MAIN RISKS IN THE DEVELOPMENT OF PERSONNEL BASE IN SCIENCE

Manush MINASYAN
PhD, Associate Professor, Senior Researcher, IE, NAS of Armenia

Key words: science, personnel base, risks, scientific degree, educational institution

Introduction

The level of development of each country is determined and evaluated by the level of scientific development and its importance. In the Republic of Armenia, measures aimed at promoting excellence in scientific and technical activities and creating a nationally competitive research system in the international arena must be consistent and systematic, while the key indicators for evaluating their effectiveness must be accessible and transparent. The formation of a synergetic system of education, science, technology and innovation, and the implementation of an effective system for the reproduction of scientific personnel in Armenia continue to remain relevant. In this context, personnel policy should be part of and derive from the science development strategy. It is necessary to realize that management is primarily the management of people, and for the latter, it is extremely important to study the patterns of personnel behavior, psychological differences in the formation and development of individuals in a certain environment, and the peculiarities of their communication in the field of science. The relevance of this article's topic is conditioned by the above. Our goal is to identify existing risks through the study of the scientific personnel base and present suggestions for the targeted use of existing potential. To achieve this goal, we have set out to study the change in the number of degree holders in the population's gender and age structure, their involvement in the scientific-educational system, the existing problems in the process of training personnel for science, to identify factors affecting the efficiency of scientists' work, and risks.

Methodology

During the study, comparative, descriptive, economic-statistical, and synthesis methods of scientific research were applied. For the purpose of analyzing the dynamics of the scientific personnel base, we studied the data from comprehensive censuses-three censuses conducted in independent Armenia. To mitigate temporal gaps, these were combined with administrative registry data, which naturally do not reflect the complete picture. Based on official statistical data, we calculated the productivity indicator per scientific worker and presented its dynamics over the last ten years. Scientific works related to the field, normative legal acts regulating the field, official statistical data, and various reports served as the information basis for the article.

Literature review

In the second half of the last century, considering that knowledge had become the third factor of production in leading economies, Paul Romer proposed making knowledge-

based technology a component of the economic system in neoclassical theory [Romer, 1986, 1002-1037]. According to T. Courchene «...knowledge, along with human capital, is increasingly finding itself at the cutting edge of competitiveness, while social policy stemming from old-style economic policy becomes insignificant in terms of growth and innovation» [Courchene,2004]. Knowledge, unlike materialized resources, is not consumed during use but is continuously reproduced, which ensures high economic efficiency today and in the future. Soviet Armenia was one of the most active centers of science, research and development work, and high-technology production in the former USSR. At its peak growth point in 1987, about 100,000 specialists worked in the field of science and technology [Armenian information technology report, 2004-2010]. Today, the situation is not quite satisfactory, although the country's government has periodically adopted strategic development programs for the field. Thus, the RA Science Sector Development Strategy for 2017-2020 analyzed the field's strengths and weaknesses and established performance evaluation indicators for the program [Resolution 35, 2017]. Perhaps one of the most important challenges is increasing the field's attractiveness for young people. It was for this purpose that the RA Minister of Education, Science, Culture and Sports approved the «Program for Involving Young Personnel in the Field of Science».

Scientific Novelty

Our research allows to identify existing risks through analysis of scientific personnel base data, as well as to characterize the dynamics of change in scientific personnel potential, and its degree of utilization. The issue of aging scientific personnel has been addressed, and the reasons for the field's low attractiveness for young people have been revealed. The productivity of scientific workers has been calculated, and its dynamics over the last ten years have been presented. The analysis of data supporting scientific and educational institutions' contribution to scientific personnel training is also useful.

Analysis

Increasing the effectiveness of human resource management in the field of science implies the evaluation of individual characteristics by the leader, revealing and developping potential. In addition to having professionalism, deep knowledge, and high responsibility, the leader must be able to create a harmonious and capable collective. Like every field, science also puts forward qualification requirements for personnel, which in our formulation are:

- High mental, creative, analytical, and informational abilities, necessary knowledge;
- Clear understanding of the goals and directions of regulating society and human life activities, economy, ability to contribute to the formation of certain behaviors, values, and attitudes of citizens;
- Enjoying high authority and respect in society;

- Contributing to the harmony and effectiveness of social relations and phenomena through their work; this should be achieved through the materialization of their scientific output;
- Ability to properly represent the country in international platforms through scientific publications;
- Without diminishing the value of the above considerations, in our conviction, the most important is the presentation of applied suggestions aimed at national economic development.

Table 1. Movement of degree holders according to the results of 2001, 2011, 2022 censuses, person

	By age groups				
		26-29	30-39	40-49	50+
	Total		**2001**		
With a scientific degree	7946	261	822	1765	5098
Men	5382	203	494	1188	3497
Women	2564	58	328	577	1601
Urban	7488	245	723	1636	4884
Rural	458	16	99	129	214
2011					
With a scientific degree	5786	477	1024	711	3574
Candidate of Science	4746	477	964	608	2697
Doctor of Science	1040	-	60	103	877
Men, Candidate of Science	2886	342	595	300	1649
Doctor of Science	786	-	36	63	687
Women, Candidate of Science	1860	135	369	308	1048
Doctor of Science	254	-	24	40	190
Urban Candidate of Science	4409	425	882	563	2539
Doctor of Science	978	-	52	92	834
Rural Candidate of Science	337	52	82	45	158
Doctor of Science	62	-	8	11	43
2022					
With a scientific degree	6108	290	918	907	3993
Candidate of Science	3035	290	445	459	1841
Doctor of Science	3073	-	473	448	2152
Men, Candidate of Science	1780	188	283	233	1076
Doctor of Science	1252	-	229	108	915
Women, Candidate of Science	1255	102	162	226	765
Doctor of Science	1821	-	244	340	1237
Urban, Candidate of Science	2921	262	412	459	1788
Doctor of Science	2610	-	352	401	1857
Rural, Candidate of Science	114	28	33	-	53
Doctor of Science	463	-	121	47	295

Source:https://www.armstat.am/am/?nid=82&id=2623,https://armstat.am/am/?nid=187, https://armstat.am/am/?nid=748

Looking at the dynamics of census-based data, one can notice that the Republic of Armenia inherited a better legacy in terms of the number of scientists from the Soviet system. Thus, according to the 2001 census results, 7,946 scientists were registered in Armenia; ten years later, in 2011, the indicator decreased by more than 27 percent, and in 2022, despite recording a 5.6 percent increase compared to the previous census, it is still 23.1 percent behind the 2001 indicator. Perhaps it would be more correct to consider the indicator in relation to the population number; in this case, we have 0.272 percent in 2001, 0.209 percent in 2011, and 0.224 percent in 2022. The gender structure of RA scientists has changed significantly during the observed period, especially in the last decade: the share of men decreased from 67.7 percent in 2001 to 49.6 percent in 2022.

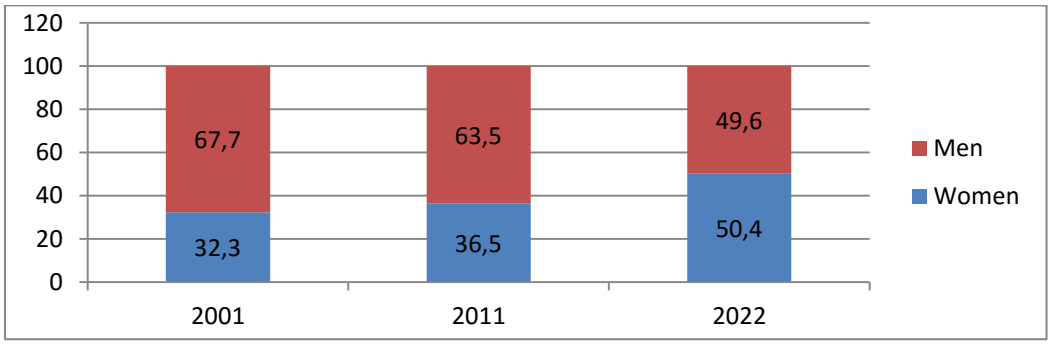

Figure 1. Change in gender structure of degree holders, 2001, 2011, 2022 censuses, %
Source:https://www.armstat.am/am/?nid=82&id=2623,https://armstat.am/am/?nid=187

The change in the age structure of scientists is also interesting: the weight of the 40-49 age group representatives decreased by 9.9 percentage points in 2011 compared to 2001, while the weight of those under 30 increased by 12.3 percentage points. The weight of the over-50 age group has been high in all years. Perhaps it is natural that the vast majority of degree holders (over 90 percent) live in the city, although a declining trend has been recorded over the years (94.2-90.6 percent).

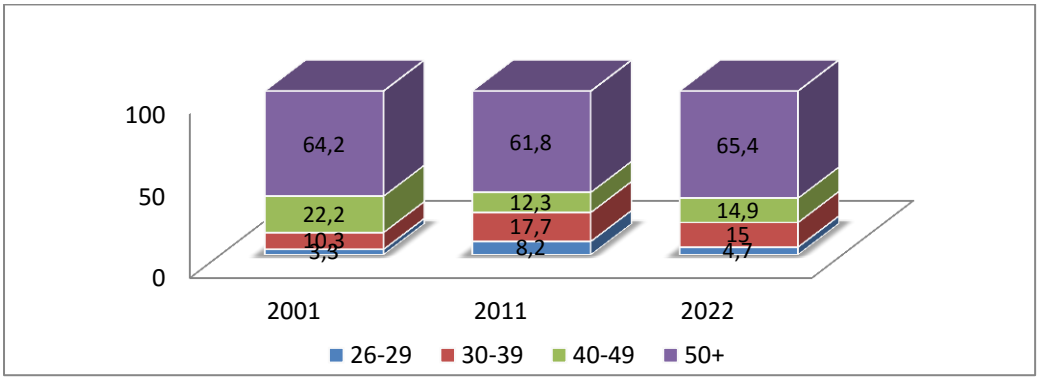

Figure 2. Change in age structure of degree holders, 2001, 2011, 2022 censuses, %
Source:https://www.armstat.am/am/?nid=82&id=2623,https://armstat.am/am/?nid=187

In 2001 and 2011, the majority of degree holders were candidates of science, while in 2022, according to census results, the share of doctors of science was 50.3 percent. This indicator does not inspire confidence, especially considering the form of data collection (according to survey), and there are also other administrative registry data according to which candidates of science make up a significant part of degree holders in all years.

Table 2. Movement of the number of scientific-educational organizations and their personnel base 2014-2023

Source:https://armstat.am/file/doc/99552303.pdf, https://armstat.am/file/doc/99516758.pdf

	2023	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**
Scientific institutions, total	89	91	94	65	63	63	69	69	70	66
Researchers and technicians	4005	4003	3949	3657	3512	3552	3807	4002	4164	4514
having academic degrees of Doctor of Science	437	437	428	403	425	410	426	436	457	497
Candidate of Science	1592	1594	1542	1400	1378	1403	1553	1578	1594	1579
Volume of scientific and technical works, mlrd drams	15,8	16,7	14,4	12,3	11,8	10,9	12,2	12,1	12,6	11,5
Domestic costs, mlrd drams	16,9	17,8	14,9	13,7	12,1	10,5	11,9	11,1	11,9	10,9
Nuber of higher educational institutions	53	54	55	55	56	56	61	63	60	62
Number of teaching staff	6450	6505	6484	6538	6747	7002	7406	7598	7947	7913
having academic degrees of Doctor of Science	614	589	659	624	624	653	634	663	683	681
Candidate of Science	2758	2845	2924	2931	2972	3043	3182	3257	3352	3247
working part time	2078	2388	2261	2323	1991	1845	1990	1932	1907	2109

In 2021, the number of operating scientific organizations in Armenia increased by 45 percent compared to the previous year, with an average annual figure of 74 over the last ten years. For small Armenia, perhaps, this is not a bad indicator. The number of researchers in scientific organizations averaged 3,916 people over the last ten years. It is noteworthy that about half of the researchers in scientific organizations did not have a scientific degree in 2023. Over the last ten years, the volume of scientific research work in our country has increased by only 37.4 percent or an average of 3.7 percent annually, which is 1.0 percentage points lower than the average annual economic growth rate during that period - once again proving that scientific development is separated from economic and social development. In our conviction, it should have a leading role, contributing to economic growth as well. As a result, the productivity of one scientific worker continues to be low, having the following trajectory over the last ten years.

A significant problem is also the low level of candidate thesis defense by PhD graduates. As shown in the figure, the weight of candidate thesis defenders compared to PhD graduates in scientific organizations is higher than the corresponding indicator for

universities in all observed years. The fact that the state also lacks a clear strategy for preparing scientific personnel by specialties is evidenced by the study of the professional structure of PhD program admissions or graduates. And this implies that there is no assessment of economic demand, no proper cooperation with the private sector.

The social prestige of science in Armenia has such a low level that scientific discussions are completely absent when marking the country's development goals and ways to achieve them. The main risks in personnel potential development in modern science are:

-The first group of risks relates to personnel provision, their correspondence to specific fields and research directions. Against the background of rapid technological developments, it is impossible to make medium-term, let alone long-term predictions about the number of necessary personnel in specific fields. Today, this problem is no longer solved by the state; it is partially left to those choosing the profession - students, who naturally are in worse starting positions due to lack of information. It is also extremely important to prevent brain drain from the country.

- The next group of risks is related to the initial requirements for engaging in scientific activities: they have become stricter and more diverse - high level of knowledge, work experience, ability to learn independently, perfect knowledge of languages, certain skills, etc. These requirements, considering the current salary level, are too much for university graduates. On the other hand, according to the criteria approved by RA Government Decision N2298N of December 21, 2023, those who received their first graduation document in higher professional education programs maximum 20 years ago cannot hold junior researcher positions. As a result, even a scientist of different ranks who doesn't have the corresponding number of articles in international scientific databases in the last five years cannot hold a junior researcher position and will be forced to leave the field of science.

- The third group of risks is related to the low motivation of those who chose scientific activity as a profession. When we talk about the field of science, we essentially imagine unstable employment, dependence of highly qualified workforce payment on place and time.

- The fourth group of risks is related to the choice of science development strategy. The selection of priorities in the context of growing private financing share in production and fierce competition, both domestically and internationally, depends less and less on scientists and more on those who hold financial resources.

- The fifth group of risks is related to the commercialization of scientific research. The difficulty of achieving balance between fundamental and applied research is essential for the development of scientific research and technology; recorded deviations can have negative consequences for both science and the future development of the country and the world. We believe focusing on producing knowledge with commercial demand can significantly harm the development of fundamental science.

- The absence of strategic indicators, goals, and measures to achieve them regarding the state's demand for scientific personnel by specialties can be considered the sixth risk. Clear formulation of short-term and long-term problems is also very important.
- The next group of risks is related to the international aspects of scientific activity. The balance between open and closed scientific and technological developments (the dilemma of openness versus know-how), the balance between local and international participation in scientific research, unequal distribution of talent are significant issues in the dynamics of human resource potential.
- Science is not a field that can be disregarded today, closing scientific institutions, and then quickly reopening and moving forward tomorrow when they are needed. This is the field where recovering what is lost will require decades, enormous efforts, and many times more finances than required to maintain it.

Personnel flow should be periodic in the education-science-production chain; only through the combination of these three can we rapidly develop our country.

Conclusions

The development of the personnel base in the field of science is a super-task for both the sector and the country's economic and social development. Strategic systematic steps are needed that will aim to improve the quality, number of scientific personnel, and their participation in research and innovation. Modern science should be interesting, innovative capable to demonstrating its impact on everyday life. For improving the scientific personnel potential, we have suggested:

- Create a nominal database of scientists living in RA, which should collect data about scientific degrees, titles, specialties, fields or topics of study, age, workplace, residence, completed scientific works, their contributions, etc.
- Expand the list of official statistical data: it is very scarce today and insufficient for analyses, studies, and resulting evaluations and suggestions. There is a need to change or update administrative statistical reports.
- Scientists should receive competitive salaries, social guarantees, and development opportunities. The field also needs to implement an evaluation and incentive system, where the criterion should not only be becoming a co-author of an article in international scientific databases through some tricks, but also presenting applied suggestions aimed at national economic development, the scientist's contribution to the development of that branch of science in the country.
- The quality of scientific personnel largely depends on the level of education. The post-graduate education system should integrate with the science sector development strategy to provide optimal scientific, expert, technical skills.

In our rapidly changing era, science also needs clear management models, where scientific research, publications, and scientific personnel training processes should be coordi-

nated. Science must be closely connected with the economy working together to rapidly apply scientific research results and bear innovations.

References:

1. Resolution N2298N of the Government of the Republic of Armenia dated December 21, 2023
2. Resolution N35 of the Government of the Republic of Armenia dated August 17, 2017 "On approving the 2017-2020 strategic plan for the development of the RA science sector and the schedule of measures for the implementation of the plan"
3. Order N414-A/2 of the RA Minister of Education and Science of April 3, 2020 "On approving the program for the involvement of young personnel in the field of science"
4"Armenian information technology sector software and services 2010 state of industry report" Enterprise Incubator Foundation, Yerevan, 2004-2010.
5.Courchene T.J Social Policy and the Knowledge Economy New Century.New Paradigm Options Politiques.2004
6.Romer P.Increasing Retums Long Run Growth.Journal of Political Ecanamy, vol.94,N5(Oct. 1986),pp1002-1037

Manush MINASYAN

Main risks in the development of personnel base in science

Key words: science, personnel base, risks, scientific degree, educational institution

In the Republic of Armenia, measures aimed at promoting excellence in scientific and technical activities and creating a nationally competitive research system in the international arena must be consistent and systematic, while their effectiveness evaluation key indicators should be accessible and transparent. The formation of a synergetic system of education, science, technology and innovation, and the implementation of an effective system for the reproduction of scientific personnel in Armenia continue to remain relevant. In this context, personnel policy should be part of and derive from the science development strategy. Comparative, descriptive, economic-statistical, and synthesis methods of scientific research were applied during the study. Based on official statistical data, we calculated the productivity indicator per scientific worker and presented its dynamics over the last ten years. Scientific works related to the field and normative legal acts regulating the field served as the information basis for the article. The productivity of scientific workers has been calculated, and its dynamics over the last ten years have been presented. The analysis of data supporting scientific and educational institutions' contribution to scientific personnel training is also useful.