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METHODOLOGICAL SUPPORT FOR AGILE RESOURCE REALLOCATION IN A MULTI-PROJECT HEALTHCARE ENVIRONMENT

Abstract. The organization of medical assistance in de-occupied territories and territories close to combat activities necessitates reorganizing the existing medical system, making the task of developing methodological support for Agile-redistribution of resources in a multi-project medical environment relevant. **The article aims** to develop a methodological framework for Agile redistribution of resources in the medical environment. **Research results & conclusions.** In the paper, the issue of resource reallocation in a multi-project healthcare environment is examined. A methodological framework for Agile redistribution of human resources in a healthcare setting has been developed, which is based on the use of donor-acceptor interaction. An Agile method of resource redistribution in a multi-project healthcare environment has been developed, enabling healthcare facilities to be provided with resources, taking into account the principles of resilience, adaptability, and functional reservation. A model of the Agile resource redistribution process (IDEF0) has been constructed. The use of a scenario approach to ensure Agile resource redistribution is considered. The main scenarios for redistribution have been identified. An IDEF3 model of the resource redistribution process (scenario approach) has been developed. An example of applying the developed methodological framework for conducting Agile redistribution of human resources in a healthcare environment is considered. The use of the developed support for the selected example allowed for the selection of a redistribution option that meets the defined reservation requirements, taking into account the chosen scenario.

Keywords: project management; resources; resource reallocation; Agile transformation; healthcare environment; human resources management processes, modeling.

Introduction

Problem statement. The reform of the healthcare system has led to the necessity of transforming human resources management processes to ensure the sustainable functioning of healthcare institutions and the provision of quality medical services. Implementing the third (infrastructural) stage of reform involves reviewing the network of medical institutions. It approaches to hospital planning, which requires the development and application of modern approaches to human resources management. The restoration of damaged medical facilities, reorganization of the network of medical institutions, and the creation of mobile centers for providing medical assistance to the civilian population in de-occupied territories and areas of active hostilities impose additional requirements for the resilience, adaptability, and sustainability of teams that will implement projects in a multi-project healthcare environment.

Analysis of the latest research and publications

The application of coordination mechanisms in reforming a multi-project healthcare environment will ensure the manageability of reengineering processes.

Logistic aspects of resource distribution in the healthcare environment are based on the efficient organization of supply chains, relying on the principles of industry 4.0 (I4.0), Procurement 4.0, Manufacturing 4.0, Logistics 4.0, and Warehousing 4.0 [1–3]. In the distribution of material and technical resources in the healthcare environment, depending on the defined constraints, the Resilient supply chain framework [4] can be applied.

Approaches to resource allocation among network elements, discussed in [5], can be adapted for application in the distribution of human resources in a multi-project healthcare environment.

The necessity of applying modern approaches to human resources management in the healthcare environment is recognized by the World Health Organization (WHO) in The Global Strategy on Human Resources for Health: Workforce 2030 [6–9].

Analysis of global experience in implementing human resource management systems [10–13] has shown that, in addition to traditional approaches related to motivation and personnel development, the following are relevant:

– the implementation of information technologies in human resources management processes [9];

– the application of artificial intelligence in human resources management in a multi-project healthcare environment [14];

– the formation of resilient and adaptive project teams in a multi-project healthcare environment [15], and others.

The analysis of the labor market in the healthcare sector provided in [9] gives an understanding of the forces causing the shortage and surplus of healthcare workers, the ratio of qualifications, geographical imbalance, and suboptimal productivity. Boniol M., Kunjumen T., Nair T.S. et al. note that despite the

increase in healthcare workers, there is an annual disproportion regarding their territorial distribution and level of healthcare services [16].

A. Tursunbayeva indicates that inefficient human resources management in healthcare institutions negatively affects the quality of healthcare services and can lead to a decrease in the viability of the healthcare system [17].

In creating supercluster hospitals that provide unique medical services, it is essential to consider the issue of team creation, taking into account functional reservations, to ensure continuous operation and proper quality of services as an element of Safety-Oriented Systems [18].

The application of donor-acceptor interaction principles in organizing the redistribution of resources requires a coordinated strategy for human resources management at all levels of management: medical institution, territorial community, regional management, national level, and so on. The application of classification [19] will allow for the formalization of the processes of distributing human resources of healthcare institutions at the national (macro-level), regional (meso-level), and local (micro-level) levels of personnel management systems in healthcare institutions.

The processes of human resources for health (HRH) development are complicated in conflict situations where healthcare needs intensify while healthcare staff are often reduced [20]. For the Ukrainian healthcare system, the issue of providing quality medical services is complicated by migration processes, mobilization, and combat actions [21-22]. The organization of medical assistance in de-occupied territories and territories close to combat activities necessitates reorganizing the existing medical system, making the task of developing methodological support for Agile-redistribution of resources in a multi-project medical environment relevant.

The article **aims** to develop a methodological framework for Agile redistribution of resources in the medical environment.

Main research material

The distribution of resources among the configurational elements of a multi-project medical environment should be ensured considering the continuous provision of medical services, formation of resilient teams with the capabilities for functional reserving, and so forth.

In defining the paths of transformation, it is necessary to determine the starting point for reengineering human resource management processes in a multi-project environment. At the initiation stage of the transformation project, a strategy for transformation is defined based on the analysis of the existing state of the system.

Using a stakeholder-oriented approach to resource allocation will allow for consideration of stakeholder interest in distributing human resources among the configurational elements of the medical environment.

Engaging stakeholders in defining requirements for processes requires additional procedures related to alignment and forming balanced requirements. However, it allows for the reduction of conflict risk during project execution and the enhancement of the quality of managerial decisions.

In defining the requirements for staff allocation among medical institutions, the following metrics are taken into account:

– Availability of personnel with the requisite qualifications;
– Personnel mobility (ability to change the workplace/transfer to another job);
– Donor-acceptor potential;
– Functional requirements;
– Constraints and assumptions;
– Cost of redistribution;
– Time of redistribution;
– Transport and logistics aspect.

When forming a matrix of requirements, it is advisable to ensure bi-directional tracking, which will provide maximum control over compliance with resource requirements during project implementation and will ensure prompt response to changes in requirements.

An essential aspect of resource redistribution is analyzing the current state of personnel allocation.

If the redistribution of human resources occurs due to reengineering/restructuring transformation processes, then there is a possibility of defining the current donor-acceptor profile of the portfolio.

When redistributing resources, it is necessary to consider the level of openness of the multi-project environment (Table 1).

The possibility of recruiting additional personnel to the resource pool of the multi-project environment from the outside is determined by the current state of resource provision, is regulated by normative recommendations, and considers corporate policy, type, and subordination of the medical institution. Considering the time of providing resources involved in donor-acceptor interaction, redistribution can be:

– temporary (for a certain period);
– permanent (transfer);
– gradual (gradual release from the main place of work with subsequent increase in the workload at the new place of work).

When redistributing resources, it is necessary to consider the following restrictions:

– the maximum number of resources from one institution that can be redistributed;
– the maximum workload of the redistributed resource without reducing the primary workload;
– full/partial workload as a result of redistribution (whether it remains at the primary workplace/staff);
– the time for which the resource is redistributed;
– transport-logistic restriction;
– prohibition of combinations.

The impact of transformational changes in human resource management processes on the organizational structure is determined by the content of changes, volume, time of implementation, and planned time of using the results of changes (Table 2).

Table 1 – **Impact of the type of project environment on human resource management processes**

Transformational changes	Changes in organizational structure	Changes in staffing schedule	Collaboration
Physical transformation of a medical institution / subdivision	+	+	+
Introduction / withdrawal / redistribution of personnel	-	+	+
Creation of mobile teams	-	-	+
Application of territorially-distributed / virtual teams	-	+	+

Table 2 – **Impact of Transformational Changes in Human Resource Management Processes on Organizational Structure**

Type of environment	Resource source	Description
Closed	Resource pool of the multi-project environment	Resource redistribution is carried out only from the pool. The introduction of new resources into the pool is not considered.
Mixed	Resource pool, external resources	Preference is given to resources from the pool during redistribution
	External resources, resource pool	Preference is given to external resources during redistribution
Open	Pool of project resources of the multi-project environment, external resources, consultants, and international experts	Resource redistribution is carried out without considering the affiliation of resources to the pool

The donor-acceptor profile reflects the donor and acceptor properties of projects within the multi-project medical environment, as well as the possibilities of donor-acceptor interaction [23-25].

The donor-acceptor profile of the multi-project environment contains information about:

– the number of projects capable of providing/ accepting resources of a particular qualification;

– a registry of donor-acceptor interaction projects;

– the number of resources potentially involved in donor-acceptor interaction;

– the maximum degree of resource involvement in redistribution (can be loaded no more than a specified share of the rate);

– regional (territorial) aspect;

– informational cards of projects in the multi-project medical environment.

An Agile resource redistribution method has been developed in the medical multi-project environment, which will ensure the provision of resources to institutions, considering the principles of resilience, adaptability, and functional reservation. Principal stages of the method:

Stage 1. Definition of requirements for the redistribution process.

Stage 1.1 Identification of requirements sources.

Stage 1.2 Definition of functional requirements for medical institution staff.

Stage 1.3 Definition of quantitative requirements for resources (number of employees, degree of competence reservation).

Stage 1.4 Tracing of requirements and creation of Requirement Set Hierarchy.

Stage 2. Definition of functional limitations and assumptions.

Stage 3. Definition of the donor-acceptor profile.

Stage 3.1 Definition of the donor-acceptor profile (AS IS).

Stage 3.2 Definition of the donor-acceptor profile (TO BE).

Stage 3.3 Creation of a transformation card.

Stage 4. Redistribution of resources among projects/jobs [24, 25].

Stage 5. Implementation of the redistribution.

Stage 6. Monitoring of changes and requirements.

The development of the Agile resource redistribution process model allows for the unification of the process and contributes to reducing the impact of the subjective factor. The resource redistribution process model in IDEF0 notation is presented in Fig. 1.

In the course of ensuring redistribution, the following scenarios arise:

– Searching for performers for the tasks of the acceptor project without altering the existing distribution of tasks in the acceptor project (S1);

– Searching for performers for the tasks of the acceptor project with subsequent replanning of the task distribution in the acceptor project (S2);

– Selecting performers from the general pool of candidates without considering the existing resource provision of the acceptor project and possible changes in the composition of the performers of the acceptor project (S3).

Considering the personnel policy of the medical institution regarding the processes of forming a project team, it is necessary to consider the possibility of involving external performers who are not elements of the multi-project environment and the possibility of combining tasks in different projects of the environment. Organizational reengineering of the team of a configuration element occurs without regard to the existing distribution and factually constitutes the formation of a new team, which may not include the performers of the acceptor project.

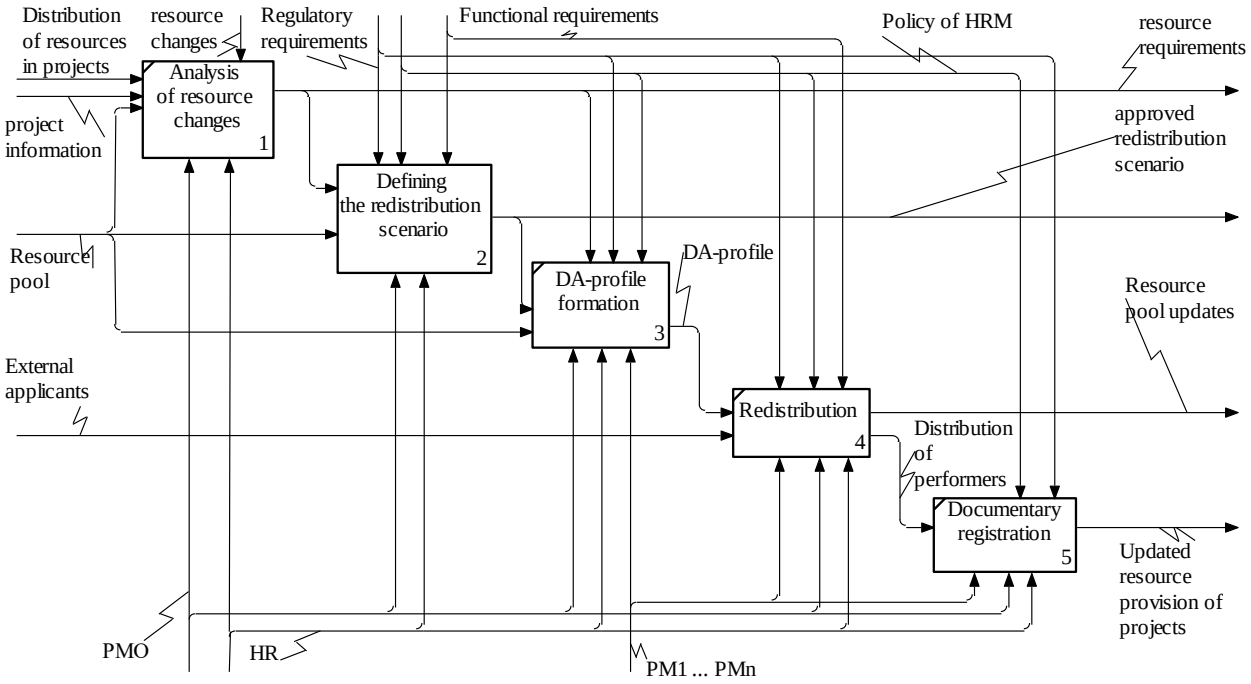

Fig.1. Agile Resource Allocation Process Model

When defining the redistribution scenario, the following requirements are taken into account:

– functional and non-functional requirements of the system;

– security requirements;

– sustainability requirements;

– requirements of the stakeholders;

– external requirements for resource redistribution (labor laws, regulatory base of the Ministry of Health, etc.).

Applying a scenario approach, in which the method of team formation depends on the selected scenario, allows taking into account corporate standards and stakeholders' interests regarding human resources management.

Table 3 presents the impact of scenarios on the distribution of performers in donor-acceptor interaction projects. A model of the resource redistribution process in a multi-project medical environment has been developed based on a scenario approach to forming project teams (Fig. 2).

In cases where it is necessary to preserve the initial composition of the project team without the possibility of applying donor-acceptor interaction, the redistribution of tasks is carried out among team members with the definition of a scenario:

– ensuring the minimum/maximum value of team characteristics;

– ensuring a minimum number of changes in the assignment of performers;

a combined option taking into account the priority of requirements.

Table 3 **– Application of the scenario approach in donor-acceptor interaction**

Scenario	**Impact on the distribution of performers of PA**	**Impact on the distribution of performers of PD**		**Terms of interaction**
		Complete withdrawal from the project PD, transfer to PA	**Partial withdrawal from the project PD**	
S1	Existing distribution remains unchanged; additional performers are additionally assigned to the tasks	-	+	Long-term, medium-term, short-term
S2	Redistribution of tasks, PA has the advantage	+/-	+	Medium-term, long-term
	Redistribution of tasks, PD has the advantage	+/-	+	Long-term
S3	Redistribution without considering the existing composition and distribution, creating a new team	+	+	Long-term

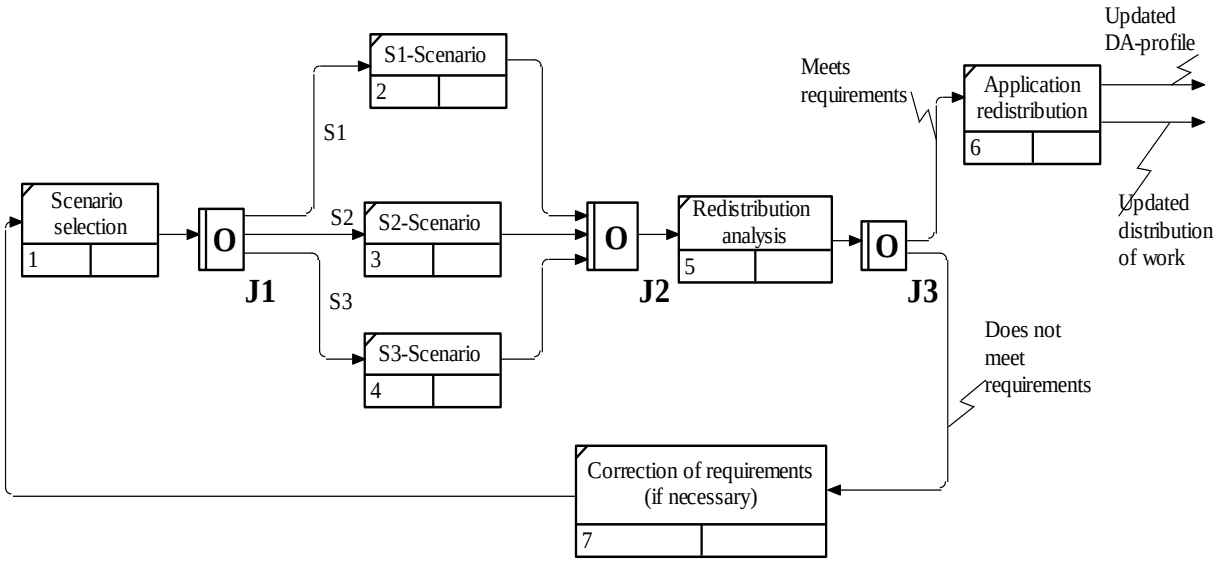

Fig. 2. IDEF3 model of the resource redistribution process (scenario approach)

Let us consider an example of resource redistribution.

Initial data:

– a given modified matrix of competencies (Table 4), the number of aggregated jobs - 8, the number of performers – 12 (Table 5);

– reservation coefficients TR1= {2, 1, 2, 1, 1, 1, 2, 2};

– team characteristic - C=51;

– distribution by jobs M1= {6, 8, 7, 1, 8, 3, 2, 7, 4, 3, 1, 5};

– prohibition on combining jobs.

Table 4 **– Modified Competency Matrix**

Q/A	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8
q_1	0	4	0	0	0	3	0	0
q_2	0	0	5	0	0	7	0	5
q_3	5	4	0	0	0	0	6	0
q_4	4	0	0	0	0	0	0	5
q_5	0	0	3	0	6	0	0	4
q_6	0	7	4	0	0	6	0	0
q_7	6	3	5	0	0	0	0	6
q_8	0	0	0	5	0	0	4	0
q_9	0	0	0	6	5	0	0	7
q_{10}	7	0	4	0	0	3	0	0
q_{11}	4	0	0	0	5	0	0	0
q_{12}	0	0	0	0	4	6	0	0

Table 5 **– Distribution of performers by work**

№	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8
q_1	0	0	0	0	0	3	0	0
q_2	0	0	0	0	0	0	0	5
q_3	0	0	0	0	0	0	6	0
q_4	4	0	0	0	0	0	0	0
q_5	0	0	0	0	6	0	0	4
q_6	0	0	4	0	0	6	0	0
q_7	0	3	0	0	0	0	0	0
q_8	0	0	0	0	0	0	4	0
q_9	0	0	0	6	0	0	0	0
q_{10}	0	0	4	0	0	0	0	0
q_{11}	4	0	0	0	0	0	0	0
q_{12}	0	0	0	0	4	0	0	0

It is necessary to redistribute resources among tasks without involving additional performers from the projects of the environment and to ensure reservation coefficients TR2= {1, 2, 1, 2, 1, 2, 1, 2}, combined scenario: minimum number of changes and maximum characteristic.

Options for redistribution are shown in Table 6.

The characteristics of the options are shown in Table 7.

Considering the defined constraints, we choose option 4:

number of changes – 5,

change in characteristic – 4,

value of characteristic – 55).

In the redistribution, performers 1, 8, 10, 11, and 12 are involved.

The distribution of tasks after redistribution is shown in Table 8.

Table 6 **– Options for Redistribution**

№	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	a_{10}	a_{11}	a_{12}
1	2	3	7	1	8	2	8	4	4	6	5	6
2	2	8	7	1	3	2	8	4	4	6	5	6
3	2	8	7	1	8	2	3	4	4	6	5	6
4	2	8	7	1	8	3	2	4	4	6	5	6
5	2	3	7	8	8	6	2	4	4	6	1	5
6	2	8	7	8	3	6	2	4	4	6	1	5
7	6	8	7	8	3	2	2	4	4	6	1	5

Table 7 **– Characteristics of options**

Option	Number of changes	Shift C	C
1	8	10	61
2	8	9	60
3	7	9	60
4	5	4	55
5	6	4	55
6	6	3	54
7	5	3	54

Table 8 **– Distribution of Work**

Q/A	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8
q_1	0	4	0	0	0	3	0	0
q_2	0	0	5	0	0	7	0	5
q_3	5	4	0	0	0	0	6	0
q_4	4	0	0	0	0	0	0	5
q_5	0	0	3	0	6	0	0	4
q_6	0	7	4	0	0	6	0	0
q_7	6	3	5	0	0	0	0	6
q_8	0	0	0	5	0	0	4	0
q_9	0	0	0	6	5	0	0	7
q_{10}	7	0	4	0	0	3	0	0
q_{11}	4	0	0	0	5	0	0	0
q_{12}	0	0	0	0	4	6	0	0

Conclusions

A methodology for Agile redistribution of human resources in a medical environment has been developed using a donor-acceptor interaction and considering the possibilities of functional reservation in the formation/reorganization of medical environment project teams. An Agile resource redistribution method has been developed in a medical multi-project environment, providing facilities with resources, considering the principles of resilience, adaptability, and functional reservation.

The application of the developed method will allow for the consideration of the dynamic nature of changes and requirements related to human resource management processes.

To formalize and unify management, a model of the Agile resource redistribution process (IDEF0) has been developed. A scenario approach has been proposed to ensure Agile resource redistribution, which will take into account existing restrictions of the redistribution process, regulatory requirements, and corporate culture. An IDEF3 model of the resource redistribution process (scenario approach) has been developed.

An example of applying the developed methodological support in conducting Agile human resource redistribution in a medical environment has been considered.

The use of the developed support for the selected example allowed for the selection of a redistribution option that meets the defined reservation requirements, taking into account the chosen scenario.

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Методологічне забезпечення Agile-перерозподілу ресурсів в мультипроєктному медичному середовищі

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Анотація. Організація медичної допомоги на деокупованих територіях та територіях, наближених до бойових дій, зумовлює необхідність реорганізації існуючої медичної системи, що робить актуальним завдання розробки методичного забезпечення Agile-перерозподілу ресурсів у мультипроектному медичному середовищі. **Метою статті** є розробка методологічної основи гнучкого перерозподілу ресурсів у медичному середовищі. **Результати дослідження та висновки.** В статті розглянуто питання перерозподілу ресурсів в мультипроєктному медичному середовищі. Розроблено методологічне забезпечення Agile-перерозподілу людських ресурсів в медичному середовищі, яке базується на використанні донорно-акцепторної взаємодії. Розроблено метод Agile-перерозподілу ресурсів в медичному мультипроєктному середовищі, що дозволить забезпечити заклади ресурсами з урахуванням принципів резельєнтності, адаптивності та функціонального резервування. Побудовано модель процесу Agile-перерозподілу ресурсів (IDEF0). Розглянуто використання сценарного підходу для забезпечення Agile-перерозподілу ресурсів. Визначені основні сценарії перерозподілу. Розроблена IDEF3 модель процесу перерозподілу ресурсів (сценарний підхід). Розглянуто приклад застосування розробленого методологічного забезпечення при проведенні Agile-перерозподілу людських ресурсів в медичному середовищі. Використання розробленої підтримки для обраного прикладу дозволило вибрати варіант перерозподілу, який відповідає визначеним вимогам резервування з урахуванням обраного сценарію.

Ключові слова: управління проєктами; ресурси; перерозподіл ресурсів; Agile-трансформація; медичне середовище; процеси управління людськими ресурсами; моделювання.