




### Ruzanna TADEVOSYAN

Junior Researcher at ASUE  
"Amberd" Research Center

*In 2014, she graduated from ASUE and started her PhD studies. Since 2018 she has been working at "Amberd" Research Center, ASUE. In 2018-2020 she studied for an MA in Agribusiness at Texas A&M University. She has attended professional training courses at various universities around the world.*

 <https://orcid.org/0000-0003-2226-6435>

## ARMENIA'S INNOVATION OUTPUT: WHAT SHOULD WE DO?

DOI: 10.52174/2579-2989\_2023.6-64

**Keywords:** *innovation, output, patent, utility model, innovation voucher*

*In the paper, the indicators characterizing the innovation output of RA have been studied and analyzed, particularly patent applications, utility models, trademarks, high-tech exports, ICT services exports, and several other indicators typical to creative activity. Armenia is generally in a better position with innovation output than in innovation input. However, in the past, the RA innovation input/innovation output ratio, or in other words, efficiency, was higher. Most indicators characterizing the output have an increasing tendency, however, the number of patent applications has decreased in recent years. At the same time, the number of patent applications registered in the USA by the RA residents is increasing. If the trend continues, it is possible that in the RA, as in several developed European countries, the number of patent applications registered in the national patent office will be significantly less than those registered in the USA. The analysis shows that in recent years there is a tendency to decrease the number of aggregate patent applications of the RA residents. The study of international experience shows that innovation vouchers are widely used in many countries to encourage patenting and innovation activities in general, so policymakers in this direction in the RA should also consider the possibilities of using this tool.*

Innovation as a complex and multidimensional phenomenon is difficult to measure at the macro level. Therefore, to evaluate the innovation performance of the countries, different indicators are used, which express either the innovation input or the output of the country. The

Global Innovation Index published by WIPO measures the innovation performance of countries by assessing all possible resources and outcomes. In this paper, we will look at the Innovation output of the RA, analyzing all the indicators that are included in the pillars of the GII output. In general, the most common outcome measure of innovation is patents, but apart from that, some information about the country's innovation result is also given by the set of high-tech goods export weight, ICT service export weight, and some other indicators, which this article is dedicated to a detailed analysis.

Previously, Armenia was more efficient in turning innovative input into output. However, this efficiency has somewhat decreased compared to previous years, which is also reflected in the fact that Armenia used to show a better result than the expected result of its income level, and now the result is in line with the expectations typical of its income level.

In the Knowledge and Technology Output pillar, Armenia has progressed by 3 positions compared to 2022, now holding the 67th position. Moreover, Armenia has achieved its best results in this and Creative Output pillars. Specifically, in the Knowledge Creation pillar, in the indicator of Utility models by origin/bn PPP GDP, Armenia ranks 16th. Meanwhile, in the last 2-3 years,

according to the Patents by origin/bn PPP\$ GDP indicator, Armenia has experienced regression, dropping from the 29th position in 2020 to the 59th position in 2023. A decline in the global number of patents following the financial and economic crisis of 2009 was manifested only in 2019. Conversely, in Armenia, the number of patents increased that year, but in subsequent years, it steadily declined at a significant rate (Chart 1).

It is crucial to emphasize that since the independence of the RA, several legislative changes have been implemented concerning patenting activities. Specifically, until 2009, the Law of the RA on Patents was in force; subsequently, the Law of the RA on Inventions, Utility Models, and Industrial Designs replaced it. From 2021 onward, the Laws on Industrial Design and on Patents of the RA have been in force. Moreover, according to the latter, there is a distinction between the invention patent (valid for 20 years) and the short-term invention patent, which is granted for 10 years. However, in the statistics of the World Intellectual Property Organization (WIPO), short-term invention patents correspond to the utility model, so the total number of patents of the Intellectual Property Office of the RA Ministry of Economy does not match with WIPO. Despite this discrepancy, the overall trend remains

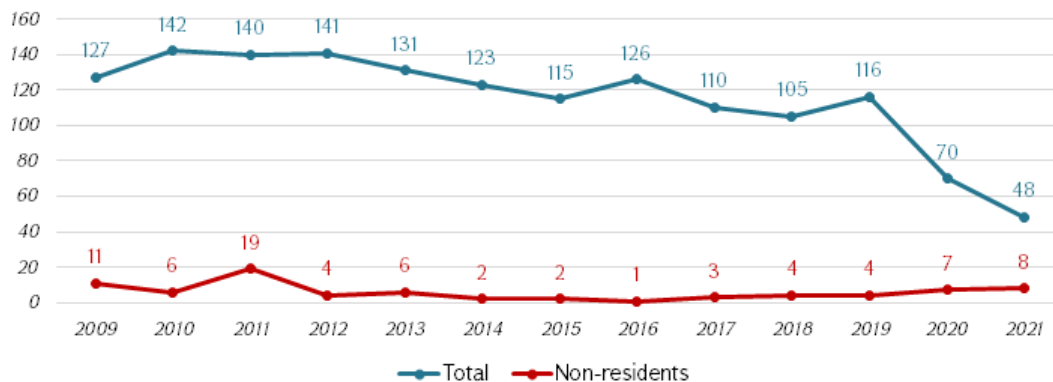


CHART 1

**Number of patent applications registered in the RA, 2009-2021<sup>1</sup>**

<sup>1</sup> WIPO IP Statistics Datacenter, <https://www3.wipo.int/ipstats/ips-search/search-result?type=IPS&selectedTab=patent&indicator=10&reportType=11&fromYear=1999&toYear=2021&ipsOffSelValues=AM&ipsOriSelValues=&ipsTechSelValues=901,902,900>

consistent: a decline since 2019. Additionally, in 2022, with the implementation of the new law in 2021, the indicator may have decreased further, considering some alterations in the process. Armenia's indicator of PCT patent applications per one billion dollars of GDP remained constant, securing the 53rd position in 2023. As reported by the Office of Intellectual Property, in 2022, the number of PCT applications amounted to 7<sup>2</sup>.

The expert surveys conducted with some inventors disclose that in Armenia they do not want to spend money in this prospective direction, it is very difficult to realize the invention. Perhaps this is the main problem of inventors in the RA. Therefore, steps are needed in the direction of easing the realization of the invention.

In addition to the number of patent applications registered in the RA, it is appropriate to consider the number of patent applications registered in the USA by the RA residents, taking into account the fact that the intellectual property protection process in the USA is highly trusted by investors. Thus, although the number of patent applications in the RA in 2009 shows a decreasing trend in general, but the number of patent applications of the RA residents in the USA shows a growing trend (Chart 1 and Chart 2). For comparison, let's note that if in 2011 the number of patent applications by the RA residents in the USA was only 8, then in 2021 it was 54. In 10 years, it has increased by about 7 times. Moreover, in 2021, for the first time, the number of patent applications registered by the RA residents in the USA exceeded the number of patents registered in the RA, by 35%. It should be noted, however, that this phenomenon has long been characteristic of a number of European countries, particularly in 2021 some countries of Western, Central, and

Northern Europe, such as Spain, Austria, Belgium, the Netherlands, Luxembourg, Denmark, Sweden, Finland, Lithuania and Estonia registered twice as many patents in the US as in their own country. And, for example, the number of patents registered in the US by Irish residents is more than a hundred times higher than the number of patents registered in the national patent office. While it is positive to note the rise in the number of patent applications registered by the residents of the Republic of Armenia in the USA, the simultaneous decrease in the number of patent applications filed by the RA residents in both Armenia and the USA since 2019 raises certain concerns. A number of countries around the world implement measures to encourage patent activity, for example, Latvia, Lithuania, and Ireland issue innovation vouchers intended for the development of new products and technologies, feasibility studies, industry research, experimental work including prototyping, industrial for design development, testing and patenting of new products and technologies, as well as strengthening the protection of patents for innovators, industrial designs and semiconductor products.

The amount of innovation vouchers varies from country to country, depending on the specific purpose of the provision. For example, Enterprise Ireland, a government entity in Ireland, provides a €5,000 voucher to SMEs to identify new business opportunities through collaboration with external sources of knowledge<sup>3</sup>. Lithuania grants another €5,800 innovation voucher to SMEs to boost business-science linkages<sup>4</sup>. Another country comparable to Armenia in terms of starting conditions, Latvia, also provides innovation vouchers in the range of 25,000 euros<sup>5</sup> to promote R&D and innovation activities

<sup>1</sup> Intellectual Property Office of the RA Ministry of Economy (2022). Annual report 2022, <https://aipo.am/public/uploads/files/file-W6rA1xLdcK.pdf>

<sup>2</sup> Enterprise Ireland official page <https://www.enterprise-ireland.com/en/research-innovation/companies/collaborate-with-companies-research-institutes/innovation-voucher.shortcut.html>

<sup>3</sup> EU (2019). Voucher Schemes in the Member States; A Report on the Use of Voucher Schemes to Promote

<sup>4</sup> Innovation and Digitization EU, [https://ec.europa.eu/information\\_society/newsroom/image/document/2019-32/member\\_states\\_use\\_of\\_voucher\\_schemes\\_OD31F683-AA92-B7FF-684433BCBD8A4F3A\\_61225.pdf](https://ec.europa.eu/information_society/newsroom/image/document/2019-32/member_states_use_of_voucher_schemes_OD31F683-AA92-B7FF-684433BCBD8A4F3A_61225.pdf)

<sup>5</sup> EU (2019). Monitoring Progress in National Initiatives on Digitizing Industry; Country Report Latvia, [https://ec.europa.eu/information\\_society/newsroom/image/document/2019-32/country\\_report\\_-\\_latvia\\_-\\_final\\_2019\\_OD30BE44-054B-C822-C8DE-FA25536D65B0\\_61211.pdf](https://ec.europa.eu/information_society/newsroom/image/document/2019-32/country_report_-_latvia_-_final_2019_OD30BE44-054B-C822-C8DE-FA25536D65B0_61211.pdf)

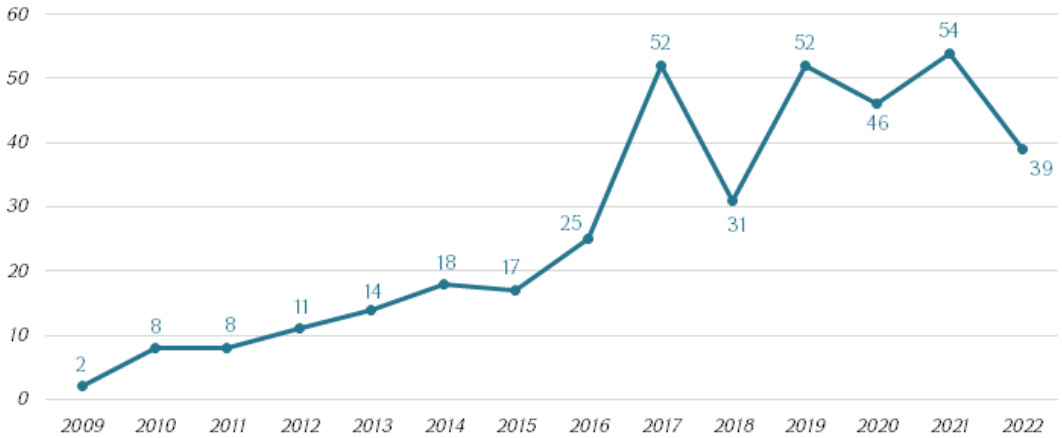


CHART 2

**Total number of patent applications by the RA residents registered in the USA<sup>6</sup>**

performed by businesses, and the vouchers are provided to SMEs in pre-specified smart specialization directions<sup>7</sup>. Armenia can also provide innovation vouchers to promote patent activity, making it a condition for the collaboration of external sources of knowledge to develop prototypes, do feasibility studies, and patent registration.

Returning to other indicators characterizing the innovation output, it is worth mentioning that in the last-h-index citable documents indicator of the Knowledge creation sub-pillar, Armenia secured the 76th position. In 2022, Armenia's h-index was 228, showing a 6.54% increase compared to the previous year. However, the indicators of several other countries increased at a faster rate, leading to a decline in Armenia's ranking both compared to the previous year and to the 2020 indicator.

Next, in the Knowledge Impact sub-column, the indicator of labor productivity growth is impressive: 3.4%, by which Armenia ranked 13th. The latter is calculated by the average value of GDP growth per employee over the last 5 years, so the

reduction of the shadow economy also has a significant impact on this indicator. The next indicator in this sub-pillar is the value of unicorns in relation to GDP. As of April 7, 2023, the number of unicorns in the world (unicorns are those startups whose value exceeds 1 billion US dollars) is 1,207<sup>8</sup>. And although this indicator is not calculated for Armenia, it is important to emphasize that Armenia is the only country in the South Caucasus that has a unicorn, Picsart. It is noteworthy that only a few countries with a small economy and population have startups that exceed one billion dollars. In the last indicator of this group, with the share of high and medium-high technology products in manufacturing at 5.6%, Armenia ranks 100th. It is important to emphasize that this indicator has slightly increased in recent years, by 1.2 percentage points compared to 2020. However, it is still considered one of Armenia's weak points.

Referring to the last group of the Knowledge and Technology pillar, the Knowledge diffusion sub-pillar, it should be noted that the degree of complexity of Armenia's production and export, in other

<sup>6</sup> Based on US Patent and Trademark office (USPTO) annual reports data, <https://www.uspto.gov/about-us/performance-and-planning/uspto-annual-reports>

<sup>7</sup> EU (2017). Latvian Research Funding Background Report, <https://ec.europa.eu/research-and-innovation/sites/default/files/rio/report/KI-AX-17-007-EN-N%2520Latvia.pdf>

<sup>8</sup> WIPO. (2023). Global Innovation Index 2023 Report. <https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2023-en-main-report-global-innovation-index-2023-16th-edition.pdf>

words, the index of economic complexity (ECI), is problematic here. The latter is calculated based on the diversity and complexity of exported goods. Developed countries possessing great potential in knowledge, export complex products such as machinery, chemicals, vehicles, etc. On the contrary, developing countries, with limited capacity, tend to export goods with a low complexity index, such as mining and agricultural products. Over the last 20 years, Armenia has witnessed a decline in its ECI. In 2000, the index stood at 0.60, but according to the latest available data of 2022, it has regressed to -0.52. Consequently, Armenia has descended from the 35th position in 2000 to the 91st position in 2022<sup>9</sup>.

Another indicator reflecting knowledge diffusion is the proportion of high-tech exports in total trade. In 2020, this chart accounted for 0.7 percent of Armenia's overall trade, placing the country at the 79th position in the ranking. For comparison, it is worth noting that in GII 2020, when the 2018 indicator was applied, it was lower than the current result by 0.1 percentage points, but at that time Armenia was ranked the 75th. Therefore, we can conclude that the decline in the position is not the result of the deterioration of the indicator, but simply the result of faster improvement of the indicator of other countries. Armenia's notable strength in the GII lies in the indicator of the share of ICT services export in the total trade within the Knowledge dissemination sub-pillar, standing at 7%. This achievement positions Armenia impressively at the 9th rank globally. In addition, in GII 2023 ICT 2021 indicator is used, that is, before several Russian specialists in the IT sector moved to Armenia as a result of the Russian-Ukrainian war. Therefore, we can predict that the indicators of 2022 and 2023 will be higher.

Indicators of the last pillar of the GII, Creative output, have also improved and are generally considered to be one of Armenia's strengths. Specifically, in terms of Trademarks

by origin/bn PPP\$ GDP, included in the group of intangible assets, Armenia took the 16th place in 2023, improving its position by one place compared to the previous year, but still falling behind by 2 places in 2020 as a result. Additionally, in the domain of Industrial designs by origin/bn PPP\$ GDP, encompassing rights that safeguard the decorative or aesthetic aspects of the applicant's product, Armenia ascended to the 45th position, signifying an advancement in comparison to the preceding year. In the group of these indicators, one of the weaknesses of Armenia is the absence of any brand among the Global Top 5000 brands. Although only 77 countries have brands in this series. In the group of creative goods and services indicators, with a 0.5% indicator of the export of cultural and creative services in general trade, Armenia took the 52nd position in 2023, declining by 0.1 percentage points compared to 2020. The indicator includes exports of advertising, marketing research, public opinion polls, cultural heritage, entertainment, and audiovisual services. In contrast to creative services, the export of creative goods (antiques, works of art, books, magazines, architectural plans and drawings, maps, films, jewelry, etc.) in the entire trade, with an indicator of 1.5%, in 2023, Armenia occupied the 35th position, improving its positions compared to both the previous year and 2020. The results recorded by Armenia in the last sub-pillar, online creativity, are notably impressive. In terms of the indicator for general Top-level domains (gTLDs) per thousand inhabitants aged 15-69 (such as .biz, .info, .org, .net, and .com), Armenia ranks the 61st. Additionally, with Country-code domains (ccTLD, such as .am, .ru, etc.), Armenia is ranked the 52nd. Furthermore, there has been progress in both indicators compared to the previous year and 2020. Armenia ranks the 35th in the number of commits on GitHub per million inhabitants aged 15-69. The latter is the world's largest AI code generation platform, primarily

<sup>9</sup> The Atlas of Economic Complexity. <https://atlas.cid.harvard-edu/rankings>

designed for developers. Finally, according to the last indicator, Mobile app creation/bn PPP\$ GDP, Armenia has improved its position compared to previous years and now occupies the 43rd position. This indicator is measured by the number of worldwide downloads of apps created in a given country.

Thus, from the study of the indicators of the innovation output of Armenia, it becomes clear that, in general, the indicators characterizing the output have secured a high ranking for the RA and generally have a growing trend. The best indicator of Armenia is its ICT services export as a proportion of total trade, securing the country the prestigious 9th position. At the same time, a somewhat worrisome trend emerges after 2019, indicating a decrease in the most significant indicator characterizing innovation activity—the number of patent applications. On the other hand, although the number of patent applications in the

RA is decreasing, the number of patent applications registered by RA residents in the US is generally increasing. If the trend continues, it is possible that in the coming years, the number of patent applications submitted by the RA residents in the USA will significantly exceed the number of patent applications in the RA. In 2021, for the first time, the number of patent applications registered by the RA residents in the USA exceeded the number of patent applications registered by the RA residents in the RA. It should be noted that this phenomenon is also characteristic of a number of developed European countries. Therefore, there are no concerns in this regard. However, in 2020-2022, the number of aggregate patent applications of the RA residents decreased, which is already worrying. To promote patent activity, Armenia can consider implementing innovation vouchers, a strategy employed by several countries globally.

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**Ռուզաննա ԹԱԴԵՎՈՅԱՆ**  
«Ամբերդ» հեղափոխական կենտրոնի կրթության հեղափոխող, ՀՊՏՀ

ԿՐԹՈՒԹՅՈՒՆ, ՆՈՐԱՐԱՐՈՒԹՅՈՒՆ, ԳԻՏԵԼԻԲ

**ՀՀ ԻՆՈՎԱՑԻՈՆ ԱՐԴՅՈՒՆՔԸ. ԻՆՉ ԱՆԵԼ**

Հոդվածում ուսումնասիրվել և վերլուծվել է ՀՀ ինովացիոն արդյունքը բնութագրող ցուցանիշները, մասնավորապես՝ արտոնագրային հայտերի, օգտակար մոդելների, ապրանքանիշների, բարձր տեխնոլոգիական ապրանքների արտահանման, ՏՀՏ ծառայությունների արտահանման և ստեղծարար գործունեությունը բնութագրող մի շարք այլ ցուցանիշները: Ընդհանուր առմամբ ՀՀ-ն ըստ ինովացիոն արդյունքի ավելի լավ դիրքերում է, քան ինովացիոն ռեսուրսներով: Սակայն նախինում ՀՀ ինովացիոն ռեսուրսներ/ ինովացիոն արդյունք հարաբերակցությունը կամ այլ կերպ ասած արդյունավետությունը ավելի բարձր էր: Արդյունքը բնութագրող ցուցանիշների մեծ մասը աճման միտում ունի, սակայն արտոնագրային հայտերի թիվը վերջին տարիներին որոշակիորեն նվազում է: Մինևույն ժամանակ աճում է ՀՀ ռեզիդենտների կողմից ԱՄՆ-ում գրանցված արտոնագրային հայտերի թիվը: Եթե միտումը պահպանվի, հնարավոր է, որ ՀՀ-ում, ինչպես մի շարք եվրոպական զարգացած երկրներում, ազգային արտոնագրային գրասենյակում գրանցած արտոնագրային հայտերի թիվը շեշտակի զիջի ԱՄՆ-ում գրանցվածներին: Վերլուծությունը ցույց է տալիս, որ վերջին տարիներին ՀՀ ռեզիդենտների գումարային արտոնագրային հայտերի թվի նվազման միտում էլ կա: Միջազգային փորձի ուսումնասիրությունը վկայում է, որ շատ երկրներում արտոնագրային և առհասարակ ինովացիոն գործունեությունը խրախուսելու համար լայնորեն կիրառվում են ինովացիոն վաուչերները, ուստի ՀՀ-ում այս ուղղությամբ քաղաքականություն մշակողները պետք է դիտարկեն նաև այս գործիքի կիրառման հնարավորությունները:

**Հիմնաբաներ.** *ինովացիա, արդյունք, արտոնագիր, օգտակար մոդել, ինովացիոն վաուչեր*

**Рузанна ТАДЕВОСЯН**  
*Младший исследователь исследовательского центра «Амберд», АГЭУ*

ОБРАЗОВАНИЕ, ИННОВАЦИИ, ЗНАНИЯ

**ИННОВАЦИОННЫЕ РЕЗУЛЬТАТЫ АРМЕНИИ: ЧТО СЛЕДУЕТ НАМ ДЕЛАТЬ?**

В статье изучены и проанализированы показатели, характеризующие инновационные результаты РА, в частности патентные заявки, полезные модели, товарные знаки, экспорт высоких технологий, экспорт услуг ИКТ и ряд других показателей, характеризующих творческую деятельность. Армения в целом находится в лучшем положении по результатам инноваций, чем по вкладу инноваций. Однако в прошлом соотношение ввода/вывода инноваций в РА, или, другими словами, эффективность, было выше. В то же время увеличивается количество патентных заявок, зарегистрированных в США резидентами РА. Если тенденция сохранится, то возможно, что в РА, как и в ряде развитых европейских стран, количество патентных заявок, зарегистрированных в национальном патентном ведомстве, будет существенно меньше, чем зарегистрированных в США. Анализ показывает, что в последние годы наблюдается тенденция к снижению количества совокупных патентных заявок резидентов РА. Изучение международного опыта показывает, что инновационные ваучеры широко используются во многих странах для стимулирования патентной и инновационной деятельности в целом, поэтому политикам в этом направлении в РА следует также рассмотреть возможности использования этого инструмента.

**Ключевые слова:** *инновация, результат, патент, полезная модель, инновационный ваучер*