

“Science in times of crisis: How does the war affect the efficiency of Ukrainian scientists?”

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SCIENCE IN TIMES OF CRISIS: HOW DOES THE WAR AFFECT THE EFFICIENCY OF UKRAINIAN SCIENTISTS?

Abstract

This study aims to assess how to prevent the loss of academic potential due to the full-scale war unleashed by Russia on the territory of Ukraine. The paper establishes the relationship between the location of Ukrainian researchers and their ability to engage in scientific activity and determines the factors that decrease scientific efficiency during the war. Moreover, it identifies the influence of the scientists' place of residence on their scientific efficiency. The sample comprises 172 lecturers from Berdyansk State Pedagogical University, Ukraine. This university was chosen because it was located in the temporarily occupied territory at the beginning of the war and later was relocated to another city. 40.8% of respondents who left the temporarily occupied territory for the Ukraine-controlled territories noted a decrease in the effectiveness of their scientific activities. Furthermore, 33.8% could not think about science at all. The most challenging situation is for those who went abroad: 55.6% show decreased scientific activity, and 27.7% note its complete absence. The most significant reasons that prevent scientific activity are financial instability, lack of access to equipment, loss of relevance of previously started research, inability to concentrate on science, poor quality or lack of Internet, and adaptation to a new residence.

Keywords

scientific efficiency, scientific activity, crisis, large-scale war, university, temporarily occupied territory

JEL Classification

I23, J24, H56, O15

INTRODUCTION

Ukrainians, regardless of their professional affiliation, suffer from a sharp change in the usual run of things, situation breakdown, and worsening in all life-activity spheres due to the full-scale war that Russia unleashed on the territory of Ukraine. Any war is always a traumatic and borderline experience because it unexpectedly damages people's life and career plans or prospects and leads to unanswered obstacles and trials (Stone, 2022b; Danylyshyn, 2022). These challenges are significant for individuals and organizations (Kozmenko & Ostapenko, 2022; Lopushniak et al., 2022; Ostapenko, 2022; Foris et al., 2022).

Such a crisis in any person's life causes uncertainty (Pavlova et al., 2022; Suchikova, 2023). People who are constantly under fire are beginning to get used to this new reality, to understand the sounds of incoming shelling, and to look for rules and regularities when they are under fire. Any human brain begins to look for signs of normality in it, trying to put this abnormal situation in order one way or the other.

In this sense, professions related to intellectual and creative activities are especially vulnerable. Cultural actors, artists, and scientists need more resources than representatives of other professions. In particu-

lar, they need high motivation, satisfaction with the creative process, a high level of insistence on high standards, extreme attention intensity, persistence, originality, or intuition. However, scientific creativity is forced to obey the formal criteria of scientific rationality, which are self-debatable.

In addition to the academic load, lecturers of Ukrainian universities must engage in scientific work. This type of activity, without a doubt, consumes time and motivation. However, scientists usually have high internal work motivation and ‘taste for science,’ are more willing to accept relatively lower wages and place more value on working conditions that provide independence and flexibility (Roach & Sauermann, 2010; Zacher et al., 2019). Today, instead of being conservative and resistant to any changes, scientists must be self-guided, proactive, flexible, and adaptable in managing their possibilities (Tee et al., 2022).

That is why it is crucial to determine the factors that affect scientific activity to prevent the loss of academic potential, which is necessary for the postwar reconstruction of Ukraine.

1. LITERATURE REVIEW

At the beginning of a full-scale invasion, the scientific community reacted sharply to the Russian invasion. On March 1, 2022, the journal *Nature* published “Rebuke against Russian science grows as the deadly conflict enters its sixth day” (Gaind & Else, 2022). The article states: “Russia’s unprovoked invasion of Ukraine has unleashed an outpouring of condemnation from scientists and research organizations worldwide. Some organizations in Western nations have moved quickly to sever links with Russia – cutting off funding and resources and ending collaborations with Russian scientists.”

A very controversial article appeared on the pages of *Cell* magazine with the following message: “We have been inspired by and applaud the labs around the world that have opened their doors to displaced scientists and remain committed to supporting scientists, whoever and wherever they are. Because science requires collaboration and trust, we urge the scientific community to continue efforts like this and to remain united, especially in times as difficult as these” (Stoika et al., 2022).

Ukrainian scientists have begun to actively call on countries to exclude Russia from their scientific programs and call on Russian institutions and academic leaders to condemn the invasion. Gradually, there were more and more such voices. So, on the 100th day of the war, the editors of the *Proceedings of the Shevchenko Scientific Society. Medical Sciences* appealed to the authors and readers of the publication with the appeal “We

overcome all enemies: From plagues to people!” in the editorial article with the telling title “The war and science in Ukraine: We can contribute to victory” (Zayachkivska et al., 2022). Ukrainian scientists who were abroad at the beginning of the war and worked in foreign institutions also took a strong position (Boglaienko, 2022).

At the same time, Russia continues to destroy Ukrainian scientific infrastructure; to this day, scientific and cultural heritage is being destroyed every day (Suchikova & Tsybuliak, 2023). As a result, Ukrainian scientific and academic potential is threatened.

Many scientists moved abroad and continued their work there (Stone, 2022c). Stone (2022a) stated, “After the invasion, Ukrainian researchers turn into resistance fighters and refugees.” Many scientists went to the front (McNutt & Hildebrand, 2022), while others continued to work. Moroz (2022) considered in his note “Here in Ukraine, science continues under air raids” for *Nature*: “I write this from my office – and sometimes from our air-raid shelter, a small room on the ground floor, tucked under the stairs with a kettle, tea, a store of bottled water, and six chairs arranged around a desk.” Of course, this situation fundamentally affects the scientific activity of Ukrainian scientists.

Fiialka (2022) showed that “Russian military aggression had a significant impact on the publishing activity and scientific interests of Ukrainian researchers, influenced the attitudes and motives of Ukrainian scientists regarding the conduct of

scientific activity and the publication of its results in scientific publications.” She emphasizes that it is now imperative to prevent the loss of Ukraine’s scientific potential, but these processes are already taking place. Thus, the main factors that negatively affect scientific and educational activities are psychological discomfort, lack of funding, changes in scientific relationships, and difficulties collecting experimental samples. Kurapov et al. (2023) reported the results of a survey of university students and teachers, which indicate that most respondents (97.8%) reported worsening of their psycho-emotional state, including depression (84.3%), exhaustion (86.7%), loneliness (51.8%), nervousness (84.4%), and anger (76.9%).

The impact of war on the psycho-emotional state of the civilian population has been widely studied in the example of other wars (Hanson & Vogel, 2012; Garry & Checchi, 2020; Borho et al., 2020). Wars harm health directly through hostilities and indirectly through broader socioeconomic consequences (Garry & Checchi, 2020; Grundy et al., 2008; Guha-Sapir & van Panhuis, 2002). Moreover, the consequences of the war will be felt for many years even after its end (Bogic et al., 2015; Murthy & Lakshminarayana, 2006; Ghosh et al., 2004; Cardozo et al., 2004).

Sheather (2022) gave the world an important message on the second day of the war: “As Russian troops cross into Ukraine, we need to remind ourselves of the impact of war on health.”

However, against the uncertainty and instability in Ukraine due to large-scale war, Ukrainians are gradually looking for new opportunities for recovery and further professional activity. Enlisting new resources that enable one to overcome unexpected and unexpected challenges and traumas in career development is seen as critical to achieving favorable career outcomes (Hall, 2004). Moreover, the primary motivating factor for scientists is internal satisfaction with their research results (Blind et al., 2018, 2022).

Polishchuk et al. (2022) identified the needs of Ukrainian academics during the war, including free access to research databases, journals, archives, Internet platforms, educational materials, online libraries, software, etc. This suggests that

Ukrainian scientists are turning into front-line soldiers: “In the face of the ongoing Russian invasion, scientists in Ukraine and their supporters have shown tenacity and creativity to continue working in their country and elsewhere” (Poskett & Shaw, 2022). Maryl et al. (2022) analyzed available support offers for Ukrainian scientists but noted that more than such offers is needed to meet all professional needs.

A survey conducted within the framework of UAScience.Reload showed that “74.5% of respondents are ready to volunteer as experts in projects related to strengthening Ukraine’s defense capabilities/reconstruction (Harashchenko et al., 2022). On average, they are willing to spend 14.15 hours a week on this activity.” The forces are being mobilized to contribute to the victory. However, this war changes not only Ukrainians but also the whole world (Morrice, 2022; Bosse, 2022). It is vital to establish new narratives (Götz & Staun, 2022), and scientists should become a voice in this process (Kulyk, 2016; Sasse & Lackner, 2018).

Therefore, although the war exhausts and demotivates the Ukrainian scientific elite, scientists are trying not only to survive but also to continue developing Ukrainian science.

The impact of the war on the scientific potential and academic staff of Ukrainian universities and institutes is now widely researched. Lavrysh et al. (2022) outlined the key problems that the university must solve: preservation of human capital, student-orientated educational process, flexible curricula and schedules, internationalization, career development, and psychological and physical safety of teachers and students.

However, no studies are devoted to the relationships between the location of scientists and their scientific effectiveness. The factors that hinder the scientific activity of teachers and the connection of these factors with the war have yet to be adequately covered. Additionally, the mandatory performance of the entire workload by lecturers (including scientific work) during the war, taking into account the security situation, has not yet been resolved. No studies are devoted to the scientific effectiveness of scientists under occupation and whose universities relo-

cated during the war. Thus, this study aims to determine how a Ukrainian scientist's location affects his/her scientific activity and what factors prevent the restoration of scientific efficiency during the war.

2. METHODS

2.1. Participants

The analysis involved 172 representatives from the academic teaching staff of Berdyansk State Pedagogical University. This university was chosen because it was located in the temporarily occupied territory at the beginning of the war and then was displaced. Displaced universities are characterized by the fact that some employees are inter-

nal migrants (moved to the territories controlled by Ukraine); some are external migrants (moved abroad); and others remain in the temporarily occupied city but continue to work online at the university.

Organizing a centralized evacuation from temporarily occupied cities is impossible, so everyone makes decisions independently, considering the perception of security and family circumstances. Thus, the survey was anonymous for the safety consideration of the respondents.

Figure 1 shows the distribution by age, academic degree, and English proficiency. By the time of the survey, more than half of the respondents left places of temporary occupation and 10.5% of them moved to other countries (Figure 2).



Figure 1. Respondents' characteristics



Figure 2. Distribution of respondents by place of stay

2.2. Instruments and procedure

The study used a questionnaire survey in Google Forms and semi-structured individual interviews. The research methodology is based on qualitative-quantitative analysis with individual interviewing of the target group and questionnaires. Such an approach ensures a deep understanding of the influence of the war on the scientific efficiency of Ukrainian scientists.

To collect data on the scientific efficiency of researchers, a questionnaire containing 11 closed questions) was developed:

- Three questions related to age, scientific degree, and level of English language proficiency;
- Eight questions are constructed according to the quantitative indicators of evaluating the effectiveness of scientific activity in the university.

These questions were based on quantitative assessment indicators of the efficiency of the scientific activity at the university. The survey was carried out during a week in July 2022. The response rate reached 82% (172 respondents).

A semi-structured individual interviews evaluated the scientific efficiency of scientists during the crisis. 20 respondents with various experiences during the war were engaged: a place of stay, age, and academic degree. It was conducted online under consideration of safety and due to the limited physical presence in different parts of Ukraine and the world. Moreover, for safety considerations, the

interview transcripts and video recordings have been deleted immediately after processing the received data. The respondents have given their consent to participate in this analysis and to use their personal data in the most general terms.

2.3. Research methods

For the mathematical interpretation of survey results, the study used combined methods, which included models of linear and multiple regression analysis and SPSS (Statistical Package for the Social Sciences) software. Linear regression was used to check the factor dependence hypothesis of scientific activity on the respondent's place of stay.

2.4. Mathematical check of the research model

Before analyzing the relationship between the location of scientists and the independent variables, several tests have been carried out to check the data suitability for the regression analysis.

The multicollinearity analysis helped to research the uniqueness of the independent variable since its presence can contribute to the overestimation of standard errors and the false absence of statistically significant results (O'Brien, 2007).

The tolerance index (TI) and variance inflation factor (VIF), which show the degree of relationship between the independent variable and other explanatory variables in the regression model, were investigated to determine the multicollinearity among the independent variables (Draper & Smith, 2012).

The presence of multicollinearity for a specific variable is not confirmed if the tolerance level is greater than or equal to 0.01 and the VIF value is significantly less than 10. Table 1 shows that all variables meet the tolerance level and variance inflation factor (it is within the framework of 1-5, indicating the moderate correlation between the given predictor variable and other predictor variables in the model) (Chatterjee & Simonoff, 2013). This suggests that multicollinearity is absent among the explanatory variables.

Table 1. Multicollinearity check of the research model

Model analyzing the influence of war on the effectiveness of lecturers' scientific activity	Collinearity statistics	
	Tolerance	VIF
War prevented you from completing previous scientific research	0.873	1.146
Internet access	0.959	1.043
Change in scientific interests since the beginning of the war	0.846	1.183
The best channels for informing about scientific opportunities	0.942	1.061
Willingness to participate in a grant or other financing	0.836	1.196
The influence of war on the choice of scientific journals for publication	0.855	1.170
Submission of articles to specialized Ukrainian journals during the war	0.860	1.163
The level of information about opportunities for scientists at the university	0.888	1.126

In order to check the linear regression assumptions, the study plotted the distribution graph of the standardized residuals (PP), which compares the observed cumulative distribution function of the standardized residual with the expected normal distribution (Figure 3). Since the points are aligned on a 45-degree baseline, the data are normally distributed (Thode, 2002).

Based on the location of the basic regression model, a scientist has a statistically significant influence on scientific activity. The results indicate the necessity of additional research on the relationship between scientific efficiency and scientific activity paying attention to the location of scientists.

In order to identify the nonlinearity or other trends, which are typical for one predictor, the paper considered the graphs of partial regression to determine the relationship between the dependent variable (scientist's location) and the independent variables (scientific efficiency) depending on other independent variables (Figure 4).

Figure 4b shows the presence of three areas, which is well consistent with the current situation in the country: those scientists who remained in the occupied territory have the least access to the Internet, and those who have gone abroad have the

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: Change of residence since the beginning of the war

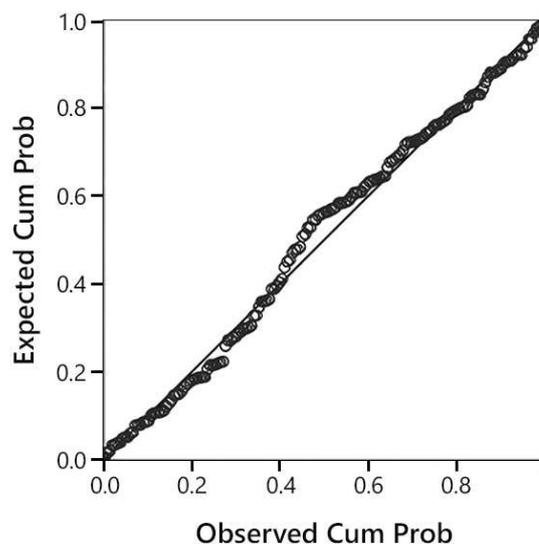
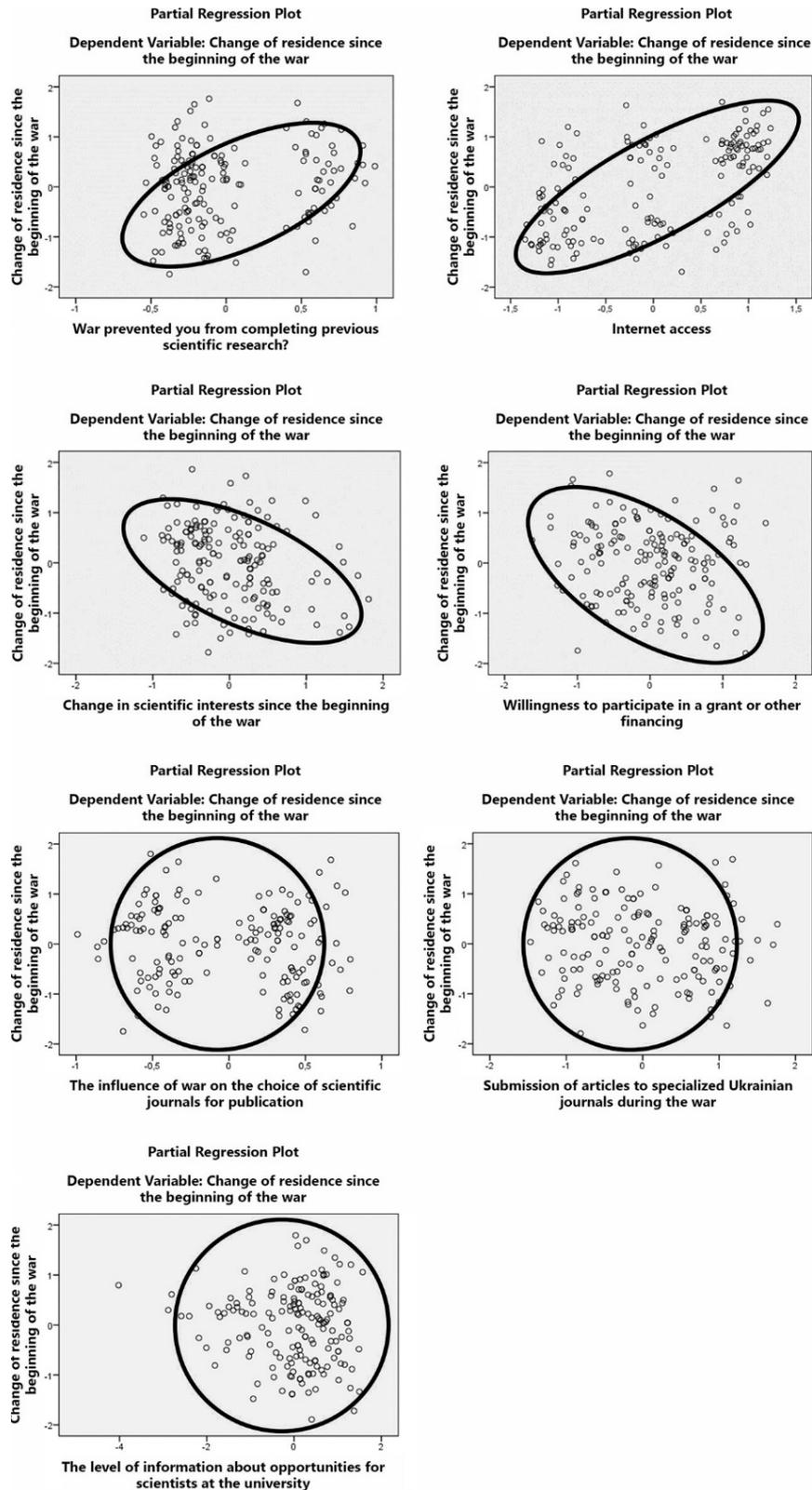


Figure 3. Normal P-P graph of standardized residuals



Note: a) impossibility of completing the preliminary research, b) access to the Internet; c) change of research interests since the beginning of the war; d) readiness to participate in a grant or other financing; e) selection of scientific journals; f) submission of journal articles during the war (publication activities during the war); g) need for information awareness of scientific opportunities.

Figure 4. Partial regression between the scientist's place of stay of the scientist and other indicators evaluated

best Internet. The need for information awareness of scientific opportunities for almost all respondents shows an insignificant but positive correlation (Figure 4g). In general, the indicators show a low level of partial correlation in the vast majority. This result is likely because most of these indicators have a pairwise dependence on one another. In this case, applying multidimensional analysis or qualitative assessment is reasonable.

3. RESULTS

The main challenge for any Ukrainian and, in particular, for scientists is the security situation, which primarily depends on the place of stay. Some scientists have gone abroad; others remain in the territory of Ukraine. It is worth mentioning that the territory of Ukraine is non-uniformed in terms of security. Thus, the following territories can be conventionally identified:

- areas of active combat operations or areas of daily shelling;
- occupied territories, where the occupation order is established and Ukrainian legislation and security guarantees do not apply;

- territories where there are no active combat operations and which are relatively secure.

Now survival is the primary task of every Ukrainian, and the values of self-realization naturally take a back seat.

3.1. Brief analysis of displaced universities of Ukraine

Today there are 16 relocated universities in Ukraine, some of which have been relocated for the second time (MON, n.d.). Universities in the Zaporizhzhia region (Berdiansk State Pedagogical University, Bogdan Khmelnytsky Melitopol State Pedagogical University, Dmytro Motornyi Tavria State Agrotechnological University) were relocated to the city of Zaporizhzhia. Universities in other temporarily occupied territories were relocated outside of their regions. The map of relocated universities is shown in Figure 5. At the time of this analysis, the city of Kherson has already been de-occupied; however, for security reasons, universities continue to operate in temporary locations. Today, it is difficult to estimate the number of university lecturers who continue to work but are still on the territory of the temporarily occu-

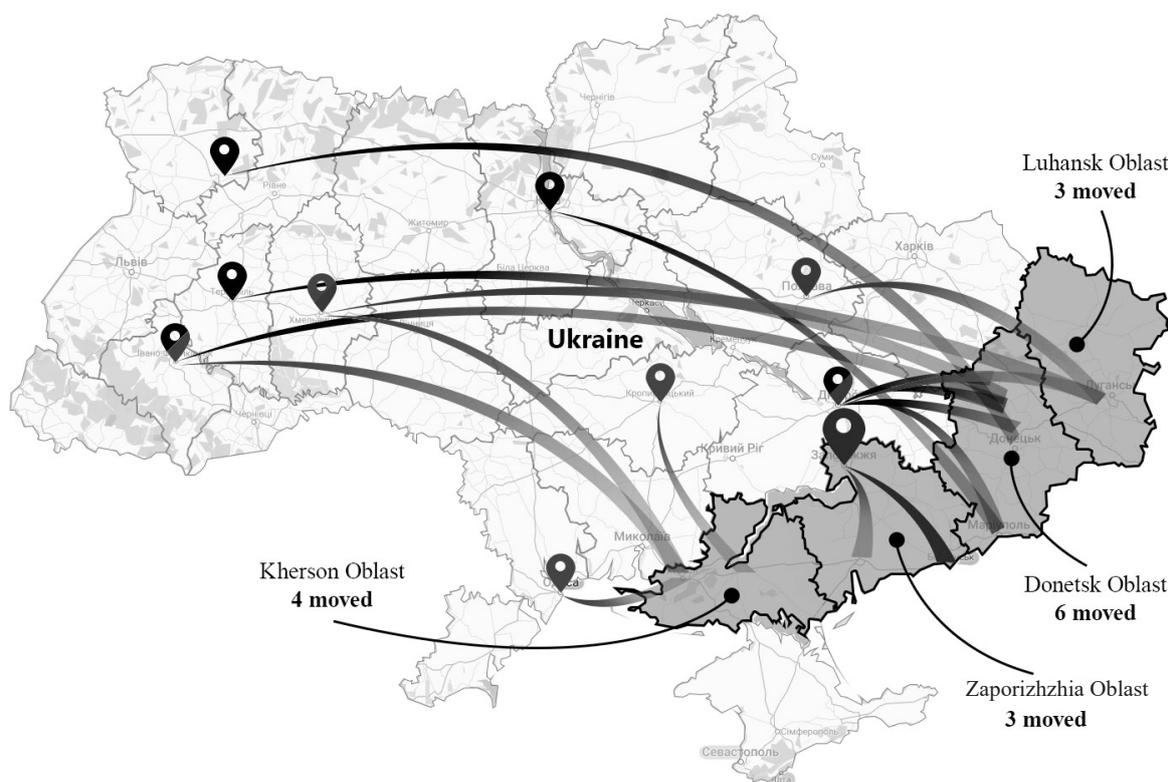


Figure 5. Map of displaced universities in Ukraine

pied cities because this process is variable – many are still looking for ways to evacuate, even though the temporarily occupied cities are closed to entry and exit. In general, each displaced university continued to operate, recruited students, and graduated bachelors and masters. In such universities, education is online.

The displaced universities have lost the material and technical base that remained in the temporarily occupied territories. To resume their activities, such universities need much more resources than those located in the territories of active hostilities. Therefore, today there are several support programs for displaced universities. Of course, lecturers of such universities have an additional stress factor, namely, the university’s relocation. Due to the complete loss of material and technical base, scientists cannot access scientific equipment to resume their activities. Such universities quickly implemented the concept of a “University without walls” (Goldschmid, 1976; Dallmann, 2021; Neame et al., 1999; Stoddart et al., 2006). Therefore, this study investigates the ability of universities to preserve scientific potential and the renewal of scientific activity.

3.2. Correlation dependencies

Table 2 shows the correlation between the estimated indicators of scientific efficiency and the scientist’s place of stay.

Access to the Internet has a strong correlation with the scientist’s place of stay of the scientist. Indices such as “change of research interests since the be-

ginning of the war” and “readiness to participate in a grant or other financing” showed the average correlation dependence.

No correlation dependences were found between the scientist’s place of stay and his/her selection of scientific journals for publication, publication activities, and the need for information awareness of scientific opportunities. Thus, regardless of the scientist’s place of stay, the crisis significantly impacted their scientific efficiency in the same way. The lack of correlation may also result in a misleading impression that these factors do not depend on the scientist’s place of stay; however, other dependence types (non-correlated) require a detailed analysis.

3.3. Standardized coefficients

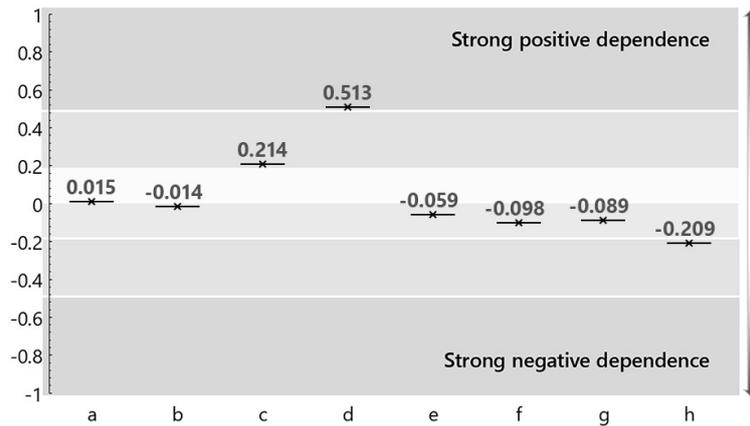
Figure 6 presents standardized coefficients; the Internet positively depends on the scientist’s place of stay. The possibility of finishing earlier research and the need for awareness of scientific opportunities also depend on the scientist’s place of stay.

Such factors as age and academic degree do not depend on the scientist’s place of stay. It means that scientists, regardless of age and stages of their scientific career, made decisions about their evacuation from the territories under occupation. The lack of clear dependency between such variables as publication/grant activities and place of stay is also interesting. However, moving from the territories under occupation does not mean that scientific activity will be quickly recovered.

Table 2. Correlation dependence between the estimated indicators of scientific efficiency and the place of stay

No.	1	2	3	4	5	6	7	8
1	–	0.108	0.500	–0.212	–0.102	0.069	–0.034	–0.074
2	0.108	–	–0.118	–0.139	–0.014	0.063	–0.260	0.177
3	0.500	–0.118	–	0.026	0.043	0.104	0.105	–0.067
4	–0.212	–0.139	0.026	–	0.309	–0.228	0.024	–0.095
5	–0.102	–0.014	0.043	0.309	–	–0.199	–0.215	–0.051
6	0.069	0.063	0.104	–0.228	–0.199	–	0.111	–0.183
7	–0.034	–0.260	0.105	0.024	–0.215	0.111	–	–0.043
8	–0.074	0.177	–0.067	–0.095	–0.051	–0.183	–0.043	–

Note: Constant: 1 – change of place of residence since the beginning of the war; 2 – impossibility of completing the preliminary research; 3 – access to the Internet; 4 – change of research interests since the beginning of the war; 5 – readiness to participate in a grant or other financing; 6 – selection of scientific journals; 7 – submission of journal articles during the war (publication activities during the war); 8 – need for information awareness of scientific opportunities.



Note: a) age; b) academic degree; c) impossibility of completing the preliminary research; d) access to the Internet; e) command level of English; f) grant activities; g) publication activities; h) information awareness about opportunities for a scientific activity to be recovered.

Figure 6. Standardized coefficients

3.4. Main reasons that prevent scientific activity from being recovered

Figure 7 shows the distribution of respondents' answers to the question "Estimate your scientific activity during the war."

Figure 8 analyzes the main reasons that prevent lecturers from participating in scientific activities. It shows the value of each of the negative factors that prevent scientific activity and their comparison with the average value for all groups of scien-

tists (those who left abroad; left the occupied territory but remained in Ukraine; remained in the occupied territory).

73.3% of the respondents did not complete their previous research due to the war; this indicator is the highest for those who moved abroad and the lowest for those who remained in the occupied territories (when compared to the average value of $\Delta = 10\%$ and $\Delta = 5.8\%$).

The loss of relevance of the research is in the range of [12%; 16.7%] for the three test groups.

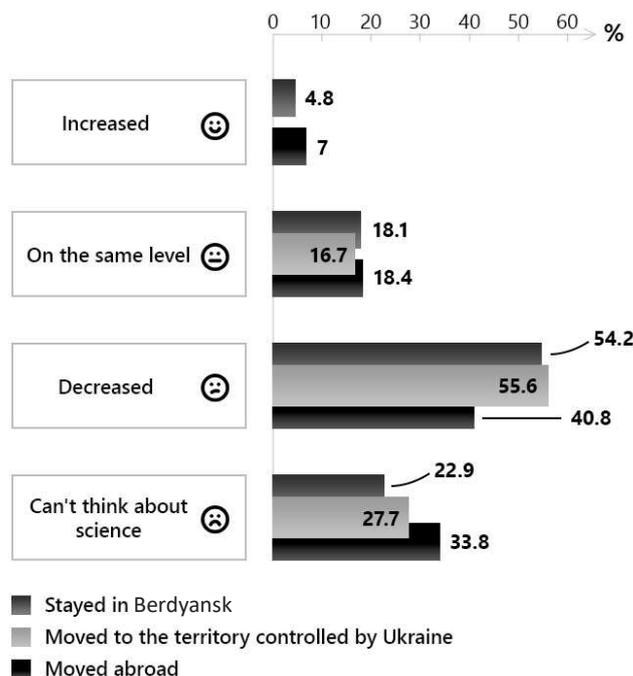
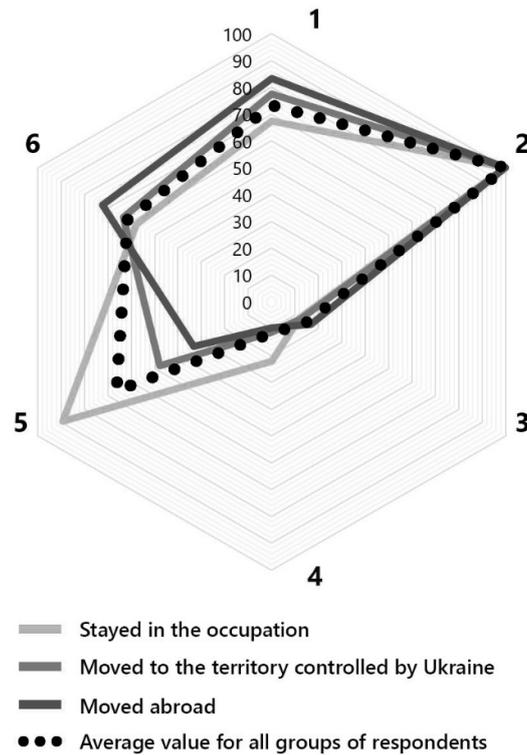


Figure 7. Subjective perception of scientific efficiency of lecturers depending on the place of stay



Note: 1 – The previously started research had not been completed due to the war; 2 – I do not have access to the scientific equipment; 3 – My research had grown stale; 4 – I cannot concentrate on the science; 5 – I have almost no Internet or the Internet speed is very low; 6 – I believe that the efficiency of the university’s scientific activity will decrease by the end of this calendar year.

Figure 8. Subjective assessment of scientific activity by university lecturers

Regardless of the place of stay, each scientist also noted that losing access to the material and technical base of the university, resources, and scientific equipment is the main factor that stops further scientific research. Scientists who left occupied territories could not even take laptops with them, so they did not have access to their previous groundworks. Moreover, in the first months of the war, the website and the institutional repository did not work, so access to the scientific texts on current research issues was also lost. Later (after three months of war), it was possible to restore the work of the website by transferring it to the cloud, but the institutional repository could not be restored. This moment also has a psychological nature because the scientists lost the archives of their publications. During the interview, some of the respondents shared their emotions and other personal information that confirms the results of the questionnaire survey:

1) Respondent 1: “You lose everything! It demoralizes and discourages people from continuing to work.”

2) Respondent 2: “I have been working for so many years, collecting my groundwork in our repository, and now I do not see the results of my work. Does it make sense to start with a clean slate?”

3) Respondent 3: “I just have to look for opportunities, how and where to work. Now I live in a dormitory, my entire family is in one room. That is simply awful! You cannot focus on something, much less engage in research, especially new issues.”

4) Respondent 4: “You know, it is so difficult to work for a long time on one issue and spend its own time on it. Suddenly it becomes untypical, and you understand that no one needs your improvements yet. I am not even sure that after the end of the war I will return to my research. We likely have to think about new issues to help Ukrainians cope with the war trauma. But I do not know where to get the strength for this.”

One main factor that makes it impossible to carry out scientific activity is access to the high-quality

Internet. 89.2 % of those who remained in the occupied territories stated that the Internet quality is very poor; often it is even absent. While those in the free territories of Ukraine and abroad mostly have good access to the Internet; 47.9 % and 33.3 % of the respondents complained about the quality of the Internet, respectively.

At the end of the survey, respondents were asked, “What do you think the scientific efficiency of the university will be at the end of this year compared to 2021?” Most scientists (61.6 %) believe that this scientific efficiency will decrease compared to 2021. In this sense, the most optimistic forecast was given by lecturers who remained in occupied territories ($\Delta=+3.8\%$ when compared to the average value). Respondents who moved abroad showed more skepticism ($\Delta=-10.7\%$). Based on their feelings and reflexing, they project onto the entire university.

This result deserves careful consideration because those who moved abroad are safe, and the safety factor has no impact on their scientific productivity. Surprisingly, the results are the opposite. This could be explained by poor adaptation and financial instability. Those who remained in the occupied territories and moved to the territories controlled by Ukraine feel the war-induced danger daily.

3.5. Factors that influence scientific efficiency

Respondents' answers to the question “What prevents you from being effective in scientific work during the war?” showed that the most significant negative impact is emotional exhaustion due to a sharp change in the usual living conditions, problems with communication, and access to the Internet. During the interview, some of the participants shared their personal information:

1) Respondent 1: “Since the beginning of the war, I could not think about science at all. It was complicated: empty shelves in grocery stores, no mobile communication, no Internet – everything you are used to has changed instantly. We had to somehow adapt to new living conditions. Only later, in the summer, when I moved to the territory controlled by

Ukraine and organized my daily routine, I wrote my first scientific article since the beginning of the war.”

- 2) Respondent 2: “It became very difficult for me to work and find internal resources to continue my full-time work, to fulfill my job duties, terms and conditions of the contract. I cannot focus on the science right now; the laboratory equipment is left in the temporarily occupied city – I lower my hands; I have to think about how to live further.”
- 3) Respondent 3: “Our family has already changed its place of stay four times during the war. Renting an apartment, arranging living conditions in a new place, buying things and clothes – this requires large financial expenses. When we left, we could not take everything. There was an idea to write a grant application to get the financing, but this procedure consumes a lot of time and resources.”
- 4) Respondent 4: “Science became impossible for me when the war started. In the first instance, I was physically and psychologically bone swollen; I tried to survive and help others if possible. It was difficult to do anything at all because the Internet was bad, and there was no access to many scientific resources. However, after VPN was installed, scientific work has slightly improved, but I do not really believe that I can get the financing for my research while being under occupation.”

When asked what contributes to the efficiency of their scientific work during the war, some respondents noted that the victory of Ukraine and the end of the war would be enough to restore their scientific activity. During the interview, some of the participants shared their thoughts:

- 1) Respondent 1: “Now I work very hard, because I feel the need to do something to keep from going crazy. And scientific work diverts my attention away from today's realities: constant air raid alarms, explosions, suffering, wandering.”
- 2) Respondent 2: “For me, as a young scientist, it is important not to lose the pace of the scientific

Table 3. Factors that influence scientific activity

Related to the war	Unrelated to the war
Access to the Internet	Insufficient level of foreign language
Lack of interest and desire to engage in scientific activity	Insufficient preparation experience for a grant application
Impossibility of participating in scientific research because the scientific equipment is not available	Lack of a balanced team for scientific research
Uncertainty about the future situation	Lack of access to data, scientific articles
Anxiety, fear, constant danger	Weak belief that financing can be obtained
Financial instability	Selection problems of topical research topics
–	Excessive load
–	lack of time
–	Low science funding

ic activity, that is why I adhere to all contract requirements and plan my career progression.”

- 3) Respondent 3: “First of all, I think about my relatives and their safety; I help and do everything to make their life a little easier during this difficult period. So I am writing individual grant applications to get additional financing.”
- 4) Respondent 4: “We must make sure to unite, do science and work as a team: it will definitely be more effective. In particular, my colleagues and I said that if we make our contribution to science, we support our university, and the country and lead to victory.”

The analysis identified the factors that influence the level of scientific efficiency and thus the scientific efficiency of each scientist (Table 3). These factors can be conventionally divided into those related to the war and those that existed before the start of the war.

Thus, even before the war, there were certain limitations that influenced university lecturers. However, entirely new and previously unfamiliar challenges to modern scientists have appeared since the beginning of the war.

4. DISCUSSION

The results of this study are preliminary and do not reflect the general picture at each subsequent moment in time because the war is still ongoing. Someone has already been able to adapt to new realities; others, on the contrary, feel exhausted. Additionally, at the time of the

survey, the situation with the Internet in the country was generally stable, while there was almost no Internet in the temporarily occupied territories. However, the situation changed at the time of the data processing and writing of this paper. Today, Ukraine’s entire territory deals with electricity consumption restrictions. In all cities in Ukraine, electricity is turned off for up to 18 hours a day. This leads to a poor access to the Internet. Today, it is becoming a typical situation when university teachers take exams and attend online events at Unbreakable Points – centers where everyone can charge gadgets and use the Internet.

Nevertheless, the obtained results are important for the general understanding of the war factors affecting Ukrainian science. These findings support Polishchuk et al. (2022), Lutsenko et al. (2023), and Fialka (2022), who demonstrated common problems that prevent scientists from fully resuming scientific activities. They include a feeling of danger, a psycho-emotional state, and problems with access to the Internet and scientific equipment.

The war significantly influenced the scientific efficiency of almost every university lecturer. This situation is common to all universities and scientific institutions in the country. No matter where the scientist is, his/her thoughts are always at the starting point: February 24, 2022. Scientific activity is considered a creative process that requires clarity of thought, inspiration, understanding of the activity, enthusiasm, and a calm and productive working state from the researcher.

However, the analysis of the Scopus database shows that the publication activity of Ukrainian

scientists decreased by only a quarter compared to 2021. In addition, the number of publications in Scopus was assessed as of February 3, 2023. At that time, not all articles (magazines) were indexed by the specified resource (the final data for 2022 will be available only at the end of May 2023). That is, the decrease in the number of publications compared to 2021 will be even smaller. This shows that, despite all factors and limitations, Ukrainian scientists feel the importance of their mission and continue to preserve and develop Ukrainian science. At the same time, it proves the opinion of scientists about the importance of not only quantitative indicators but also the value of the ideal practice of science as a service to humanity (Edwards & Roy, 2017), even in times of such crisis phenomena as war.

This study has limitations. First, it focused on quantitative indicators when evaluating the effectiveness of scientific research activities by

scientists of only one university, which was first temporarily occupied and then relocated to the territory controlled by Ukraine.

Second, almost all the study's authors are Ukrainian scientists who are directly involved in the processes currently taking place in Ukrainian science due to the full-scale war. The research team is inside the war and caught up in this crisis. Therefore, on the one hand, it allows a more profound and better analysis of the accurate picture of the effects of the war on scientific activity. However, the discussion about the results occurs through reflexing and understanding the new reality. But on the other hand, it can have a subjective effect on understanding the obtained results through specific internal optics because this crisis affected every Ukrainian scientist.

The dynamics of reviving the scientific activity of teachers in Ukrainian universities needs further research.

CONCLUSION

The purpose of this study was to establish the relationship between the location of Ukrainian researchers and their ability to conduct scientific activity, as well as to determine the factors that prevent the restoration of scientific efficiency during the war. The analysis interviewed lecturers from Berdyansk State Pedagogical University, which is temporarily displaced due to the occupation of the city of Berdyansk.

The results demonstrate that scientific efficiency depends to a large extent on the location of the lecturers. 40.8% of those who moved from the temporarily occupied city of Berdyansk to Ukraine-controlled territories note a decrease in the effectiveness of their scientific activities; 33.8% at the time of the survey answered that they could not think about science at all. 54.2% of the lecturers who were in Berdyansk at the time of the survey reported a decrease in scientific activity, but only 22.9% were unable to resume their scientific activity. The most significant percentage of teachers for whom the war affected scientific activity are those who moved abroad: 55.6% show a decrease in scientific activity, and 27.7% – a complete absence of scientific activity.

The respondents noted the following reasons that prevent scientific activity: lack of access to scientific equipment; loss of relevance of previously started research; inability to concentrate on science; poor quality or lack of Internet. The war prevented 73.3% of the respondents from completing their previous studies, the highest for those who moved abroad and the lowest for those who remained in the occupation. This indicates that the scientific activity is hindered by problems related to adaptation in a new country. Scientists also noted that financial instability also affects their scientific activity. The loss of material and technical base to carry out research is the main factor that prevented the scientists of Berdyansk State Pedagogical University from continuing the scientific research that started before the war. All respondents stressed this factor.

The results obtained during this study demonstrate that Ukraine must focus on preserving its academic potential because Ukraine's post-war recovery will need specialists capable of conducting productive activities and training a new generation of specialists.

AUTHOR CONTRIBUTIONS

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