Graduate Students, Postgraduate Studies and Thesis Defense: Success/Failure Factors

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Abstract—**In this paper, the authors attempted to answer the question about the reasons for the unsatisfactory state of learning outcomes in graduate school. A multidimensional typology of graduate students was carried out (using the example of Dubna State University) using cluster analysis with preliminary factor analysis. The authors identified the key latent factors: interaction with the supervisor, sociocultural potential, organization of work on the thesis, career opportunities underlying the cluster model. Inside the graduate community, there are four internally homogeneous clusters: "Depressed", "Resource", "Disappointed", and "Random". It is shown that the most promising from the point of view of scientific "growth" and the defense of the thesis are graduate students of the second group — "resource". At the same time, the strongest motivational factors that act as a guarantor of the successful completion of postgraduate studies and defending a thesis are still the established interaction with the supervisor and interest in the research topic — the traditional "values" of any graduate student.**

Keywords—post graduate school; post graduate students; postgraduate students typology; thesis defense; cluster analysis; factor analysis

I. INTRODUCTION

In modern transitive society, many social institutions are undergoing serious structural and substantive changes. For Russian postgraduate studies, the effects of these changes manifest themselves in the form of two leading trends: a decrease in the number of people entering graduate school (consistently, starting in 2011) simultaneously with a decrease in the number of people defending a thesis (the proportion of people who defended their thesis reached a minimum in 2017 since 2014 does not exceed 20%) [1].

In accordance with the Federal State Educational Standards for the Training of Higher Qualification Personnel, graduate school has become the third stage of higher education. What does this mean? In fact, graduate school is embedded in the standard of education with all its attributes:

educational programs and curricula; high classroom load - lectures and seminars with mandatory attendance; a strict system of tests and examinations with grades in the test books. At the same time, graduate students, as a rule, are already adults (the average age of a Russian graduate student, according to 2017 [2], is over 28 years old), often bearing material responsibility for themselves and their family. The low level of postgraduate scholarship payments — the standard size of state scholarship is three times lower than the subsistence minimum — forces many graduate students to work along with their studies. As a result, this leads to the fact that own research work goes to the distant plan.

In parallel with this process, the number of thesis councils is decreasing (by 1.5 times compared with 2010) [3]. We leave out the discussion of the reasons for this state of affairs. There is no doubt, however, that one of the consequences of the reduction in the number of councils has been the reduction in the opportunities for graduate students to defend the thesis.

The President of Russia also drew attention to these problems: at a meeting in January 2019 with the head of the Russian Academy of Sciences V.V. Putin said that graduate school in our country "should be only scientific" [4]. How can the potential of young scientific personnel be included in solving the problem of developing priority areas of science, technology, and technology, ensuring the introduction of breakthrough critical technologies, approved by a presidential decree [5]? Of course, it is the graduate school as an institution that continues to be the leading source of training for such personnel.

The problem of thesis defenses is common to all of Russia, but it is seen as particularly acute for the regions. Dubna, which received the status of a science city in 2001, is considered the "forge" of scientific personnel. Every year more than 60 people enroll in the graduate school of Dubna state University, but only a few of them reach defense.

Against this background, of course, the important task is to understand why this is happening. Is there one answer for everyone? On the other hand, can we select within the graduate community a group for which certain but different factors are pivotal? Is it possible, based on the analysis of the set of variables, to assume that some graduate students have more prospects of remaining in the scientific community, while others have less? Finally, who is currently attracted to science and graduate school in particular?

II. EXTENT OF PREVIOUS RESEARCH

The main problems of modern postgraduate studies within the framework of the discourse on the third level of higher education are reflected in a number of scientific papers published in recent years. So, the questions of the goal-setting of graduate students — "the thesis or diploma of the postgraduate study?" — are considered by B.I. Poor, V.A. Bodrov and others [6], [7]. The problem of postgraduate positioning in the structure of higher education is analyzed by D.Yu. Raichuk, N.V. Minina, B.I. Poor, V.S. Senashenko et al. [8], [9], [10]. The approaches to the organization of the educational process in the new conditions of modern postgraduate studies are distinguished in their works by E.V. Karavaeva, N.A. Platonov et al. [11, 12]. A number of authors are attempting to construct not only a multidimensional typology of graduate students (using the example of graduate students of state universities at Volga Federal District) but also an integral model of modern Russian postgraduate education [13, 14]. Analyzed and other issues related to graduate school and graduate students, as well as prospects for the development of higher education and domestic science [15], [16].

III. RESEARCH METHODOLOGY

A. Research Questions

- Is it possible to identify homogeneous groups with the graduate community of Dubna State University?

- What are the main features and latent factors that have a significant impact on the stratification of the post-graduate community Dubna State University?

B. Empirical Research Base

The study was conducted by the online questionnaire survey of graduate students studying at Dubna State University. The use of this method allowed in a short time (from 1 to 21 November 2018) to cover the sample population (116 people — 2/3 of the total number of students in postgraduate university), sufficient to obtain statistically reliable results (sampling error was 5.18%). Of the total number of graduate students, 38% of the first year of graduate students were surveyed, 33% — the second and 29% — the third and fourth years. Two thirds of respondents specialize in the field of exact, natural and technical sciences, the rest — in the field of humanitarian and social sciences. The median age of the postgraduate students of Dubna State University was 25 years, two thirds of those studying at the postgraduate school of Dubna State University are men. For all selected indicators, the sample adequately represents the population.

The tool for collecting empirical data was a questionnaire consisting of 34 questions combined into 6 blocks. The main informative sections of the questionnaire were aimed at identifying the motivation for admission to the graduate school, professional plans, features of the organization of work on the thesis, assessment of the conditions of study at the postgraduate school of Dubna State University, the determination of factors that impede and facilitate the preparation of the thesis.

IV. RESULTS OF RESEARCH

The initial assumption was made by the idea that graduate students differ from each other in a number of parameters: the motivation for enrolling in graduate school and the efforts made in preparing the thesis, career aspirations, intellectual abilities, and material well-being.

The application of the factor analysis procedure (the principal component method was used followed by the rotation of the factors by the Varimax method) made it possible to move from a space including 39 signs to an adequately interpreted factor model of 7 factors. As a result, the following factors were identified: interaction with the supervisor; personal qualities of graduate students; organization of work on the thesis (including interest in the topic of the thesis, the activity of interaction with the supervisor on the topic of the thesis, planning the issue of thesis defense); career opportunities (including teaching skills development and academic support); system of conditions for research activities; financial; intangible (non-financial) difficulties.

It is curious that a number of variables (for example, difficulties in preparing and publishing articles in journals from State Supreme Qualifying Committee's list) correlated with several factors at once; it was decided to exclude them from the factor model.

The factors identified served as the basis for the further search for homogeneous groups of respondents (cluster analysis, Ward method). As a result, four clusters that were internally homogeneous and significantly different from each other were obtained:

- "Deprived" (includes 28 people, or 24% of respondents total number);

- "Resource" (45 people, 39%);

- "Disappointed" (32 people, 28%);

- "Random" (11 people, 9%).

The first cluster of "deprived" includes 24% of graduate students: they like to study, but difficult material circumstances force them to give up all their time to work not related to the thesis topic, and as a result, there is no longer enough strength for graduate school. It is worth noting that the share of workers in each cluster is high, however, the work of graduate students in this cluster, apparently, is not so paid, and does not allow to solve their material problems.

Also in this cluster there are a lot of those who do not work at all, are dependent on their family members — for them a postgraduate scholarship is an important source of income.

"Deprived" enrolled in graduate school to continue their studies in the profession. They are involved in the educational process: in this cluster the largest percentage of those who constantly speak at scientific seminars, a large proportion of those interested in the topic of their thesis. However, material problems do not allow them to consider the scientific field in the long term — it is in this group that the largest proportion of graduate students who plan to develop a career outside the academic sphere.

In this cluster, there are relatively more students in the areas of "Law" and "Psychology", third-year post-graduate students, and the percentage of girls above the average in the sample — 43%.

The second cluster of "resources" (the most numerous, which is good news) includes 40% of graduate students (of these, slightly less than half of girls). These are the most promising young people from the point of view of successfully completing graduate school — they all plan to defend themselves on time. They are interested in the topic of their thesis; they are constantly interacting with their supervisor. After graduating from graduate school, they would like to engage in research at a university or scientific organization.

In this cluster, the least graduate students are experiencing financial difficulties, but this is primarily due to their own work - it is in this group that the largest percentage of workers is. At the same time, the work of graduate students of this cluster is more often than the average associated with the topic of the thesis, which, of course, cannot contribute to its writing.

In this cluster is concentrated most of the graduate students enrolled in the direction of "Economics", and a significant part of the graduate students of the direction of "Computer Science and Computer Engineering". The proportion of graduate students in the first two years of study is also high.

The third cluster is "disappointed" — 28% (by the way, there are fewer girls here than on average — 31%). In graduate school, they called the supervisor. These graduate students are, in principle, interested in the chosen topic of work, and in the future, they plan to work as researchers. Perhaps due to the chosen specialty — there are many representatives of the natural sciences — it is difficult for them to find another field. However, representatives of this cluster were disappointed in graduate school; they put the lowest marks in terms of the opportunities provided (except for the teaching skills) and the learning conditions created. The graduate school is also criticized for not providing the opportunity to combine work with study. However, in this cluster, the largest percentage of graduate students participated in funded research grants. Graduate students of this group have the lowest rates of socio-cultural potential, which may indicate a critical outlook on life in general.

The fourth cluster is "random" — 9%, the proportion of men and women here is similar to the sample as a whole. Those who only imitate work on the thesis have got into this cluster. They admit that they have no interest in their thesis work, practically do not interact with their supervisor, and as a result, they doubt that they will come to the defense. These graduate students do not work and do not study, and in general, they are satisfied with this situation — it is curious that in this group there is not a single dissatisfied with the training. The main reason for entering graduate school is an unwillingness to leave the university environment. The fact that graduate students of this cluster plan to become university teachers looks frightening.

A. Academic and Scientific Activity

More than half of graduate students said that the main motive for continuing education in graduate school was the desire to engage in research. This is the leading motive for graduate students of the second and third clusters (see "Table I"). Among postgraduate students of the third cluster, most of those who, after graduating from graduate school, would like to work in a scientific institution as a research assistant (69%), among other clusters of such graduate students are much less. Apparently, graduate students of the second ("resource") and third ("disappointed") clusters have the greatest prospects of remaining in science. Already now among them, there are most of all those who combine the writing of a Ph.D. thesis with work outside the university, while in the field that coincides with the topic of the thesis (40% and 56% in the second and third clusters, respectively).

Approximately half of the graduate students of the first and fourth clusters are confident that the efforts and time spent on graduate school will, in any case, have a positive impact on their future careers and outside the academic field (50% and 55%, respectively). However, unlike the "random" postgraduate students of the first cluster, they demonstrate a higher level of involvement in postgraduate activities — they constantly interact during the work on the thesis with the supervisor (82%) and speak at the scientific seminars of their department and inter-faculty scientific seminars of the university (43%).

"Resource" graduate students see their future in the university, as well as in another scientific institution. By all accounts, these are the most "successful" young people, but they do not exclude work in a knowledge-intensive business, including abroad. Graduate students of the second cluster demonstrate a high interest in the work on the thesis at present and the preservation of interest from the moment of admission. In conjunction with other indicators (assessment of difficulties and favorable factors, self-assessment, the degree of interaction with the supervisor, etc.), this indicates the disposition of this group of graduate students to successfully complete graduate school and defend their thesis. Indeed, only 2% of representatives of the "resource" graduate students believe that they will not have time to go to the defense in time. Do graduate students in other clusters, the figure is much higher. Among the graduate students of this group, the proportion of those who adhere to the "thesis" approach to graduate school is higher; believes that the goal

of graduate school is the preparation and submission to the expert community of the original and sought-after scientific research.

TABLE I. ACADEMIC AND SCIENTIFIC ACTIVITY OF GRADUATE STUDENTS (% COLUMN)

		Cluster			
		1	*2*	*3*	*4*
Motivation for admission to graduate school	Plain to engage in research in high school or scientific organization	54	**60**	**63**	36
	Postgraduate education will help develop a career outside the academic sphere	**50**	44	28	**55**
Professional expectations and plans	After graduating from graduate school I would like to work at the university or other educational organization as a teacher	43	40	47	**73**
	After finishing graduate school I would like to work at the scientific institution as a research assistant	36	40	**69**	27
	After graduation, I would like to work at the knowledge-intensive business	21	**31**	28	27
	Abroad	18	**16**	**16**	0
Work on thesis	I was always interested in working on my thesis	43	**64**	56	36
	The work on the thesis greatly "absorbs" my attention and interest at the present time	54	**76**	56	18
	I will not to the defense of the thesis	14	2	9	**27**
	I combine the writing of my thesis with work outside the university, in a field that coincides with the topic of the thesis	25	40	**56**	45
Interaction with scientific advisor	I constantly interact during the work on my thesis with the scientific advisor	**82**	76	69	36
Involvement in research activities	I speak at the scientific seminars of my department and inter-faculty scientific seminars of the university	**43**	18	25	9
	I combine the writing of my thesis with the work at the research laboratory on a similar topic	7	13	**16**	0

B. Social and Culture Potential

According to the indicators of sociocultural potential, graduate students of the second cluster are clearly superior to all others. Graduate students of the third cluster ("disappointed") for most indicators show the lowest values.

It is possible that critical young people gathered in this cluster. They place high demands not only on others (most of them are graduate students who are dissatisfied with both the training in general and the conditions and opportunities created by the university), but also towards themselves.

TABLE II. EVALUATE HOW THE FOLLOWING STATEMENTS APPLY TO YOU ON A SCALE FROM 1 TO 5

Statements	Cluster			
	1	*2*	*3*	*4*
I am fluent in a foreign language	0,00	**0,12**	0,08	0,00
I have numerous social ties	-0,04	**0,28**	-0,11	0,23
I have good health	0,29	**0,50**	0,20	0,23
I am able to organize people to solve problems	0,25	**0,60**	0,00	0,41
My intellectual abilities are above average	0,36	**0,52**	0,14	0,36
I always achieve goals	0,36	**0,64**	0,16	0,41
I always do the work on time	0,32	**0,56**	0,19	0,41
Ready to learn all my life	**0,68**	**0,71**	**0,39**	**0,59**
Sociable	**0,50**	**0,76**	0,00	**0,50**
Enterprising	0,39	**0,60**	0,05	0,41

The "Table II" shows calculated indices, where 1 corresponds to the situation when all respondents agree with the statement.

C. Financial Situation

The material security of graduate students (along with motivation and ability to research) is an important factor in the successful development of a graduate program. Many of them are forced to combine their studies with part-time jobs, which, as a rule, are not related to science and essentially disconnect from work on the thesis. The data obtained

("Table III", "Table IV", "Table V") indicate that graduate students are strongly differentiated by income level, and, consequently, by the time that remains for scientific work.

Low-income graduate students are concentrated mainly in the first cluster ("deprived"): almost half of them have enough money only for food. Among the graduate students of this cluster the most non-working, i.e. they are dependent on their family members. The share of women in this cluster is one of the highest — 43%. Here is also the largest percentage of those who count on a graduate student scholarship.

TABLE III.   PLEASE, SELECT THE STATEMENTS THAT BEST DESCRIBE THE FINANCIAL SITUATION OF YOUR FAMILY (% COLUMN)

Family finances	Cluster			
	1	*2*	*3*	*4*
Not enough money even for food	0	0	3	0
There is enough money for food, but buying the clothes causes a serious problem	46	2	6	0
There is enough money for food and clothing, but it is difficult for me to buy durable goods (TV, refrigerator, etc.)	43	47	38	73
Money is quite enough for large household appliances, but I could not buy a new car, not on credit	11	27	38	27
There is enough money for everything except such expensive acquisitions as a summer house, an apartment	0	20	16	0
I have no material difficulties. If necessary, I could purchase a cottage, an apartment	0	4	0	0

TABLE IV.   PLEASE, INDICATE YOUR MAIN SOURCES OF INCOME THIS TIME. SELECT ALL RELEVANT ANSWERS (% COLUMN)

Principal income earner	Cluster			
	1	*2*	*3*	*4*
Wages and salaries	82	98	84	91
Graduate traineeship	75	62	56	73
Assistance from family members/relatives	36	16	31	9
Grants	0	7	13	0
Other	4	4	6	9

Representatives of the second and third clusters are the most financially secure. However, the material well-being of the "resource" graduate students is achieved by them through paid work. Among the "disillusioned" graduate students, one-third also rely on help from relatives.

TABLE V.   YOU ARE CURRENTLY (CHOSE ONE OF THE FOLLOWING ANSWERS) (% COLUMN)

Employment	Cluster			
	1	*2*	*3*	*4*
1.Full time work at Dubna State University	3,6	8,9	3,1	9,1
2. Full time work outside Dubna State University	60,7	73,3	62,5	63,6
Total: full time work	*64,3*	**82,2**	*65,6*	*72,7*
3.Part time work at Dubna State University	7,1	2,2	**12,5**	0
4.Part time work outside Dubna State Unniversity	10,7	13,3	15,6	9,1
Total: part-time work	*17,9*	*15,6*	*28,1*	*9,1*
5.Irregular extra earnings at Dubna State University	0	0	0	9,1
6.Irregular extra earning outside Dubna State University	3,6	0	0	0
7.Do not have wage earning employment	**14,3**	2,2	6,3	9,1

In general, more than 2/3 of graduate students in each cluster work with the goal of earning full time. Approximately half of all graduate students work in a field that coincides with the topic of the thesis, 75% of them are representatives of the second and third clusters. Perhaps that is why graduate students of the second and third clusters are much less likely than others to talk about the negative impact of work on education in graduate school. They also believe that the experience they gained at work turned out to be useful for their activities in graduate school, and vice versa, the experience they gained in graduate school is useful for their work.

D. The Difficulties of Studying in Graduate School

Among all the possible factors that prevent postgraduate studies, the majority of graduate students in the first place put "necessity to combine postgraduate activities with work". In assessing other factors (total of 10), there are differences depending on the cluster ("Table VI"). Graduate students of the first cluster, "deprived," note insufficient financial support and uncertain employment prospects after receiving a degree. "Resource" graduate students point to a complex curriculum and difficulties in preparing articles from SSQC's list. Journal publications are also among the main difficulties for graduate students from the third and fourth clusters. "Random" graduate students are recognized in the loss of interest in the research topic.

TABLE VI.   DEMOTIVATING FACTORS (FIRST THREE) PLEASE, INDICATE WHAT EXTENT THE FOLLOWING FACTORS IMPEDE YOUR POSTGRADUATE STUDIES? (THE FIRST THREE FACTORS FOR EACH CLUSTER THAT SCORED THE MOST POINTS WERE SELECTED).

Position	Cluster			
	1	*2*	*3*	*4*
I	The necessity to combine postgraduate activities with work	The necessity to combine postgraduate activities with work	The necessity to combine postgraduate activities with work	The necessity to combine postgraduate activities with work
II	Insufficient financial support	Sophisticated curriculum and academic requirements	Difficulties with the preparation and publication of articles in journals from the list SSQC on the topic of the thesis	Difficulties with the preparation and publication of articles in journals from the list SSQC on the topic of the thesis
III	Uncertain employment perspectives after obtaining a degree	Difficulties with the preparation and publication of articles in journals from the list SSQC on the topic of the thesis	Insufficient financial support	Loss of interest to the topic of thesis research

V.   CONCLUSION

Summing, it can be stated that the second type of graduate students has the greatest resources, abilities, and motivation that contribute to scientific activity. However, they do not exclude work abroad or in a knowledge-intensive business. Graduate students of the third type, if desired, can associate their lives with work in a scientific institution or university. Graduate students of the first cluster with a favorable, above all, a material situation may remain in the scientific field. Finally, graduate students of the fourth type of scientific career, apparently, do not plan.

Summarizing the results obtained, we can say that the most promising from the point of view of defending a thesis are postgraduate students of the first and second year of study — especially with adequate material support, which would allow them to devote more time to scientific work, by the time of completion of graduate school "thesis fuse" for many passes. The need to provide for the family and the lack of career prospects, coupled with an insufficient level of information about employment opportunities after graduate school, worsen the situation even more.

At the same time, the strongest motivational factors that act as a guarantor of the successful completion of postgraduate studies and defending a thesis are still the established interaction with the supervisor and interest in the research topic — the traditional "values" of any graduate student.

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