

Statistical Assessment of Sweden's Innovation Ecosystem. Characterization and Analysis of the Current Situation

SHAIKIN Dinmukhammed, Cand. of Econ. Sci., Head of Department, shaikindimash@mail.ru, NPLC «Manash Kozybayev North Kazakhstan University», Kazakhstan, Petropavl, Pushkin Street, 86.

Abstract. A brief analysis of the situation is presented, which reflects the current state of the scientific and technological sphere in Sweden. The emphasis is placed on the need to introduce OECD standards in our country, which is one of the key imperatives in the implementation of scientific and technological policy. Based on the analysis of the conceptual apparatus and the study of scientific literature, approaches to the analysis of the scientific and technological sphere are presented. The size of intramural R&D expenditures in Sweden in 2015-2020, as well as their relationship to gross domestic product examined and analyzed. It is noted that accounting for intramural R&D expenditures is carried out in accordance with international OECD standards, primarily in accordance with the «FRASCATI» Manual. Information on indirect incentives, the purpose of which is to increase motivation among researchers to implement and execute R&D projects, is provided. The author's proposals have been formulated and supplemented, the implementation of which will ensure the effective development of scientific and technological policy in the Republic of Kazakhstan.

Keywords: analysis, intramural expenditures, Research and Development, OECD, applied, experimental, basic research, indicator, «FRASCATI» Manual.

Sweden is a country located in Northern Europe on the Scandinavian Peninsula, which is one of the states of the European Union and a member of the Organization for Economic Cooperation and Development (OECD, France Paris).

Introduction. Sweden is a European innovation leader and ranks first among the European Union countries in terms of intramural R&D expenditures relative to GDP (3,53% in 2020).

Thus, it can be stated that Sweden has performed the main scientific, technological and innovative goal of the European program «Europe 2020 strategy», as well as the «Horizon 2020» program to achieve by all countries of the European Union the value of the level of intramural R&D expenditures in relation to GDP of at least 3% by 2020 [1].

The author notes that today only a few countries of the European Union have achieved this goal. Among them are Belgium (3.38%), Austria (3.22%), Germany (3.13%) and, in fact, Sweden itself [2].

The world leader in this indicator now is Israel. In this country, the value of the level of intramural R&D expenditures in relation to GDP in 2020 was 5.44%, which is 0.3% more than in 2019 [4].

The aim of the work is to analyze and assess the current situation reflecting the innovation ecosystem of Sweden.

To achieve this goal, **the following tasks** are solved in the article:

- strategic documents adopted at the national level

that contribute to the development of the innovation environment in Sweden are presented;

- statistical data reflecting the dynamics of the ratio of intramural R&D expenditures to GDP in a number of OECD countries that are world innovation leaders are presented;

- emphasis is placed on the main OECD standard (the «FRASCATI» Manual), which contains key terminological aspects that reveal the main definitions used in the scientific, technological and innovative sphere;

- recommendations have been formulated, the implementation of which will improve the innovation ecosystem of our country.

Materials and research methods. The main role in the formation and development of the environment in which R&D projects carried out in Sweden is played by the state. After the end of the Second World War, the country began to pursue a coordinated policy in the field of R&D. The Swedish Council for Science, which was established in 1962, became an advisory body in the field of scientific activity and scientific and technical policy. This structure is managed by the Prime Minister of the country, and the council includes ministers directly related to R&D (ministers of education, finance, industry, agriculture, defense, representatives of leading industrial firms, non-profit organizations, as well as outstanding scientists and researchers).

The Swedish Ministry of Education, as the key

body overseeing the implementation of R&D policy, manages the research activities of all universities in the country. The remaining ministries and their subordinate organizations (depending on the field of activity) are responsible for specific areas and relevant branches of R&D, which are carried out by the state and private research companies, organizations, as well as enterprises of the non-profit sector.

The key functions for the development of R&D projects are carried out by seven state research councils, whose activities are controlled by a special state body. This is a Scientific Preparatory Commission. Within the framework of the functioning of the state research councils, the issues of formation and development of fundamental, applied and experimental research in the field of natural, technical, social and humanitarian sciences, medicine, agriculture and forest lands are considered. Recently, research in the field of nuclear energy has become increasingly important.

The world-famous administrative scientific center is the Royal Swedish Academy of Sciences, whose activities are mainly aimed at the development of mathematics and natural sciences, the organization of congresses, symposiums, relations with foreign and international scientific centers, as well as the awarding of the Nobel Prize in Physics and Chemistry.

In Sweden, there is a clear division in the implementation of R&D projects. For example, at universities, in organized research institutes and centers, fundamental research is carried out, which is an experimental or theoretical activity aimed mainly at obtaining new knowledge of a fundamental nature about phenomena and observed facts, without special plans for their practical application.

Research institutes and design bureaus of leading industrial concerns and centers, working under the guidance of relevant ministries, carry out applied research and development work. Among them are the Research Institute of Atomic Physics, the Aviation Research Institute and others. It is customary to refer to applied research as original research undertaken with the aim of obtaining new knowledge and aimed mainly at achieving specific practical goals or obtaining specific results.

It also reflects the final development work, which is a systematic activity based on existing knowledge obtained as a result of research and / or

practical experience, aimed at the production of new materials, products or devices for the introduction of new processes, systems and services, or a significant improvement of existing or implemented.

The main scientific, technological and innovative potential among Swedish higher education institutions is concentrated in such universities as Uppsala University (Uppsala Universitet, founded in 1477), Lund University (Lunds universitet, founded in 1666), Gothenburg University (Göteborgs universitet, founded in 1954), Karolinska Institute (Karolinska institutet, founded in 1965) and the Royal Institute of Technology (Kungliga Tekniska högskolan, founded in 1970).

According to 2021 data, all these educational institutions are included in the 500 universities of the QS University Rankings. For example, Lund University (Lunds universitet) occupies the 97th position in this ranking, Uppsala University (Uppsala universitet) is on the 124th position, Stockholm University (Stockholms universitet) is on the 181st place [5].

A brief analysis of the current situation. The key indicator characterizing the scientific, technological and innovative development of the R&D sphere of any country is the relation of intramural R&D expenditures to GDP.

According to statistics, the level of intramural R&D expenditures in relation to GDP in Sweden in 2020 was 3.53%, which is 0.12% more than in 2019 and 0.21% more than in 2018 (see table 1 and figure).

It is also noted that the value of intramural R&D expenditures in the considered period in Sweden tended to increase.

Thus, the value of this indicator in Sweden in 2020 amounted to 175,825 million SEK, which is 2,154 million SEK (or 1.24%) more than in 2019 and by 8,882 million SEK (or 5.32%) is more than in 2018.

In a long-term analysis of the dynamics of the level of intramural R&D expenditures to GDP (we consider five-year period), the value of this indicator increased by 0.32% and amounted to 3.53% in 2020, which confirms the status of the scientific, technological and innovative European Leader, that is, the first place among the European Union countries in terms of intramural R&D expenditures to GDP.

The basic principle in accounting for intramural

Table 1 – Intramural R&D expenditures and its relation to GDP in Sweden in 2015-2020

Indicator	2015	2016	2017	2018	2019	2020
Gross domestic product, mln. SEK*	4 723 053.0	4 818 179.0	4 934 732.1	5 028 403.6	5 092 991.2	4 980 878.2
Intramural Research and Development expenditures, mln. SEK	151 610	156 109	165 807	166 943	173 671	175 825
Intramural Research and Development expenditures and its relation to GDP, %	3.21	3.24	3.36	3.32	3.41	3.53

Source: <https://www.scb.se/en/> – Official website of the Statistical Agency of Sweden [3].

* SEK – Swedish krona.

R&D expenditures, which is followed by the Swedish state statistical authorities, is the allocation of sources of R&D financing (sources of funds) and sectors of R&D (sectors of performance). The sources of funding and R&D sectors are clearly defined in the OECD «FRASCATI» Manual.

When conducting statistical accounting in Sweden, the following main sectors are provided for the formation and financing of R&D:

- business enterprise;
- government;
- private non-profit;
- higher education.

As can be seen from table 2, the largest values of the intramural R&D expenditures are occupied by the business enterprise sector Sweden (127,707 million SEK in 2020).

The lowest value of intramural R&D expenditures is noted in the non-profit sector. The value of this indicator in 2020 amounted to 205 million SEK, which is 3 million SEK (or 1.49%) more than in 2019 and by 17 million SEK (or 9.04%) more than in 2018.

According to table 3, in terms of shares, as well as in absolute terms, intramural R&D expenditures

in the business enterprise sector are of the greatest importance. In the implementation of R&D, their share in 2020 in total intramural R&D expenditures amounted to 72,3%.

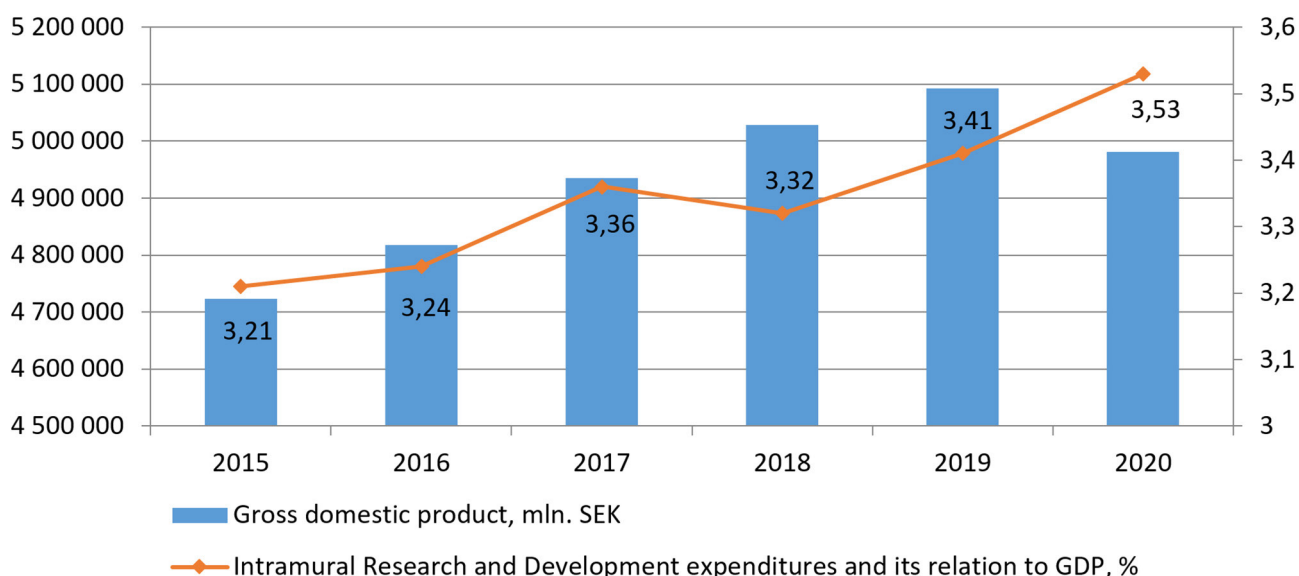
Thus, the share of the Swedish business sector's intramural R&D expenditures to GDP in 2020 was more than 2.55% (i.e. $3.53\% \cdot 72.3\% / 100\%$).

The state actively pursues a policy related to direct and indirect incentives for business to invest in R&D.

In Sweden, the forms of direct financing of R&D include grants allocated by the state, business and non-profit sectors. It can also be grants and programs of the European Union.

The methods of indirect business incentives usually include various forms of tax credits and concessions (research and development tax credits, tax allowances), which are actively used in the modern world in countries striving for global innovation leadership.

The system of tax preferences for R&D businesses in Sweden was introduced by the state fiscal authorities in 2014. According to the OECD, in 2020, the share of indirect business incentives in Sweden's



Dynamics of GDP and intramural R&D expenditures in Sweden in 2015-2020

Table 2 – Data on intramural R&D expenditures by the sectors of performance in Sweden in 2015-2020, million SEK

Year	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector	R&D as share of GDP
2015	105 654	5 183	40 492	281	3.21%
2016	108 623	5 315	41 868	303	3.24%
2017	118 262	6 005	41 343	197	3.36%
2018	118 449	6 037	42 269	188	3.32%
2019	124 523	7 837	41 109	202	3.41%
2020	127 207	7 729	40 684	205	3.53%

Table 3 – Data on the levels of intramural R&D expenditures to GDP by implementation sectors in Sweden in 2015-2020, %

Year	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector	R&D as share of GDP
2015	69.7	3.4	26.7	0.2	100.0%
2016	69.6	3.4	26.8	0.2	100.0%
2017	71.3	3.6	24.9	0.1	100.0%
2018	71.0	3.6	25.3	0.1	100.0%
2019	71.7	4.5	23.7	0.1	100.0%
2020	72.3	4.4	23.1	0.1	100.0%

Source: <https://www.scb.se/en/> – Official website of the Statistical Agency of Sweden [3].

GDP was 0.021% [4].

In conformity with the tax legislation in Sweden, there is a reduction in social insurance payments for employees engaged in R&D in commercial enterprises. Under this mechanism, the amount of such deduction for a company can be up to 230,000 SEK per month. On the one hand, this is an incentive for an employee to engage in R&D and have more income paid by the company. On the other hand, this represents a benefit for the company in the form of an additional deduction when determining corporate income tax (income tax).

Conclusions. Sweden's scientific and technological experience in organizing direct and indirect financing of the R&D sector, which is an innovative European leader, can also be used in the Republic of Kazakhstan, which is striving to enter the top 30 advanced countries of the world.

The author believes that in the Republic of Kazakhstan it is necessary:

- to improve the system of direct and indirect incentives that would interest business entities in investing in R&D projects;

- based on the best practices of countries that are world leaders in the field of R&D, to develop and implement domestic methodological recommendations for business on the implementation and performance of intramural R&D expenditures in accordance with OECD standards;

- study international R&D legislation, develop and improve proposals, the implementation of which would increase the level of intramural R&D expenditures in relation to GDP;

- widely promote and cover in the media and on television the OECD standards necessary for accounting for intramural R&D expenditures;

- to hold thematic conferences, forums and round tables at the universities, research institutes, enterprises, etc.

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5. www.topuniversities.com/university-rankings – official website for the world university ranking QS University Ranking.

Швецияның инновациялық экожүйесін статистикалық бағалау. Ағымдағы жағдайды сипаттау және талдау

ШАЙКИН Дінмухаммед Нұрланұлы, э.ғ.к., кафедра меңгерушісі, shaikindimash@mail.ru, «Манаш Қозыбаев атындағы Солтүстік Қазақстан университеті» КеАҚ, Қазақстан, Петропавл, Пушкин көшесі, 86.

Аңдатпа. Швециядағы ғылыми-технологиялық саланың қазіргі жағдайын көрсететін жағдайға қысқаша талдау берілген. Біздің елімізде ЭЫДҰ стандарттарын енгізу қажеттілігіне баса назар аударылды, бұл ғылыми-технологиялық саясатты жүзеге асыру кезіндегі негізгі императивтердің бірі болып табылады. Тұжырымдамалық аппаратты талдау және ғылыми әдебиеттерді зерттеу негізінде ғылыми-технологиялық саланы талдау тәсілдері ұсынылған. 2015-2020 жылдардағы Швециядағы ҒЗТКЖ-ға ішкі шығындардың мөлшері, сондай-ақ олардың жалпы ішкі өнімге қатынасы қарастырылады және талданады. ҒЗТКЖ-ға ішкі шығындар-

ды есепке алу ЭЫДҰ халықаралық стандарттарына сәйкес, бірінші кезекте «ФРАСКАТИ» басшылығына сәйкес жүзеге асырылатыны атап өтілді. Зерттеушілердің ҒЗТҚЖ жобаларын жүзеге асыруға және орындауға деген ынтыласын арттыруға бағытталған жанама ынталандырулар туралы ақпарат берілген. Авторлық ұсыныстар тұжырымдалып, толықтырылды, оларды іске асыру Қазақстан Республикасында ғылыми-технологиялық саясаттың тиімді дамуын қамтамасыз етуге мүмкіндік береді.

Кілт сөздер: талдау, ішкі шығындар, ғылыми-зерттеу және тәжірибелі-конструкторлық жұмыстар, ЭЫДҰ, қолданбалы, эксперименттік, негізгі зерттеулер, көрсеткіш, «ФРАСКАТИ» Нұсқаулық.

Статистическая оценка инновационной экосистемы Швеции. Характеристика и анализ текущей ситуации

ШАЙКИН Динмухаммед Нурланович, к.э.н., зав. кафедрой, shaikindimash@mail.ru,
НАО «Северо-Казахстанский университет имени Манаша Козыбаева», Казахстан, Петропавловск,
ул. Пушкина, 86.

Аннотация. Представлен краткий анализ ситуации, которая отражает текущее состояние научно-технологической сферы в Швеции. Сделан акцент на необходимости внедрения в нашей стране стандартов ОЭСР, что является одним из ключевых императивов при осуществлении научно-технологической политики. На основе анализа понятийного аппарата и изучения научной литературы представлены подходы к анализу научно-технологической сферы. Рассмотрены и проанализированы размеры внутренних затрат на НИОКР в Швеции в 2015-2020гг., а также их отношение к валовому внутреннему продукту. Отмечено, что учет внутренних затрат на НИОКР осуществляется в соответствии с международными стандартами ОЭСР, в первую очередь, в соответствии с Руководством «ФРАСКАТИ». Приведена информация о косвенных стимулах, целью которых является рост мотивации среди исследователей к осуществлению и выполнению НИОКР-проектов. Сформулированы и дополнены авторские предложения, реализация которых позволит обеспечить эффективное развитие научно-технологической политики в Республике Казахстан.

Ключевые слова: анализ, внутренние затраты, научно-исследовательские и опытно-конструкторские работы, ОЭСР, прикладные, экспериментальные, фундаментальные исследования, показатель, Руководство «ФРАСКАТИ».

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