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Technologies for Responding to the Main Challenges of Ensuring the Safety of the Engineering Migrant Workers in the System of Migration Security

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ABSTRACT

The engineering sector of the economy is growing rapidly and in many Eastern European countries, supply and demand are only going up. The terrible events of the pandemic and military actions in the very center of Europe led to mass labor migration of the population. For scientists and practitioners, the question arose of finding ways to ensure safety for them and the formation of proper safe working conditions in new regions with new challenges. This determined the relevance of the research topic. The main goal of the study is the application of mathematical technologies to counteract the main challenges that negatively affect engineering migrant workers in terms of security. The methodology implies the use of modeling methods with the flexibility to change the basic parameters. Based on the results of the analysis, we presented several models to counteract the negative impact of the main challenges faced by engineering labor migrants in modern conditions. The study has a number of limitations and concerns the use of modeling technology for only one region as an example. Further research should concern not only an individual worker in the field of engineering but also entire engineering enterprises.

1. INTRODUCTION

Today we live in a new reality when a real war is taking place on the territory of Ukraine. This has affected all aspects of life in neighboring countries, from migration security to the protection of migrants. The period of hostilities has passed in 6 months and the majority of migrants from Ukraine have already become labor migrants facing new challenges in the regions neighboring Ukraine.

In today's world, economic globalization is a clear manifestation of the growing mobility of labor migration of the population. The whole world is in a global migration system, consisting of regional migration systems. Today, the migration crisis has worsened both in the EU countries and in the world.

Migration is not the only solution in this situation, but it is certainly a possible way to solve it if it is regulated, predicted, and managed.

In the process of globalization in developed countries, the demand for labor migrants is growing. As a result of the growing competition for highly educated workers, the scale of labor migration of skilled workers is increasingly expanding. At the same time, there is a high demand for vacancies for unskilled and low-skilled workers. The use of cheap labor migrants allows employers to remain competitive due to lower labor costs. From a legal point of view, such a phenomenon is recognized as discrimination based on citizenship.

Another component of the problem is the reluctance of the population to engage in low-paid or unskilled work. In these circumstances, the shortage of hands was and continues to be solved at the expense of illegal labor migrants. After all, illegal labor migrants, on the one hand, are a source of cheap labor, and on the other hand, they cannot use the right to unite to fight for decent working conditions and count on social protection.

The discussion and research of labor migration issues today is not so much in the context of the need to recognize the rights of labor migrants but in the context of the controversial nature of labor migration itself. Consequently, it contains contradictions between the economic logic of globalization, on the one hand, and the moral values that embody the concept of "man", on the other.

The most massive and significant migration flow for Ukraine is the labor migration of citizens abroad. Thanks to the freedom of movement gained during independence in the face of difficult economic circumstances and low wages, working abroad has become a strategy for many Ukrainians to survive and improve the well-being of their families. It is a powerful social shock absorber, a factor in reducing poverty, the tension in the labor market, and a source of significant foreign exchange earnings, but at the same time carries the risk of losing part of the labor and intellectual potential necessary for the development of the country.

The issue of labor migration combines several dimensions at once in the context of the COVID-19 pandemic and military actions: the economic consequences of anti-epidemic restrictions and military actions, the migration dimension of strengthening security at the borders and the ban on movement, and the human dimension of social and medical protection of foreign workers, countering discrimination. The need for quick and radical solutions to a new, little-understood, and

extreme situation makes governments feel compelled – or tempted – to impose severe restrictions on basic rights, which can particularly hit under-protected groups, often including migrant workers. Also, the pandemic and related anti-epidemic measures have led to an increase in the frequency of cases of racism and xenophobia, including those directed against migrant workers. On the other hand, the coronavirus crisis has demonstrated the dependence of some countries on workers from abroad, which has formed a certain layer of political rhetoric and journalism with a positive assessment of the role of labor migrants.

The leading place in terms of the level of labor migration among the countries of the Eastern Partnership is occupied by Ukraine, which is traditionally included in the list of top suppliers of labor. The last surge in labor migration of Ukrainians occurred after 2022 due to the economic crisis and the fall of the national currency after the annexation of Crimea and the start of Russia's armed aggression.

The pandemic and related restrictions have led to a drop in industrial production, services rendered, construction, rising unemployment, and falling incomes for workers. The EU and Eastern Partnership countries need a balanced and harmonized approach to the protection of migrant workers.

Most specialists in the engineering field began to flee Ukraine as a result of military actions. And met with new challenges. Engineering migrant workers should be included in social protection programs in countries of destination, such as one-time or multiple cash payments, compensation for hours not worked, tax exemptions, or credit payments. EU countries should also facilitate the ability of labor migrants to change jobs in the event of dismissal and provide them with full and unconditional access to health care.

The main goal of the study is the application of mathematical technologies to counteract the main challenges that negatively affect engineering migrant workers in terms of security.

The reason for choosing this topic was that today the topic of labor migration has become especially acute, due to the deployment of a full-scale war on the territory of Ukraine. Given these events, a large number of highly qualified specialists were forced to leave their jobs and look for alternatives abroad. By itself, the engineering sector of each country has a chance to develop only on the condition that it constantly attracts highly qualified specialists on the one hand, and forms a system for ensuring its own security and eliminating low-skilled personnel from the engineering system. In this regard, the study of the main aspects of ensuring the safety of engineering migrant workers in the system of migration security is an extremely important and relevant topic for the authors.

As a result of the study, we presented several models to counteract the negative impact of the main problems faced by engineering labor migrants in modern conditions, which can become an important component of ensuring the safety of labor migrants in the engineering complex.

The entire study consists of the following structural components:

Introduction, where the relevance and theoretical foundations of the subject under study were studied. Literature review in this section, the main scientific achievements and existing models and mechanisms for solving the goal set for the study were analyzed. Methodology, which analyzed the main methodological approaches used in this study. The main part of the research work is placed on the results of the study. In the "Discussion" section, a comparison of existing works was carried out and the structures for conducting the study and the results obtained by us were selected. In the "Conclusions" section, the main results of the study were summarized.

2. LITERATURE REVIEW

To begin with, conducting a study of scientific and practical literature on the selected topic, it should be noted that practically, the generally accepted opinion of most scientists [1-3] is the fact that the main component of migrations in the modern world is resettlement due to economic factors, primarily temporary movements in order to earn more. In such migrations, the ratio of the quality of life in the countries (regions) of origin (residence) and the countries (regions) of the migrants' destination plays a decisive role. Unfortunately, forced resettlement caused by conflicts, wars, and man-made and environmental disasters is quite large-scale. But our research further on in the text will talk about labor migration already through the prism of waging war in the very center of Europe.

Narrowing our research to the field of engineering, as noted by Kryshtanovych et al. [4], this sector is always in demand and engineering knowledge is accepted in any corner of the world. Of course, Ukrainians in this specialty understand this, and therefore, in the conditions of the introduction of war on the territory of their state, they migrated to new engineering enterprises of the world.

There are enough regional studies of the work of migrants from Eastern Europe [5, 6]. Most have a positive attitude to this factor and note that it contributes to the development of the engineering sector of the country as a whole. The arrival of qualified workers in the field of engineering contributes to the modernization of the recipient countries, replenishes the intellectual capital of the destination country, creates an appropriate competitive environment for its residents, and stimulates the improvement of qualifications. And competition in the market of engineering enterprises only stimulates innovation.

Today, the problems regarding the implementation of measures for accommodation and employment of forced migrants, support for Ukrainians, cooperation with international organizations in countering and fighting illegal labor migration, arrangement of borders, bringing Ukrainian migration legislation in line with the requirements of international norms and principles of migration, regulation of intensive flows of external labor migration, migration security for Ukrainian engineering enterprises working abroad, and prevention of the outflow of intellectual potential in the field of engineering [7]. And those words sounded even before the beginning of the full-scale military aggression of the Russian Federation.

Expressing an intermediate opinion about the peculiarities of the introduction of business by domestic engineering enterprises abroad, they note that the positive impact of migration on development, however, does not happen automatically, but requires purposeful multi-vector work of both individual states and the international community as a whole. That is why the importance of migration security policy - both at the national, regional, and global levels - is naturally growing, its tasks are becoming more complicated, and the implementation mechanisms occupy a prominent place in state bodies [8, 9].

It is difficult to evaluate the scientific and practical literature today since the war in Ukraine started only a few months ago, and therefore there are still no clear studies on this topic. This not only raises the relevance of our chosen research. We strive to analyze the life and safety of workers in the engineering sector of Ukraine in new conditions and new regions.

3. METHODOLOGY

Describing the research methodology, it should be done in several stages, which can be briefly described in this section.

First of all, it should be noted that we are talking about migrant workers in the engineering sector of Ukraine, who, as a result of the war, were forced to look for engineering enterprises in neighboring countries. Thus, the challenges that were for them in the new regions should be viewed through the prism of regional security for labor migrants. We used the method of a face-to-face survey of 30 migrant workers in the engineering sector of the economy in one of the regions of Poland, which has become practically the largest hub for all IT and engineering specialists (Subcarpathian Voivodeship). It is difficult to talk about the professionalism of the survey in a war because here one should concentrate on the possibilities in general. That is, it is good that there is generally someone to conduct a survey on this topic with.

It should also be noted that the entire survey process was carried out in accordance with the ethical standards of scientific research. All respondents agreed to participate in the survey and to process some of their personal data. All personal data of the respondents used in the course of the survey and the subsequent conduct of the study remained anonymous. The survey was conducted in the live communication mode, which made it possible to obtain as much useful information as possible. All specialists are employees of the engineering field with at least 5 years of experience.

The next method is the "classification tree" methodology, which allows, through the so-called "tree branches", to show a particular process sequentially to achieve the main goal, in stages. In our case, this concerns responding to the main challenges that have become for labor migrants in the engineering sector of the economy in the Subcarpathian Voivodeship.

Table 1. Basic conditions for the application of methodological technology IDEF0

Technology condition	Characteristics of conditions for our model
What is the essence of this model?	Present security opportunities for engineering labor migrants from Ukraine in Subcarpathian Voivodeship
Who is the main audience?	Labor migrants of the engineering sector of the economy of Ukraine
What technology will you use?	Functional and program-graphic technology of an accessible image of the main processes and stages of IDEF0
What software?	The application program for technologies for constructing vector diagram models

In order to better test the vision of our goal as the heart of the methodology, an appropriate graphical software test is needed. Here, the "black box" testing method is suitable, which will show us what we need in the end at the output, if we still achieve our goal. In our case, such a main goal will be to ensure security for engineering labor migrants from Ukraine in the region (J^0). The black box method is an intermediate method that we have applied to better demonstrate our simulation.

Having described the above methods, we would like to note that they serve only as a boundary link for the technology of forming our main model. The model itself should be formed using IDEF0 technologies. This is a convenient, functional, and software-graphic technology for an accessible image of the main processes and stages of achieving goals. So, the basic conditions for our model according to the methodology are presented in Table 1.

All results of the study using the above methods will be presented below in the text of the article.

4. RESULTS OF RESEARCH

So, through the application of our methodology, to begin with, to indicate what exactly should be done in order to achieve J^0 (Ensure security for engineering labor migrants from Ukraine in the region). To do this, we will build our task classification tree to achieve the goal of modeling (Figure 1).

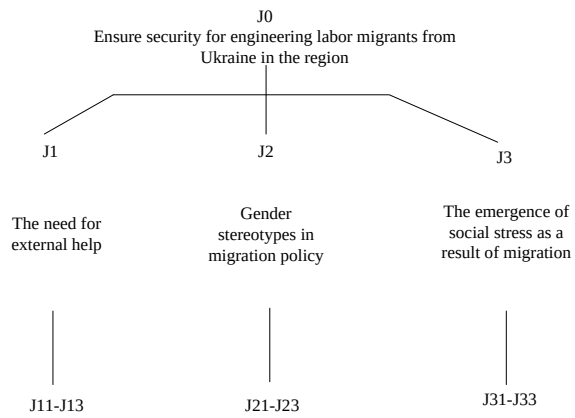

Figure 1. Task classification tree for achieving the set goal of modeling (formed by the authors)

Let's analyze the key challenges that have befallen labor migrants in the engineering sector of the Ukrainian economy in the Polish region of Subcarpathian Voivodeship:

J^1 - The need for external help. External help is provided by developed states and international organizations in the form of financial, economic, and technical support to countries with developing economies and economies in transition. The geography of foreign aid quite clearly reflects the geopolitical interests of its donor states, and its main recipients are, as a rule, the countries from which the largest flows of migrants go to the helping states. But foreign aid alone cannot solve the problems of economic backwardness, unemployment, and emigration, but it can create the conditions for the necessary social changes. One of the first problems and challenges for the whole world was the issue of international assistance to migrants and refugees from Ukraine. Many engineering enterprises, apart from international assistance, are ready to accept and pay rent for specialists from Ukraine.

J^2 - Gender stereotypes in migration policy. It is a well-known fact that the majority of labor migrants from Ukraine are women and children. Today, thanks to a progressive society in the world, the problem of gender in the engineering field is gradually disappearing. Unfortunately, Poland still has

some gender issues. Of course, the main factor that encourages citizens of Ukraine to leave for countries, for example, the EU, is the provision of protection from war and a significantly higher level of wages outside Ukraine, but in this case, it is discrimination that will be a more significant factor than wages in the EU. After all, it is discrimination in this case that can make it impossible to get a job at all and, as a result, material consequences for existence. Therefore, it is understandable that, seeking not only a better fate, security, understanding and decent treatment, most women in engineering in the field can also choose an engineering company that pays even less than others of the same type. Such an attitude towards this category of persons is connected not only with the mentality but also with the corresponding level of legal regulation of the prohibition of discrimination. Poland is trying to move away from this, but the ratio of women in engineering companies is much lower than men.

J^3 - The emergence of social stress as a result of migration. As long as there is a problem in creating jobs for citizens to fully meet their basic needs, as long as there are disagreements in social development, there will be a question of finding a place for the possible realization of the needs of the individual. Migration processes in Poland will continue in the near future because the economic condition of Ukraine, even after the war, will be low. Getting into new conditions, a person acquires a "detached status" of a labor migrant, which can lead to a deepening crisis of personal identity with the realization that he is not satisfied with this situation, but at home, he does not see opportunities for self-realization in the engineering field. The constant progress and development of the engineering sector generates a lot of stress, constant companions of a person, his lifestyle and requires constant development. For a Ukrainian engineering specialist who was running away from the war, it is difficult to immediately "catch up" with the new realities of the engineering sector.

In order to understand and test the main ideas that are laid down as the desired result, we build our J^0 achievement diagram through the above methodology (Figure 2).

All the elements presented in Figure 2 will contribute to the achievement of J^0 and may vary depending on the environment in which the migrant is located. We took into account the peculiarities of our region.

Using the IDEF0 technology, we will build a basic model for responding to the main challenges for labor migrants in the engineering sector of the economy in Poland in Figure 3.

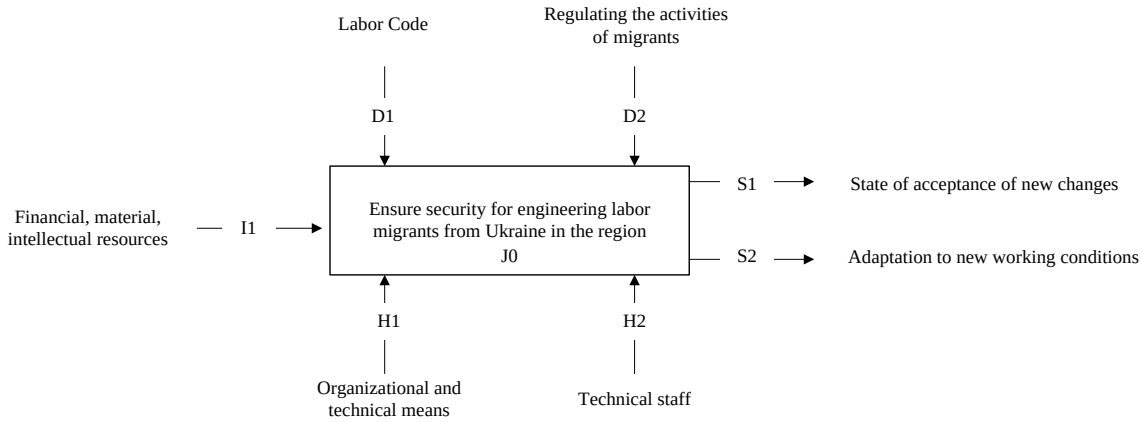

Figure 2. A diagram depicting the desired result when J^0 is reached (formed by the authors)

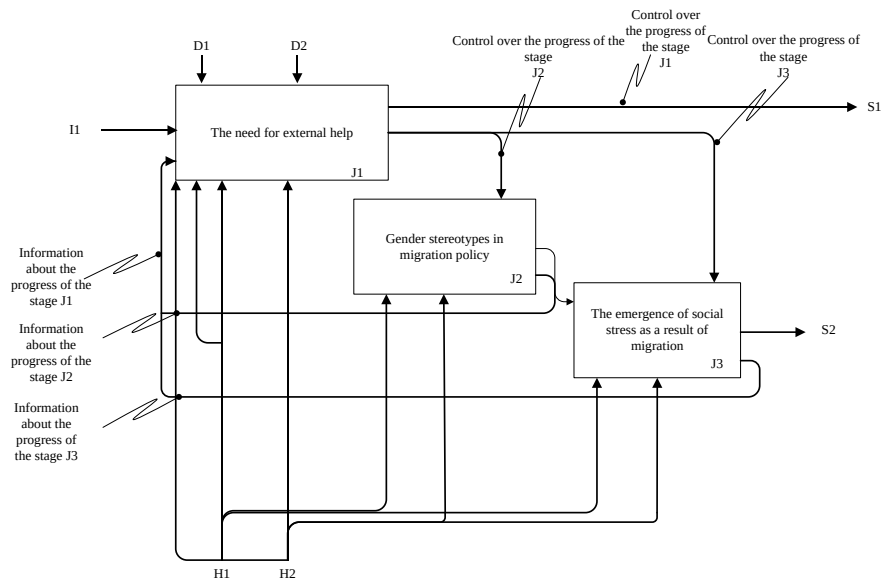

Figure 3. The basic model for responding to the main challenges for labor migrants in the engineering sector of the economy in Poland (formed by the authors)

The result of applying the IDEF0 modeling technology to respond to the challenges brought by J^1 is presented in Figure 4.

Let's analyze how we can respond to the need for external assistance in the Polish region of Subcarpathian Voivodeship:

J^{11} - The process of obtaining assistance from the Polish government. Poland is one of the few countries in the world that have donated almost everything to help Ukraine and its refugees. The largest number of labor migrants is considered to be in Poland. The Subcarpathian Voivodeship region is saturated and has prospects for the development of the engineering sector of the economy. For labor migrants, the first challenge during migration was the process of obtaining assistance from the Polish government. This is not a difficult, but still, a security process that needs some effort.

J^{12} - Seeking benefits from a new employer. There are no mass cases in the Subcarpathian Voivodeship region when engineering companies are ready to help migrant workers who want to work in them with temporary housing or other things. Therefore, the starting weeks of stay abroad for engineering specialists from Ukraine can become a real challenge.

J^{13} - Receiving UNHCR Poland assistance. The UNHCR Poland is very serious about helping Ukrainian refugees. And they really appreciate those who are ready to work. Significant assistance from the UNHCR Poland office can also be found in the Subcarpathian Voivodeship. The challenge for specialists in the engineering sector of the economy may be the search for additional opportunities for assistance from the existing UNHCR Poland, however, in other regions of Poland.

The result of applying the IDEF0 modeling technology to respond to the challenges brought by J^2 is presented in Figure 5.

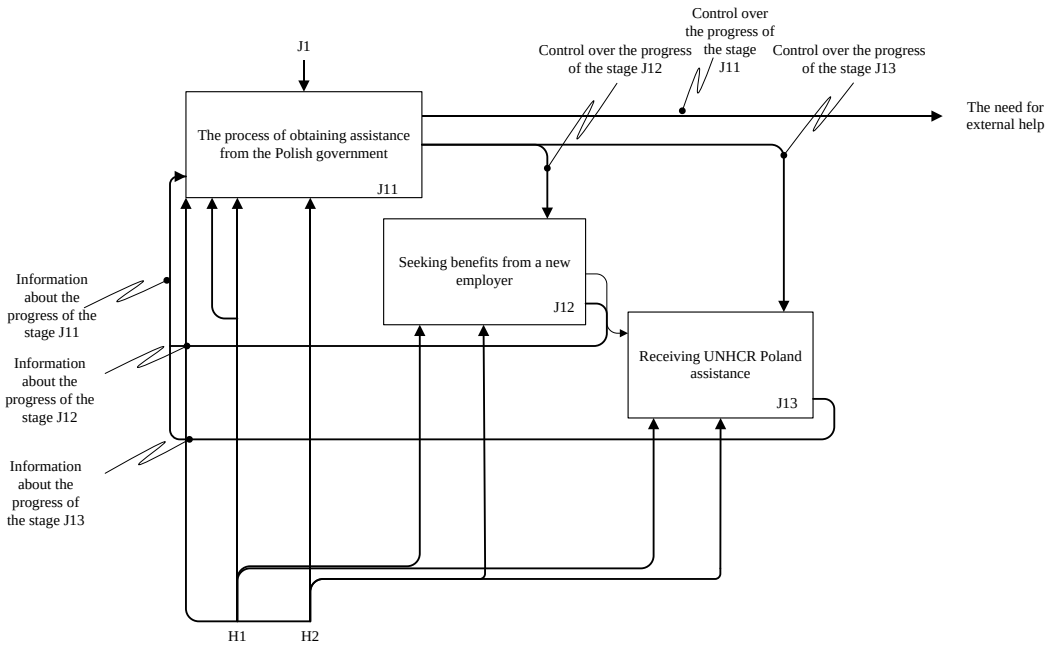

Figure 4. The result of applying the IDEF0 modeling technology to respond to the challenges brought by J^1 (formed by the authors)

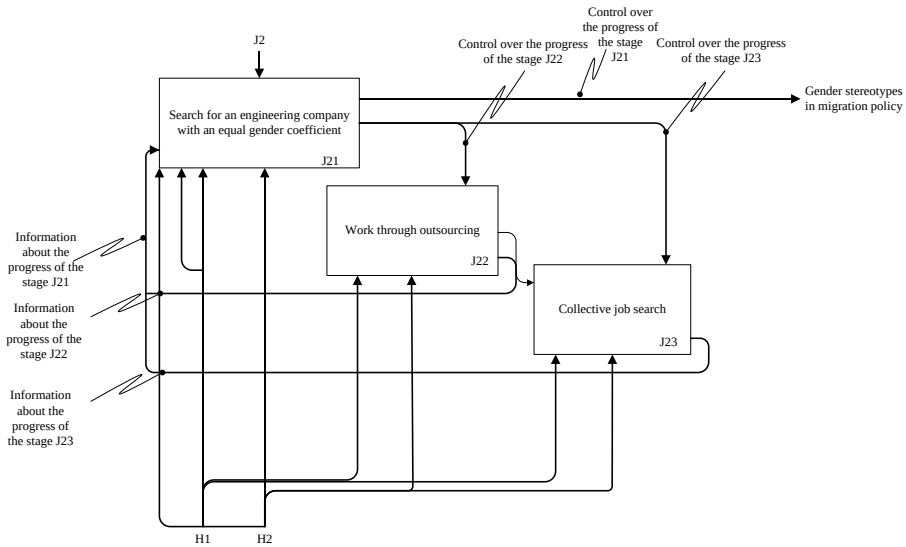

Figure 5. The result of applying the IDEF0 modeling technology to respond to the challenges brought by J^2 (formed by the authors)

Let's analyze how we can respond to the gender challenge in the engineering field of activity in the Polish region of Subcarpathian Voivodeship:

J^{21} - Search for an engineering company with an equal gender coefficient. The best and probably the easiest option would be to find an engineering enterprise where the number of men and women is the same. This does not create social tension between employees and makes it easier to integrate into the team. In addition, at 50 to 50, a better level of corporate security is achieved and the internal culture of the engineering enterprise develops.

J^{22} - Work through outsourcing. The Subcarpathian Voivodeship region welcomes outsourcing and fully recognizes it as people with work. Remote work for a migrant is a plus better and slowly assimilating a new environment. This work significantly reduces the risk of gender discrimination.

J^{23} - Collective job search. For better air conditioning inside a new workplace in an engineering company, one of the options would be a collective job search with a girlfriend or friend. This will be much better at reducing the gender challenge in the new job.

The result of applying the IDEF0 modeling technology to respond to the challenges brought by J^3 is presented in Figure 6.

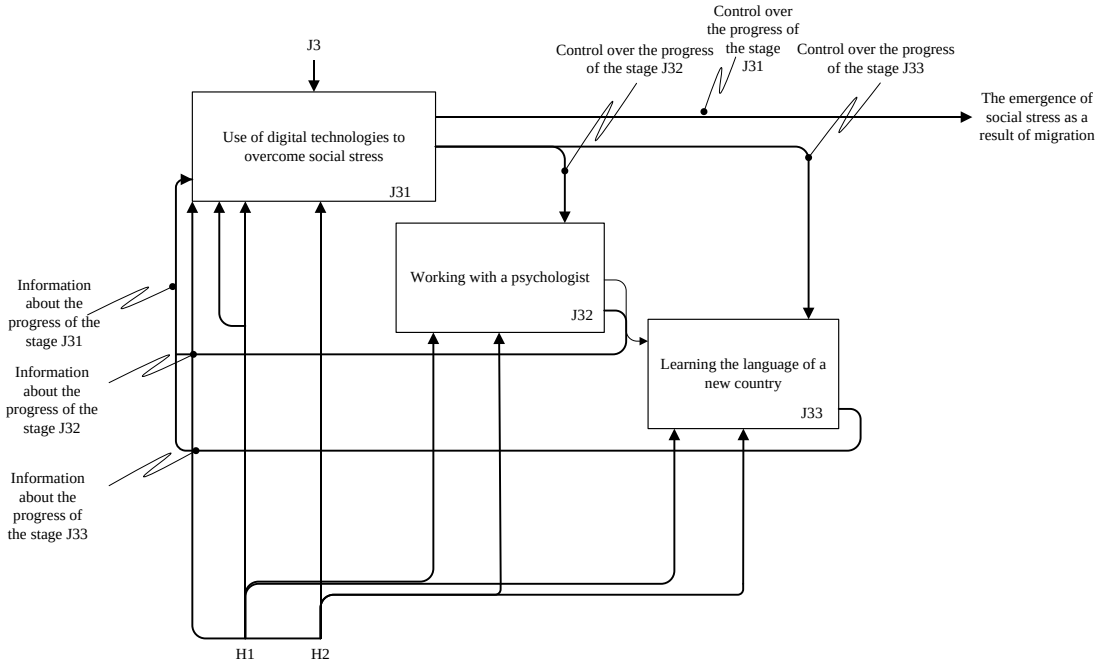

Figure 6. The result of applying the IDEF0 modeling technology to respond to the challenges brought by J^3 (formed by the authors)

Let's analyze how we can respond to the social challenge in the engineering field of activity in the Polish region of Subcarpathian Voivodeship:

J^{31} - Use of digital technologies to overcome social stress. Digital communications, due to their information power and virtual figurative power, reproduce surrogates of the socialization environment and therefore compensate for a significant part of the changes in the cultural environment that usually force a migrant to adapt to a new environment and assimilate. Satellite TV channels, the Internet, transport, and public associations easily create for the educated urban migrant the spiritual environment with which he has always dealt.

J^{32} - Working with a psychologist. The work of a professional psychologist is often underestimated in the engineering field. Employees do not actively use his services, which is a mistake. The professional help of a psychologist can help you cope with the challenges of social stress. Thanks to the close cooperation of the region with Ukraine, finding a Ukrainian speaker will not be a problem.

J^{33} - Learning the language of a new country. The language barrier has rarely been a problem in Poland, but still, in the context of overcoming social stress, this issue should be addressed.

In summarizing, it is worth noting that, despite the existence of already significant scientific works related to this topic [4, 7-9], we present our results through the use of relevant and popular methods for achieving the goal, which details the ultimate goal and graphically reflects the entire process.

5. DISCUSSIONS

Discussing the results of the study, we would like to note that in summary and generalizing the opinion of the majority of scientists [10-12], a number of measures are proposed to respond to the main challenges facing the provision of security for migrant workers in the field of engineering: to intensify the negotiation process to conclude agreements on mutual employment of citizens and their security with countries where the number of labor migrants - citizens of Ukraine is the largest; contribute to the acceleration of amendments to agreements on cooperation in the field of labor migration and social protection of labor migrants; to implement measures for the adoption of draft agreements regulating the movement of labor with the EU countries; promote the dissemination through the media of information for citizens of Ukraine about the possibility of legal employment abroad; create mechanisms to

prevent the decline in the qualifications of highly educated specialists as a result of their being in low-skilled jobs abroad.

Researchers note the fact that the main challenges for labor migrants in the engineering sector of the economy should be considered through modeling at the macro level [13, 14]. The regulation of migration processes at the macro level should become an important component of the socio-economic policy of the state to regulate the engineering sector of the economy. The task of managing migration, especially its external forms, is not to erect barriers by introducing a system of administrative and restrictive measures that will prevent migrants from entering developed countries, but on the basis of respect for human rights and humanity. principles to manage the migration flows of the population, in particular permanent migrants and labor migrants, taking into account the interests of donors and recipients.

As noted by Podra et al. [15], modeling in the field of countering any negative factors in migration security should occur with the formation of a system of legal, administrative, organizational and financial measures, as well as information support by government structures and public organizations and associations to streamline the migration space, the introduction of a visa-free regime for citizens of Ukraine with other countries, the regulation of the migration movement of the population from the standpoint of national priorities, the quantitative and qualitative composition of migration flows, their social, demographic and economic structure The regime and measures of the migration policy of the state must carefully monitor migration processes, current trends and phenomena, promptly respond to changes and control them in order to comply with national and regional interests, the personal needs of migrants and, in general, contribute to ensuring the national security of Ukraine.

It should be noted that our study has differences, which are primarily related to the fact that they did not try to cover all the problems and challenges that labor migrants face today, but chose to separately take the region where, due to the war, the majority of Ukrainian labor migrants flee in the field of engineering. So, there are enough scientific works on the formation of such models, but none of them is relevant today for accounting for the mass labor migration of Ukrainians as a result of the war. This changes the rules for ensuring the security of the region, where there are the largest flows of labor migrants.

Our research has a number of implications that may manifest itself in the management of migration policy. The fact is that specialists in the engineering sector are extremely valuable personnel not only for the private sector, but also for the state. Today, any government program that is intended to be implemented must attract specialists from the engineering sector, which today is large and competitive.

6. CONCLUSIONS

Summing up, it should be noted that migration as a phenomenon arose and developed simultaneously with the development of human civilization. But in recent years, migration movements in the modern world have become significant, which, of course, is one of the signs of its globalization.

Migration and security are values that are considered fundamentally different. Migration has a visible embodiment in the people involved in the process of spatial movement, and security is more symbolic than a specific visual expression since it is more identified with structures and institutions. Migration tends to be measured quantitatively; does not, in its existence, depend on, or depends only to a certain extent on, the qualitative assessment to which the assessment has an impact on prohibiting or encouraging migration, and security is inherently linked to the qualitative assessment. Migration is a real and possible challenge to conservation. It has a direct impact on security as a state and whether or not it is consistent with security as a goal.

For a long time, migration was not covered by the discourse of security, since the view of security was limited, firstly, only to the security of the state, and secondly, to geopolitical and military threats, that is, of external nature, while migration was seen as a matter of internal affairs, but everything changed at the beginning 2022 with the war on the territory of Ukraine.

The vectors of influence of labor migration of specialists in the field of engineering on economic and national security differ depending on whether we are talking about the country of destination or origin of migrants. The dangers of migration are primarily recorded in host societies, which, in general, is paradoxical, since thanks to immigrants they replenish their human and intellectual resources, that is, the main factors of production, thereby increasing economic security. Despite this, the population sometimes has a negative attitude towards migration because of its cost, that is, an additional burden on the social assistance system, the users of which are often migrants, and an increase in the burden on education, transport, and housing systems. But not in the case when a neighboring country has a big crisis and needs support. Of course, we did not cover all the regions where engineering specialists migrated from Ukraine, since it is not realistic to understand for one study.

Based on the results of the analysis, we presented several models to counteract the negative impact of the main challenges faced by engineering labor migrants in modern conditions. The study has a number of limitations and concerns the use of modeling technology for only one region as an example. Further research should concern not only an individual worker in the field of engineering but also entire engineering enterprises.

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