.1. Introducing Virtual Organizations.

For USPs themselves, a paradigm shift may be dictated by considering the virtualization of part of their activities. There are alternative definitions of virtual organizations, but all relate to network structures:

1) A virtual organization is an organization that exists as a corporate association without a geographic center and operates through telecommunications. It is formed by legally independent organizations sharing resources and skills to achieve set goals. Interaction among members of virtual organizations primarily occurs through computer networks. In business, a virtual organization is understood as a company that outsources its core functions to external contractors.

2) A virtual corporation is a community of functional partners managing the design, production, and delivery of products and services using modern information technologies and contract systems, with independent working groups and structures, without personal meetings or opening an official office at a specific geographical address. The principle of "service for service" or "money for service" underlies this concept, and after realizing actual deals, profit is obtained. Unlike a traditional business corporation, a virtual corporation does not have a fixed number of participants, a fixed organizational structure, or other attributes of a formal organization.

3) A virtual company is a company that operates in virtual reality - on the Internet, outsourcing a significant number of business functions. Company management is conducted both in virtual space and in real life. This management style is called "parallel management." Virtual companies operate, for example, in commerce, IT, consulting, advertising businesses, etc.

The main idea of network structures is the partnership of market participants with different functions and specific limited resources that are useful to one another. This partnership allows for achieving a synergistic effect based on each participant's specific contribution to achieving commercial goals that correspond to the interests of all partners. It is a dynamic structure in which the main components can be "assembled" or "disassembled" according to changing competitive conditions. The advantages of the network include:

1) Each participant focuses on the type of activity in which they achieve the highest results.

2) Network organization participants are connected not by traditional hierarchical relationships, but by contracts and shared goals.

3) Some organizations have brought their network operation to a level where barriers between the company, its clients, and competitors are practically erased.

4) The number of network participants can expand as needed (including outsourcing contracts).

5) Participants whose services are not needed at a particular moment can be removed from the network;

6) Organizations can also eliminate those activities or individual operations that can be performed by other network participants.

7) Since all network participants perform specific duties, the overall quality of work increases.

The main advantage of a virtual enterprise is the distribution of risks among the participants of the virtual enterprise and the narrow specialization of the performers. The start of USP's work in such an unusual format for them today will provoke a serious transformation towards improving cooperation with housing and communal services consumers. Instead of broadly directed "semi-skilled" workers, real specialists in their field will begin to appear (Fig. 3).

6.2. The introduction of remote work, including telecommuting and freelancing (in the case of the absence of a permanent employer), is a form of employment in which the client and the contractor are located at a considerable distance from each other, transmitting tasks, work results, and payment via the internet.

Advantages of remote work include:

1) Reduced costs, including office space and related expenses such as parking, computer equipment, furniture, office supplies, lighting, heating, ventilation, and air conditioning. These costs are transferred to remote workers. Remote work also reduces employee expenses, such as commuting and clothing, and allows living in a cheaper area than near the office.

2) Higher employee motivation and job satisfaction, thanks to autonomy and flexibility. Remote work naturally attracts motivated individuals capable of self-organization and taking personal responsibility.

3) Reduced commuting time and fewer meetings, leaving more time for productive work.

4) Environmental benefits, including reduced transportation and electricity consumption due to smaller office spaces.

5) Increased productivity, as employees have the freedom and authority to decide how and when to perform their tasks.

6) Lower employee turnover and higher loyalty, as remote workers have lower intentions to leave the organization.

7) Access to a larger pool of workers, as remote work allows for selecting employees regardless of significant differences in locations. These positions often receive more responses and are ultimately more valued.

8) Continuity of work during local or global problems, as some team members remain online and can continue to support the project during political instability, unrest, or natural disasters.

Disadvantages of remote work include:

1) Decreased face-to-face interaction, leading to difficulties in obtaining and interpreting information, and providing feedback.

2) Distractions, such as children, spouses, pets, and neighbors.

3) Team-building challenges, making it harder to maintain relationships with colleagues.

4) Information security concerns, as employees require training, tools, and technologies for remote work.

5) Loss of control by management.

6) Workplace envy and conflicts, as employees without remote work privileges may envy those who have them, leading to disputes at the workplace.

7) Hasty implementation of remote work during COVID-19 and the military conflict in 2022, leading to untested technology and insufficient training.

In fact, recent events have already started to gradually change the USP's perspective towards their own reformation in the direction of remote work, but there is still much work to be done (Fig. 3).

7. Implementation of quality management system in USP activities. The desire to stimulate the production of goods competitive on world markets has led to the creation of a new organizational method for continuous improvement of all organizational processes, production, and service. This method is called Total Quality Management (TQM). Considering the traditionally backward service segment of USP, TQM is an essential component of an ergonomic approach, which is developed in the models and methods of this work (fig. 3).

The principles of TQM for USP are: customer orientation; employee involvement for advantageous use of their abilities - improvement of the company is the work of every employee; approach to quality system as a business process system; systemic approach to management - USP management should help subordinates learn to do their work better; continuous improvement. The goal of USP inspections is to improve processes and reduce costs. Quality management has no end, it is a continuous process.

Thus, the application of ergonomic principles in project management of development of USP has shown its prospectiveness. The developed approach to improving the method of forming a dynamic organizational structure of development projects will allow managers of these projects, by implementing them in the practical activities of USP, to increase the effectiveness of their management.

Conclusions of the conducted research and prospects for further exploration in this direction. Implementation of ergonomic principles in project management for Utility Service Providers (USP), including communication ergonomics, human resource management, activity design, work scheduling, collective work design, implementation of new work organization paradigms (such as virtual organizations and remote work), and total quality management. The implementation of these principles is aimed at significantly improving the efficiency of project management for USP through the ergonomic use of human resources.

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