

## WHAT IS THE GENDER DIMENSION IN THE REPRODUCTION OF ENGINEERS

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### Abstract

The article examines the gender dimension of reproduction problem of Russian engineering cadres. According to gender statistics in Russia - women make up almost half of highly qualified specialists in the employment structure of the economically active population. The practice indicates the presence of the social barriers that prevent women, having equal starting opportunities as men, climb career ladder as fast as men. The authors analyze the gender patterns of choice of engineer profession by Masters in STEM-training areas, and working women-engineers assessment of the problems of women professional self-realization in the modern industry. Research findings based on formal interviews with Masters of technical training areas and on materials of expert survey of engineers in the three largest industrial corporations of the industrial region.

**Key words:** female engineer, gender stereotypes.

**JEL Code:** Human capital; Skills; Occupational choice; Labor productivity (J24), Economics of Gender (J16).

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### Introduction

Reproduction of engineers is processes for continual restoration and renewal of professional, social and cultural resources of the professional community. Expanded reproduction is characterized by the growth of the group and / or a higher level of development of social qualities of its representatives. To one of the main institutional factors for the sustainable reproduction of the professional staff, include vocational education.

In Russia, women constitute more than half of all university students, including at least one third are trained in STEM-direction. Among practitioners, engineers, women make up at least one third of the employed. In case of the increasing demand for engineers, there is real need for women-engineers. In order to ensure their potential is not enough to build up their strength, to refocus on women's education, where previously dominated by men. It is not just a quantitative increase in the share of women in STEM-experts, but, above all, to create conditions for significant capacity and manifestations of their resource potential, overcoming structural barriers to professional development and career advancement of women in engineering. The authors analyze the gender patterns of choice of profession engineer female masters STEM-

training areas, that is, persons who have already received basic technical education and make a choice for further development in the field of engineering. Particular attention is paid to the analysis of ratings of working women engineers on their resource capabilities, women's views about the field of engineering as "man's age-old" areas of employment.

## 1. Theoretical backgrounds

In Russia objectively was created good preconditions for successful career advancement of women. International non-governmental organization Social Watch on the basis of a combination of publicly available data in the area of socio-economic development in various countries around the world each year calculates gender parity index and publishes its rating on the world. According to the rating, now dominated by the Nordic countries such as Norway (first place - 89 points), Finland (88 points), Sweden (87 points). Index value of gender equality in Russia is 75 points (31 in the ranking), which puts it in the group of countries with a low level. Not fall below the rating of Russia have helped high rate of gender equality in education, he reached 100 points (which is comparable with the leading developed countries). However, women's participation in economic activities is only 81 points, and participation in decision-making at all 44 points (The gender equity index).

NidhiTandon and others provided an overview of global trends in the professional development and employment of women in the sector of information and communication technologies, and gave examples of various national policies, training programs and initiatives, designed for girls and women as potential students and professionals. Researchers predict the emergence of new "hybrid" professions "that require women's creativity and intuition(Tandon (2013), Tang (1997), Margheri,Imran et al. 2015).

Russian sociologists (Sillaste (2014), Zaslavskaya (2006), and others), revealed the influence of cultural stereotypes, the pressure of social norms. That social stereotypes, biases, prejudices have a very serious impact on the public consciousness and determine the different strategies of professional men and women.

Massyana and Uvarov (2007) argued that the career advancement of women in engineering takes place in difficult circumstances. Women have to overcome many obstacles. Among them, the most significant is the "male solidarity", double (family and industrial) employment of women and the presence of persistent public opinion (technique - case male). Low self-esteem are often closely intertwined with the lack of ambition. It is also typical for the majority of the respondents of Women Engineers (irrespective of their positions at the moment).

Portuguese explorers (Saavedra and dr.2014) studied the experiences of the participants of interpersonal relations in the academic environment and the workplace in order to identify the behavioral strategies of women engineers in a male environment. They identified the expectations of young women enrolled in the College of STEM - specialties of the difficulties anticipated transition into the working environment to the dominance of men. They found the real difficulties experienced women - engineers in their relations with male colleagues, describe strategies for overcoming these difficulties, used by women engineers in their daily professional activities.

Ural sociologists (Wisniewski, et al Bannikova. 2013) studied the gender features of interest to future engineering profession. For its findings, they used data from a survey of applicants STEM -SPECIAL, data for the secondary analysis of the materials of sociological monitoring students in the Urals region. They found that in the process of choosing the girls engineering specialty act today the most immediate concerns of the universal nature of the future profession, its prestige and possibilities of rapid career. By doing a technical college (and "playing in the men's field"), the girl can not help men gain setting. Pragmatic interest received in high school engineering expertise, enabling them to flexible social movements, begins to "manly" to prevail over the interests of the heuristic. Half of the entrants, submitting documents for technical specialty, work in industry are not going to. For them produced in a technical college knowledge act as a kind of instrumental value, which increases the competitiveness of other (non-manufacturing) sectors - government and business, where men and women, as opposed to production, are already playing on equal terms (Bannikova L., Vishnevsky Yu. Etc.2013).

## **2. Methodology**

For the study of gender-specific interest girls masters for future engineering profession we have conducted in the spring of 2014 an expert survey of undergraduates STEM-direction. The volume of sample - 80 people representing different technical institutes of the Ural Federal University. 55% of them - the first year undergraduates, 45% - second. Among the respondents, 65% of master's men and 35% of women age 21 to 23 years. Almost all the masters have a basic technical education, preferably at the same university.

In the summer of 2013 to collect evaluations conducted engineering professionals (N = 240), three of the largest industrial enterprises in the region. One-third of the total sample were women-engineers. In the profiles of different groups of respondents included a number of

questions about the motives of the choice of the engineering profession, about career plans, assessing the status of the engineer in modern Russian society. For the conclusions, the authors used data from their past research motives for choosing the engineering profession young girls-applicants and students of technical specialties of the Ural region. (Bannikova, Boronina and dr.2013).

### 3. Results

In Russia, which has the maximum value of the index of gender equality in education, women have a higher level of training. According to gender statistics in Russia, women's almost half (47%) are senior and mid-level qualifications, while those of employed men, only a quarter (25%). However, there remains sectoral segregation of women senior and mid-level qualification. For example, among women with highly qualified specialists only 3% in areas of STEM-employment among men - 7%. The researchers estimate this trend as the preservation of "glass walls" in a professional career women.

**Table 1.**Percentage of men and women in professional and executive roles

Occupations as per Russian Standard Classification of Occupations	Total	Women	Men
Directors (representatives) of government agencies and administration, organizations and companies	8.7	6.9	10.5
<b>Highly qualified professionals, including</b>	<b>20.6</b>	<b>25.5</b>	<b>15.8</b>
STEM professionals	5.3	3.2	7.3
Biology, agriculture and health professionals	2.2	2.9	1.6
Education professionals	3.6	5.8	1.4
Other professional occupations	9.6	13.6	5.5
<b>Specialists with medium qualifications</b>	<b>15.4</b>	<b>21.2</b>	<b>9.7</b>
STEM specialists with medium qualifications	3.4	1.7	4.9
Other specialists with medium qualifications	12	19.5	4.8
Skilled trades and service occupations	55.3	46.5	64
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source: Calculated according to the Federal Statistics Service of the Russian Federation (2014)

Most persistent in their choice of engineering career young girls studying engineering master's degree programs. They note awareness of their career path of choice in the evaluation of motives Admission to master (Table 2). The girls are enrolled in a master's importance grows interesting work, opportunity to realize their abilities in comparison with undergraduate students. Postgraduate estimated by them as a chance to realize their potential in practical engineering work, an additional chance of employment, flexibility in career development of intellectual capital (increasing specialization). Status motives are less pronounced than in men. Along with these women - masters stored heuristic motivation, the desire for self-realization, self willingness to research, although not to the same extent as that of the entrants.

**Table 2.** Motives for master's degree study (% of those who checked every motive)\*

Motivational factors	Women	Men	Difference
To gain scientific, social and professional status	29	34	-5
To increase knowledge (enhance specialization) in a certain field	54	44	+10
Master's degree as an additional employment advantage	57	44	+13
To get teaching experience (for a future occupation)	11	10	+1
To gain a foothold in the academic environment, to remain employed by the department (laboratory)	7	12	-5
Personal fulfillment, a chance to launch one's own research projects in the future	25	18	+7
Family tradition, parents' influence	7	8	-1
By mere chance, could not find a job	4	4	0
Influence, advice of academics	14	18	-4
*Total exceeds 100 per cent because one interviewee could tick several answers			

Source: Calculated from data of a questionnaire survey of female masters and practicing engineers.

In general, master's degree, as it develops in Russia today, yet has not academic, but rather a professional orientation. In the motifs of female engineers who choose to study a Masters technical areas, noted a predominance of the influence of social norms ("additional chance of employment", "status") when you store settings for creative self-realization.

Preserved during the master degree several romantic attitude toward the engineering profession is clearly evident in comparison with estimates prestige of the profession of engineer. (Table 3) Such high differences in estimates are due, of course, the age and experience of practical work. Despite the fact that most of the girls masters combine work with study, only half of the respondents profile training coincides with the content of their work, that is, they have the opportunity to apply the obtained knowledge to give professional experience. Orientation to the future professional activity coincides with the direction of master's training in full in only one of the four girls, each second noted that there is only partial matches. One of four girls said that the work and training is not the same, and planned future work does not meet the program's Master Studies.

**Table 3.** Evaluation of the engineering profession's prestige (% of those who chose each option)

Level of prestige	<i>masters</i>	<i>engineers</i>	<i>difference</i>
high	39	2	+37
above average	18	11	+7
Average	43	63	- 20
below average	0	16	-16
low	0	8	-8
total	100	100	

Source: Calculated from data of a questionnaire survey of female masters and practicing engineers.

The "input" into the profession women dreamed of the possibility of research search, invention, creative expression, planned to engage in research activities. Theoretically, such a possibility exists, but the concrete work at the workplace and in the unit is not connected to the inventions. In the past five years have not been and today there is work in progress in the vast majority of women (84%) of any proposals and inventions. Unfortunately, it does not boast, and more than half of male engineers.

In practice, women engineers usually work at the designers' structures, units and machines, engaged in technical calculations in the design offices of industrial enterprises. Their participation in management decision-making in the development of science and technology policy in the management of people in the industry significantly. Both linear and guiding engineering positions, mostly occupied by men. The study showed the "feminization" of lower-level positions. (Table 4) Analysis of the status and resource potential of women engineers also allowed to fix the effect of "sticky floor" or "long-sit" in the position of women, incomplete compliance of the content of the work with a specialty, acquired in college. At the same time, they estimated that the work performed is consistent with qualifications. Accordingly, only one-third of female respondents strongly believe in their choice, consider themselves to be engineers by vocation. The rest are unsure or give a positive or negative answer. Men on this question is given an affirmative answer, although to varying degrees of confidence.

**Table 4.** Professional potential of respondents (% of those who checked each option)

Elements of potential	Women	Men	Difference
<i>Position</i>			
Top-managers	2	13	-11
Middle managers	18	27	-9
Lower-level managers	3	18	-15
Specialists	77	42	+35
<i>Years of experience on the job</i>			
Less than 5	34	48	-14
5 to 10	25	36	-11
Less than 15	15	8	+7
Less than 20	5	3	+2
Over 20	21	5	+16
<i>Match between college degree and job</i>			
Fully related	38	48	-10
Partly related	35	40	-5
Not related, but I make use of the knowledge I acquired	27	12	+13
<i>Further training (in the past 5 years)</i>			
In Russia or abroad	59	73	-14
No	41	30	-11
<b>Total</b>	<b>100</b>	<b>100</b>	

Source: Calculated according to the survey engineers large industrial companies

Comparative characteristics of women's and men's ratings of professional qualities of elite engineers identify similarities and gender differences. Experienced professionals, both men and women engineers about the same (the average level of importance) appreciate the significance of communicative qualities and motivational attitudes projective elite engineer. (Table 5) Gender differences in the interpretation of competency generally corresponds to the intuitive notion "of the female and male" types personality. Men are often much better explain scientific phenomena, while women are more in the definition of scientific problems. Found that most women have a higher performance in academically-oriented directions. (NidhiTandon 2012).

**Table 5.** Assessment of competencies of the elite Corps of Engineers (% of those who chose each option)

Professional quality	women	Men	Difference (pp)
<i>Quality, more valued by women</i>			
Natural sciences, basic education	56	27	+29
Interest and skills research	55	44	+11
Socially responsible engineering world	24	15	+9
<i>Quality, equally valued by both genders</i>			
Communicative competence	25	28	-3
Professional communication skills in English	10	10	0
Stable motivation to work in their specialty	37	37	0
<i>Quality, more valued by men</i>			
High qualification in the field of applied sciences	24	49	-25
Thinking "Outside The Box"	59	70	-11

Source: Calculated according to the survey engineers large industrial companies

## Conclusion

The "input" into the profession in female masters of engineering specialties marked growth trend egalitarian attitudes and perceptions of the status of women engineers. Girls Masters selected graduate programs consciously, as a kind of "safety cushion", an additional chance for successful employment in the men's field engineering. They (¾ of them) do not plan to leave engineering, guided more by practical engineering activities or research activities in the chosen area or to further education in graduate school.

However, analysis of the survey data of experienced women engineers found that gender stereotypes in engineering there not only as a tradition (technique - case male), but they are supported by the industry, including the major metallurgical and engineering corporations. Organization and personnel policies of the company ("the feminization of the lower positions,"

the policy of "sticky floor") leads to lower levels of self-esteem, increase professional uncertainty of Women Engineers and is a serious obstacle to their career growth, forming an inner barrier to advancement. At the same time experienced women engineers, maintain a positive perception of the engineering profession as a potentially creative and creative.

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