

Санкт-Петербургский государственный университет

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Выпускная квалификационная работа

**Рассмотрение программ поддержки экспорта для помощи
технологическим стартапам на примере стартапов российской
Национальной технологической инициативы**

Уровень образования: магистратура

Направление 38.04.02 «Менеджмент»

Основная образовательная программа ВМ.5669 «Менеджмент (Master in
Management - MIM)»

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Санкт-Петербург
2022

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1. Introduction

1.1. Relevance of the study

Export experience in Russia is still quite weak, and there are few champions that have shown results in international markets (Russian experience in exporting technological products is mainly related to individual start-ups).

Nevertheless, in conditions of dynamically developing advanced technologies it is necessary to react promptly and qualitatively to the emergence of new markets, to forecast and occupy them in advance, implementing effective export programs and using effective marketing tools.

Accordingly, one of the priority tasks now is to analyze the adequacy of the implementation of export support measures organized by NTI, and to find out what is unique about the NTI system as a whole, which declares that it is capable of solving issues with Russian companies' leadership in international markets in the future.

1.2. Research gap

The NTI strategy takes one of the significant places in state strategic planning and is aimed primarily at strengthening the leadership of Russian companies in the global market by, among other things, achieving high performance in the export of technological innovations.

Nevertheless, at this point it remains to be clarified how feasible the STI indicators are, given Russia's human and technological resources, and whether the STI program's indicators can be viewed as realistic. And if the indicators are seen as realistic, how export programs organized by STI can achieve them and what risks might also be worth considering at this point in time when working to develop the STI system as a manager.

1.3. Research questions and aims of the study

To successfully cover the research gap, the following research questions need to be answered:

- 1) What is the uniqueness of NTI and why does it have the potential to achieve Russia's leadership in international markets?

- 2) What counts as export programs when working with the NTI system?
- 3) How is NTI's export activity currently represented?
- 4) Deficiencies in which elements of the NTI ecosystem can cause the greatest damage to the growth of technology entrepreneurs and technology companies?

For the analysis, explanatory and exploratory research strategies will be used, including case study methodology through collection of both primary and secondary data, analysis of both quantitative and qualitative data, benchmarking methodology.

Primary and secondary data will be used as data sources for the research, in particular, the companies included in the open ratings of NTI companies, interviews with the organizers and implementers of the main aspects of NTI, open analytical and scientific reports.

The aim and goal of this master's thesis is to consider the specifics of export promotion programs of NTI technological projects in new markets, analysis of their correspondence to the set targets in the NTI program and possible identification of important aspects after additional analysis of the NTI ecosystem as a whole.

Subject: their correspondence to the set targets in the NTI program and possible risks that may prevent the fulfillment of the stated objectives.

Object: export promotion programs for NTI startups in new markets and key aspects of the NTI ecosystem.

1.4 Methodology and data collection

This section will review the methodology of the study and will also focus on the specifics of some of the methods and style of research in general.

1.4.1 Accent on the format of Applied Research

In this research the author pursues the logic of conformity to the specifics of Applied research, which, unlike Basic research, implies ultimately not only expanding knowledge about the specifics of processes in business, in particular, revealing the features of the management aspect of business, but also advancing understanding of how to solve specific management problems or problems of business in general. Besides, the purpose of the research is not only to receive the results, showing the consequences from analysis of the information and

intersection of various interpretations with the results of desk research, but also to receive the results allowing exactly to solve the problem or to come nearer to the solution of the problem. Also the conclusions obtained as a result of the analysis and the relationships built as a result of the analysis can be considered not only as a contribution to public knowledge in general, but also as a contribution to specific processes of specific institutions and other stakeholders of the NTI ecosystem.

As for the context of the analyzed information, in this case it is also expected to combine the knowledge available in the scientific environment on the problem under study, as well as the knowledge available in the official reports of various institutions and companies, but also the knowledge obtained through direct communication with various stakeholders, as these stakeholders will largely become the beneficiaries of the findings, the relationships formulated and the recommendations provided to improve the identified growth points. This also applies to the specifics of organizing the time of work on the study: in this case, the time involves a clearly delineated framework, which requires greater regularity in the work on the project, and also requires additional risk assessment in case of insufficient time to obtain answers to the planned questions or to adjust them in order to solve the priority research problem as efficiently as possible.

Regarding the contribution of the research results, it should also be emphasized that it is not only the academic community and the researcher's scholarly experience that are expected to contribute, but also the professional community that directly implements the initiatives being analyzed. In addition, in this case, the researcher will be able to gain a comprehensive understanding of how the ecosystem being analyzed works, what its proven value is, and how it can be improved if the value does represent a benefit sufficient to ensure the stable emergence and scaling of startups and then companies that can become leaders in international promising new markets.

1.4.2 Epistemological status of the research

This study will initially be characterized by an Exploratory case study, as it will involve exploring a phenomenon, uncovering necessary contradictions or unexplored aspects, the clarification of which can help to formulate a more detailed priority research problem, as well as formulate relevant research questions.

Explanatory case studies will be used in further parts of the study in order to establish connections between the identified phenomena and to make the problem under analysis more systematic.

In parallel, a Descriptive case study will be used in all parts of the study in order to get a clear and understandable picture of all key aspects of the study at each step.

1.4.3 Qualitative and quantitative data sources

In addition to the division into quantitative and qualitative data sources, the information sources were divided into primary and secondary. The following were identified as qualitative and quantitative data sources.

Qualitative. Primary: unstructured, semi-structured interviews, participant observations.

Qualitative. Secondary: minutes of meeting, internal reports, consultancy reports, market research reports, government data.

Quantitative. Secondary: annual reports, registries of companies, external statistics.

Quantitative. Primary: surveys, structured interviews.

It should be noted that in-depth interviews will be conducted in a non-standardized interview format, in particular in the One to One format, which in turn is subdivided into Face-to-Face interviews, Telephone interviews, and Internet and intranet-mediated (electronic) interviews.

1.4.4 Case study methodology

As for the Case study method, this method will be carried out taking into account the following parameters. In preparation for the Case study methodology, the following dimensions and classifications were identified:

Motivation: intrinsic if we consider the NTI as a case study, instrumental if we consider the experiences of participants in the NTI chain as a case study to represent the whole phenomenon.

Design: embedded, single case if we view NTI as a case, multiple case if we view the experiences of actors in parts of the NTI chain as cases to represent the whole phenomenon.

Data: quantitative if we consider survey results, company performance statistics, qualitative if we consider interviews, official NTI positioning, information about different parts of the NTI chain, etc.

2. The NTI concept and its role in achieving technological leadership of Russia in the global economy

For a full perception of the concept of NTI should consider all of its key characteristics and features, the understanding of which affects the approach to further research.

2.1 The essence of the NTI concept

Dmitry Peskov (Special Representative of the President of the Russian Federation on Digital and Technological Development, Director of ANO “Platform of the National Technological Initiative”) defines NTI as "an association of several tens of thousands of people who are synchronizing their plans to create global technology leader companies and to change the conditions for achieving that leadership"¹.

In addition, there is another official formulation that defines NTI as "an association of representatives of business and expert communities for the development in Russia of promising technological markets and industries that can become the basis of the global economy"².

"What is NTI? It is Russia's stakes in new markets where [there are] no standards and rules yet. <...> In five years, we, as the state, have invested about 50 billion rubles, and another 50 billion rubles were raised by private business at this very early, difficult stage, when there are ideas, people, and you have to turn them into technology," he said, speaking at a meeting of the supervisory board of the Agency for Strategic Initiatives (ASI), hosted by Russian President Vladimir Putin³.

When considering the main principles of NTI, a definition can be made that includes such characteristics as a focus on bringing together not organizations, but individuals - potential or current technological entrepreneurs, representatives of educational organizations, scientists, other expert and professional communities and executive authorities who can build companies

¹ <https://fea.ru/news/6575> (reached 16.04.2022)

² <https://nti2035.ru/nti/> (reached 16.04.2022)

³ <https://tass.ru/ekonomika/13222595> (reached 01.06.2022)

that will take a share in promising global high-tech markets, which will form in the global digitalization of the world economy.

The companies created in such an environment will carry the "NTI gene," which makes companies "collectives of like-minded talent capable of dealing effectively with global technological challenges"⁴ (in particular, just for the development of the "NTI gene" a lot of attention in the NTI program is paid to the advanced training of advanced technological entrepreneurs).

Such high-tech companies, among other things, are another controlling party, which, together with the state, accelerates the pace of development in promising areas on the domestic market and on international markets. This is also why it is worth noting that the NTI program is a national and not a state technological initiative.

As for ensuring scientific progress, it is worth noting that the NTI program is aimed at ensuring that state investment in advanced research provides the scientific and technological groundwork in NTI areas, rather than turning into formal reports and scientific articles that do not actually carry sufficient practical relevance.

Thus, NTI can generally be defined as a national program that ensures the leadership of Russian companies created by technology entrepreneurs in the global emerging high-tech markets that will be formed by 2035.

Among other things, it can be noted that the definition as the main approach to the development and implementation of the NTI of "a focus on the formation of new global markets with significant growth prospects and meeting the needs of mass consumers" was adopted following a meeting of the Presidium of the Russian Presidential Council for Economic Modernization and Innovative Development of Russia on June 9, 2015⁵.

2.2 NTI 1.0 and NTI 2.0 periods

NTI 1.0 was intended to create an infrastructure that would further develop an ecosystem of innovation, including not only financial support for projects at various stages of development, but also a community with a culture of technological entrepreneurship and a

⁴ <https://nti2035.ru/nti/> (reached 16.04.2022)

⁵ <http://government.ru/orders/selection/401/18547/> (reached 01.06.2022)

system for reproducing promising personnel, as well as comprehensive, seamless acceleration of projects.

On the basis of long-term planning, prospective markets were identified, as well as “the tasks that Russia will face in 10-15 years, what advanced solutions will be needed to ensure national security, a high quality of life, the development of industries of the new technological paradigm”⁶. These forecasts are already helping to develop solutions that will ensure national security and a high quality of life for citizens. In his Address to the Federal Assembly on December 4, 2014, Russian President Vladimir Putin identified the National Technological Initiative as one of the priorities of state policy⁷.

Moreover, the choice to create exactly the ecosystem can be confirmed by other researchers, who also say that “startups and young companies struggle to grow without a well-functioning innovation system”⁸.

NTI 2.0 is about strengthening the NTI program by bringing together representatives of business and expert communities, who together can develop a common vision of new promising development markets and mechanisms for launching them, and find new models for generating profit. NTI 2.0 involves a transition to a digital model of community assembly and digital interaction tools, as well as increased involvement of regions and the scientific and educational environment, and the development of export support for companies and projects⁹.

It should be noted that entering new foreign markets is necessary, as this strategy will provide companies with larger markets, which will provide more resources for further development of new projects and also for further improvement of the economic performance of Russia.

Technology companies in the NTI framework can be divided into two large groups, each of which requires a separate, specific approach. The first group represents companies that

⁶ Послание президента Российской Федерации Федеральному собранию Российской Федерации (04.12.2014). URL: http://www.consultant.ru/document/cons_doc_LAW_171774/ (reached 23.06.2021).

⁷ Ibid.

⁸ H.Z. Adriaan van der Loos, Simona O. Negro, Marko P. Hekkert, International markets and technological innovation systems: The case of offshore wind, Environmental Innovation and Societal Transitions, Volume 34, 2020

⁹ Форсайт НТИ 2.0. URL: <https://nti-new.nti2035.ru/> (reached 23.06.2021)

directly develop technology. In this case, team members, in particular key technology specialists, deal with science and engineering. The work in this area often involves cooperation with universities and other educational institutions.

The second group represents companies that use modern technology and help a wide range of people to solve urgent tasks at another level of technological development. These companies use technologies that are already familiar to the general consumer, such as VR or AR, artificial intelligence, and many other technologies to solve everyday tasks for everyone in Russia. As part of the NTI for two such groups, various support services are being developed and how companies will be able to grow and enter global markets is being thought through¹⁰.

NTI 1.0 managed to build an infrastructure of teamwork and interaction, as well as to establish mechanisms for working with new markets, end-to-end technologies of interaction between business and the state. More than 14 billion rubles were invested in the development of NTI. In addition, during the implementation of NTI 1.0, a massive training of the next generation of specialists has begun, as this task is one of the priorities if sufficient numbers of technological entrepreneurs are needed in the future.

During this time, 8 working groups and roadmaps for new technology markets have been created, 89 spaces of collective work "Boiling Point" in 58 cities from 52 regions of Russia, as well as 14 competence centers for end-to-end technologies and 350 organizations participating in consortia. Seven venture capital funds were also created with the participation of RVC JSC, focused on the development of markets and "end-to-end" NTI technologies. More than 200,000 people became participants in the Circle Movement, a nationwide community of new-type technological enthusiasts and entrepreneurs, and managed to reach the number of 1 million participants in the Leader-ID community (a platform developed by NTI and giving the opportunity to join a million and a half entrepreneurs, researchers, students and volunteers to gain access to Boiling Points across the country and dozens of events every day. On this platform, participants can learn from the best, assemble a team, get involved in high-tech startups, and attract investors¹¹).

¹⁰ Инфраструктура НТИ. URL: <https://nti2035.ru/program/infrastructure.php> (reached 23.06.2021)

¹¹ Платформа Leader-ID. URL: <https://leader-id.ru/intro> (reached 23.06.2021)

As for the projects themselves, it is important not only that they be technology projects, but also that these projects be connected into one network, which will make it possible to build a complete ecosystem. 150 such projects (end-to-end technology projects) have been launched by the Competence Centers by the end of 2019. For example, artificial intelligence, virtual reality, quanta, sensorics and robotics, big data storage and analysis.

By the end of 2019, a total of 981 NTI projects were recorded that received financial, expert or administrative support. As for the legal aspect of creating and comprehensively supporting technology projects, the NTI also takes into account the importance of company participation in developing or reviewing the existing legal framework for successfully building an innovation ecosystem in Russia, as well as the successful export experience of Russian companies that retain their main offices in Russia. Sixty bills and regulations reducing barriers to business have been proposed by legislative working groups. Of these, 40 had already been approved by the end of 2019.

To create a broader base for a full-fledged ecosystem, NTI is also paying attention to the functioning of projects not only at the medium or large enterprise stage, but also at the idea generation and team-building step. It should be added that the decision back in the NTI 1.0 step to fund projects not only in the international market entry stages, but also in the early stages was correct, as research shows that the diversity of funding in the early stages is positively related to the export intensity of companies¹².

To this end, a "seamless acceleration" of projects is being created, which in a broad sense can also include the University 20.35 project, the first university without walls, which provides professional development in the digital economy through the construction of individual educational paths and covers key areas important for future technological entrepreneurs: by the end of 2019 more than 130 thousand people have been trained at the University 20.35.

In a narrow sense, "seamless acceleration" is the creation of consulting and financial support for a project at all steps of its development, and to provide this support, a network gas pedal is created, thanks to which, in particular, teams become more sustainable, because not getting the planned result, they still become more experienced and competent professionals

¹² Davide Castellani, Elisa Giarretta, Raffaele Staglianò, "Early-stage financing diversity and firms' export intensity: a cross-country analysis", Finance Research Letters, 2021

with formed relationships with other companies and investors and can come together again in a new team for a more elaborate implementation of an already new idea that will work^{13 14}

3. Export of advanced technologies in Russia

In addition, the role of new technological markets in the future economic development of Russia will be considered separately, and the potential of these markets will be considered using the example of the TechNet market (the market for digital design and modeling, new materials and additive technologies).

3.1 State of export of advanced technologies in Russia

Advanced technologies in this study are understood in accordance with the definition of researchers from the Higher School of Economics, which implies that these are technologies that will radically change the landscape of global production: allow a multiple increase in productivity in a short time, lead to a geographical shift of forces in global production, etc¹⁵.

These are technologies associated with the third industrial revolution: electronics; optoelectronics; information and communication technologies (together, they account for 63% of the market for advanced manufacturing technologies). In addition, these are technologies associated with the fourth industrial revolution: additive manufacturing (including 3D printing); biotechnology; life sciences (life sciences: biology, medicine, etc.); flexible manufacturing, including robotics (27% of the advanced technology market); advanced materials, aerospace, nuclear technology and weapons (9.6%)¹⁶.

According to research by the Higher School of Economics, Russia's share in global exports of advanced manufacturing in 2002-2018 ranged from 0.2-0.5%, and in global imports from 0.3-1.6%. Technology imports went to Russia from developed countries, while the country exported innovative products mainly in the post-Soviet region. It should be said that Russia's current specialization in advanced manufacturing markets is not characterized by a fully realized potential, which could serve as a basis for sustainable development in the long term. "Russia's share in the world markets of advanced manufacturing technology products

¹³ Реализация НТИ. URL: <https://nti2035.ru/nti/realization> (reached 23.06.2021)

¹⁴ Принципы НТИ. URL: <https://technet-nti.ru/article/ob-nti> (reached 23.06.2021)

¹⁵ https://www.rbc.ru/technology_and_media/13/04/2021/607478fc9a794731d03611ab (reached 01.06.2022)

¹⁶ Ibid.

does not exceed 0.6%. The exceptions are the nuclear technology market, where Russia is the leader with a 16.7% share of the world market, and the arms market, where Russia has 1.2% of the world market”¹⁷.

The main advanced technology exports from Russia are aerospace production, nuclear technology (these two segments have the lowest growth rates of all advanced manufacturing technology markets), and armaments (0.2% of all advanced manufacturing technology markets).

- 1) Leaders in global production: Germany, Netherlands, Switzerland, Belgium, Czech Republic, Hungary, Vietnam (the USA is not included in the classification as a world leader).
- 2) Surrounding the leaders: Great Britain, France, Canada, Austria, Denmark.
- 3) Moving the global technological frontier (leaders in patents): Korea, Japan, Sweden, Israel and Finland.
- 4) Catch-up producers (intensive use of technology for their own needs): Poland, Romania, Slovakia, Thailand, the Philippines, Mexico, UAE and China.
- 5) Late producers (relatively weak involvement in the production of products based on promising technologies): 35 countries, including Russia, Brazil, India, South Africa, Australia, Norway, Argentina, Kazakhstan¹⁸.

Thus, we can conclude that Russia at this moment remains not the brightest participant in the world market of advanced production technologies. Besides, now Russia risks lagging behind the technological leaders by a critical distance, which makes the need to solve the issue of increasing exports and achieving leadership in the world market even more acute.

Accordingly, the relevance of having effective export promotion programs suitable for technology projects, in particular NTI projects, which represent a fairly large share of all technology companies, is further confirmed.

¹⁷ Ibid.

¹⁸ Ibid.

3.2 The importance of scientific expertise of export promotion programs

Studying the effectiveness of export promotion programs developed by the state is currently one of the topical issues for detailed research, as more and more budget funds are allocated to such programs and high expectations are formed, but the number of studies in this area to more accurately confirm the effectiveness of investment of budget funds in one or another program is not yet spread in the same volume and the risk of developing an ineffective strategy in some of the programs is growing¹⁹.

Research on the experience of implementation and evaluation of the effectiveness of export promotion programs will help avoid inefficient spending of funds on activities that are irrelevant to new markets and entrepreneurs, and will also help increase the confidence of technology entrepreneurs in state development programs and various state investments so that programs will become more targeted, and with their help the state in general and technology entrepreneurs in particular will be able to achieve their goals of economic development and leadership in new technology markets²⁰.

For the same reason, this master's thesis will examine in more detail the experience of NTI in promoting export of technological start-ups through creation and development of export promotion programs and will assess the effectiveness of these programs in achieving global leadership of Russia in new technological markets.

4. Technological startup: concept and stages of development

Since NTI aims to develop markets of the future with inherent new technologies, the notion of a technology startup should be examined in more detail. In addition, further consideration should be given to what traits are added to a technology startup when it is classified as part of the NTI ecosystem.

4.1 The concept of a startup

At the moment there is no clear consensus on the concept of a startup. Often practitioners are guided by the age of a startup compared to traditional companies as the main criterion for distinguishing it from an ordinary company or by the feature of a startup

¹⁹ Joan Freixanet, Export promotion programs: Their impact on companies' internationalization

performance and competitiveness, *International Business Review*, Volume 21, Issue 6, 2012

²⁰ Ibid.

characterized by a short operating history. In addition, there is an opinion among entrepreneurs and journalists that a startup must necessarily have a technological component.

In this study, we will be guided by the definition of a startup proposed in the book of Steve Blank and Bob Dorf “The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company”. In this book, a startup is defined as “a temporary organization in search of a scalable, repeatable, profitable business model’.

Thus, a startup is not a company in a reduced form that necessarily carries high technology in its essence. First of all, according to this notion, a startup must test and find a working business model by doing a comprehensive job of identifying and verifying consumers.

4.1.1 The concept of a technology startup

Thus, based on the basic definition in the book of Steve Blank and Bob Dorf, we can make an addition and get a definition of a technology startup as “a temporary organization in search of a scalable, repeatable, profitable business model’, whose key value is provided by technological innovation”²¹.

4.1.2 Frequent options for the stages of startup development

In general, the classification of the stages of startup development will be important in this paper, starting specifically from the stages of startup financing. In this classification, startup development is divided into such stages as Early Stages and Late Stages. The early stages include Pre-Seed, Seed, as well as funding from business angels and Round A. The later stages include Round B, Round C, Round D, and others.

Because of the specific nature of the work, the initial stage of financing deserves special attention. It differs in that it involves the stage of idea verification, hypothesis testing, prototype development and the launch of the MVP (minimum viable product).

At this stage, FFF - Friends, Fools, Family - is considered to be the main financiers. At this step, the startup begins to fit into a system that provides various types of funding. This may include both state grants and crowdfunding and business angels²².

²¹ Blank, Steven G, and Bob Dorf. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. Pescadero, Calif: K & S Ranch, Inc, 2012.

²² <https://admitad.pro/ru/blog/raundy-privlecheniya-investitsiy-v-startap> (reached 23.06.2021)

4.1.3 Classification of companies in the NTI logic

In evaluating companies to provide them with relevant support measures from the NTI, companies are evaluated according to three criteria: Technological level (linked to NTI market and end-to-end technology priorities), Export level (as well as the degree of global competitiveness), and business size (as well as projected dynamics). Depending on how harmoniously all three aspects are developed, the corresponding measure of support is allocated.

When all three criteria are met, the company is considered a Global Leader - it is a high-tech company with experience in building a global business.

When completing the indicators on the criteria of Export Level and Business Size, the company is considered an Industry Partner - a winged, but non-technology company with experience in building a global business.

When completing the indicators according to the Technology Level and Business Size criteria, the company is considered a Regional Player - a high-tech company with successful experience in introducing products into the Russian market.

When completing the indicators according to the Export Level and Technology Level criteria, the company is considered a Hidden Champion - a medium or small technology company with experience in international markets²³.

4.1.4 The difference between NTI startups and ordinary technology startups

“The basis of the portfolio of NTI projects are "systemic" or "platform" projects that overcome technological or regulatory-organizational barriers and create around themselves an ecosystem of partners who use platform developments to create innovative products and work in global, new markets. The importance of NTI projects is determined by the response to the social and economic challenges of the state. These are, first and foremost, issues of national security, a high quality of life for people and the development of new technological mode industries”²⁴.

It is worth noting separately that in contrast to ordinary technology startups, startups created within the framework of the NTI assume a network structure. It should be noted that NTI builds an integrated system of interaction between organizations, state institutions,

²³ <https://nti2035.ru/nti/> (reached 01.06.2022)

²⁴ <https://nti2035.ru/nti/realization> (reached 01.06.2022)

technological communities and entrepreneurs; accordingly, projects to be developed in this system and engaged in exports to new markets, which are also characterized by the network nature, will be of the same nature. The effectiveness of the network nature of startups is also confirmed by the research of other scientists who state that “young companies benefit from a high density of local incumbents and strong networking organizations”²⁵.

It is also worth noting that despite the additional key characteristics of the definition of NTI startups, they still bear the characteristics of technology startups (and startups in general as companies in search of a profitable business model), since the NTI markets for which the NTI prepares and selects startups are future innovative technology markets.

5. New NTI markets: key characteristics and their role in economic leadership

As mentioned in the previous part of the study, an important condition for ensuring Russia's advantage in the global technology market by occupying large markets is to forecast promising future markets in advance and prepare a network of technology companies that will become "national champions" by that time and gain a significant share of these leaders^{26 27}.

It is important for companies to understand what markets will emerge in the future and, most importantly, what demand is forecasted for them: whether they are promising and worth investing in their development to ensure profitable leadership in the future. The development of robotics, artificial intelligence, smart home technology, and many other things are also promising areas, and it is important to understand how demand will change in these markets, what people will be willing to pay for, and what businesses should invest in to be successful not in the short term, but in the long term to grow sustainably.

²⁵ H.Z. Adriaan van der Loos, Simona O. Negro, Marko P. Hekkert, International markets and technological innovation systems: The case of offshore wind, Environmental Innovation and Societal Transitions, Volume 34, 2020

²⁶ Рейтинг быстроразвивающихся технологических компаний «ТехУспех». URL: <http://ratingtechup.ru/> (reached 23.06.2021)

²⁷ Медовников Д.С, Розмирович С. Д., Оганесян Т. К. Кандидаты в чемпионы. Особенности российских быстрорастущих технологических компаний, их стратегии развития и возможности государства по поддержке реализации этих идей. Институт менеджмента инноваций. 2015

The NTI presents a way to forecast future markets using the methodology of foresight sessions and, based on this, together with representatives of various industries, develops roadmaps, development plans for new industries and companies whose representatives participate in the foresight sessions.

Representatives of NTI and companies understand that joint development (uniting specialists, business partners, etc.) will produce a synergetic effect in the future, so foresight sessions are actively used by NTI as a way of working. Participants in foresight sessions also develop their competencies in business management and building company strategy, which is especially relevant in the post-pandemic period, when many companies need to clearly understand on what and how to build their development strategy.

This is why NTI is focusing on the new global markets that will be formed in 15-20 years. Most markets will be networked in nature (inheriting approaches that exist on the Internet, or using the infrastructure of the Web). New markets will be oriented to the person as the end user, the distance between the producer and the consumer will be minimal²⁸.

The selection of markets for NTI 1.0 was based on the following criteria:

- 1) The market will become significant and prominent on a global scale: the volume will be over \$100 billion by 2035;
- 2) At the moment there is no market, or it lacks established technological standards;
- 3) The market is preferably focused on the needs of people as end consumers (B2C priority over B2B);
- 4) The market will be a network in which intermediaries are replaced by control software;
- 5) The market is important for Russia in terms of basic needs and security;
- 6) Russia has the conditions to achieve competitive advantages and gain a significant market share;

²⁸ Национальная технологическая инициатива. Агентство стратегических инициатив.
URL:
<https://old.asi.ru/nti/> (reached 23.06.2021)

7) There are technological entrepreneurs in Russia with ambitions to create leading companies in this new technology market²⁹.

As a result of the “Foresight Fleet” strategy session held in May 2015, nine prospective markets that meet the criteria were identified: AeroNet, AutoNet, MariNet, NeuroNet, HealthNet, FoodNet, EnergyNet, TechNet, and SafeNet. Later, EduNet and SportNet markets were added³⁰.

Moreover, it is worth noting an important point that has already been noted in the division of conventional technology startups and NTI startups: when planning NTI markets, the connection of seemingly unrelated markets with several specific (so called "end-to-end") technologies was specifically taken into account. This made it possible to bet on certain technologies in order to occupy several markets at once in the future.

The screen shot of one of Dmitry Peskov's interim speeches³¹ on the development of the NTI program, in particular the NTI Matrix, shows a part of the NTI Matrix being developed at that time: the horizontal axis represents "Technologies", among which digital modeling, new materials, additive technologies, quantum communications and others are reflected (from left to right). The vertical axis "New Markets" reflects markets such as EnergyNet, FoodNet, SafeNet, and others. We just see that, for example, the EnergyNet, FoodNet, and SafeNet markets are highly intertwined due to the dominance of digital modeling, new materials, additive technologies, and quantum communications technologies in these markets.

²⁹ <https://nti2035.ru/markets/> (reached 02.06.2021)

³⁰ Ibid.

³¹ <https://www.youtube.com/watch?v=DHfLF6G2JxQ> (reached 02.06.2021)

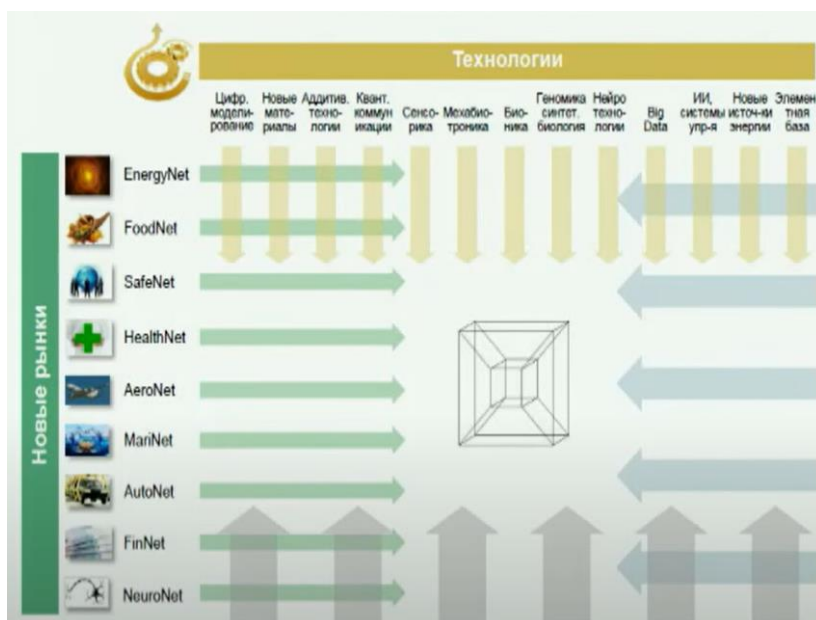


Figure 1. Part of the developing NTI Matrix, a screenshot from Dmitry Peskov's interim speech on NTI development.

One of the main goals of growing projects with such specificity, in addition to leadership in key technological areas, is to achieve the so-called technological sovereignty (the term was also introduced as part of work on the development of NTI), which allows to build independent technological chains and not depend on most sanctions and in general crisis situations, in which the first thing that often collapse is not fully controlled technological chains.

Among the results obtained, Mr. Peskov noted the precise definition of the potential of the technological markets chosen for development.

"The markets that were bet on are growing today in the world and in Russia by an average of 20-30% per year. That is, the market for civilian drones is growing today by 25% a year. Five years ago, there were about five companies in Russia that could make competitive products, today there are about 25. So we have grown by about five times in five years," he added.

Special presidential representative also noted the emergence of large private companies in the NTI markets in 2020-2021, including Sberbank, Yandex and MTS, "which

approximately doubled the rate" of the state by investing in the development of several promising companies, Peskov continued³².

5.1 Potential of NTI markets on the example of the TechNet market

The first version of the TechNet NTI roadmap was approved back in February 2017³³. After this, a large team of authors, involving the expert community, updated and updated the document. At the beginning of 2021, the updated TechNet 4.0 (advanced production technologies) NTI roadmap was approved at the meeting of the Interdepartmental Working Group of the NTI under the Government Commission on Economic Modernization and Innovative Development of the Russian Federation.

“By 2035, Russia will export 800 billion rubles worth of products created using advanced manufacturing technologies. And the country's share of global markets for "factories of the future" will reach 1.5%”³⁴. Such goals are included in the "Technet 4.0" NTI Roadmap.

By 2035, it is also expected that: 20 service provider companies to create "factories of the future" will be in the top 50 technology gazelles of the Russian Federation; the number of "factories of the future" "TechNet" NTI will grow to 30; the number of test sites (TestBeds) will grow to 25; the number of experimental digital certification centers in the country will grow to 15; 50 thousand specialists will be trained and retrained in the areas of advanced production technologies³⁵.

In addition, by 2024, more than 250 Russian enterprises will switch to digital twin technologies. At the same time, a network of "factories of the future" should be formed across the country, which will then enter global markets. There are currently six such factories in Russia.

³² <https://tass.ru/ekonomika/13222595> (reached 01.06.2022)

³³ <http://government.ru/news/26436/> (reached 01.06.2022)

³⁴ <https://ru-bezh.ru/gossektor/news/21/06/30/250-rossijskix-predpriyatij-perejdut-na-tekhnologii-cifrovyyix-dv>

³⁵

[https://www.tadviser.ru/index.php/%D0%A1%D1%82%D0%B0%D1%82%D1%8C%D1%8F:%D0%A6%D0%B8%D1%84%D1%80%D0%BE%D0%B2%D0%BE%D0%B9_%D0%B4%D0%B2%D0%BE%D0%B9%D0%BD%D0%B8%D0%BA_\(Digital_Twin_of_Organizat ion,_ DTO\)](https://www.tadviser.ru/index.php/%D0%A1%D1%82%D0%B0%D1%82%D1%8C%D1%8F:%D0%A6%D0%B8%D1%84%D1%80%D0%BE%D0%B2%D0%BE%D0%B9_%D0%B4%D0%B2%D0%BE%D0%B9%D0%BD%D0%B8%D0%BA_(Digital_Twin_of_Organizat ion,_ DTO)) (reached 01.06.2022)

The updated NTI TechNet Roadmap has two global goals:

1) Formation of a set of key competencies in the country, ensuring the integration of advanced production technologies and business models for their distribution as "factories of the future;

2) Creation of globally competitive, next-generation personalized products for NTI markets and also for high-tech industries³⁶.

6. Export promotion programs from NTI: specifics of consideration

We have already identified the uniqueness of the NTI as a program in the course of this study. In general terms, the uniqueness is that NTI aims to help technology ideas and businesses by creating a production chain from concept to realization. Thus, it is interesting to consider conceptually what place export support programs have within this chain and whether they fully reflect the essence of the specifics of the system in question.

6.1 Support measures offered by the NTI Foundation

Among the NTI support measures funded specifically by the NTI Foundation are such programs as NTI TECHNOLOGICAL BREAKTHROUGH (offers financing, finding partners and customers, overcoming administrative barriers, and technological cooperation), NTI SPIN-OFF (offers interest rate subsidies, finding partners and customers, overcoming administrative barriers, and entering the capital of project companies), INFRASTRUCTURE of NTI (offers financing, overcoming administrative barriers, and finding partners and customers), TECHNOLOGICAL COMPETITIONS "UP GREAT" (offers prize for overcoming technological barriers, PR and GR of the solutions, attention of partners and customers, the opportunity to officially prove the effectiveness of the developed solution), NTI INFRASTRUCTURE CENTERS (interest rate subsidies, search for partners and customers, overcoming administrative barriers, entering the capital of design companies), NTI COMPETENCE CENTERS (a network of engineering and educational consortia on the basis of scientific organizations and universities, development of end-to-end NTI technologies, R&D

³⁶ Дорожная карта «Технет 4.0». URL: https://technet-nti.ru/article/roadmap_new (reached 23.06.2021)

and engineering, technology transfer, training of specialists for new markets are proposed), and EXPORT of NTI³⁷.

6.2 Classification of support programs by type of NTI company

Previously, we looked at the types of NTI companies, which were subdivided according to the criteria of Export Level, Technology Level, and Business Size.

Depending on the profile of companies and the parameters for which development potential has not yet been realized, the programs are divided into four categories:

1. The EXPORT of NTI program is designed for medium and large companies at the final stage of developing and bringing export product solutions to market.
2. The NTI SPIN-OFF program will support the creation of new businesses in NTI areas on the basis of major technology companies.
3. The NTI TECHNOLOGICAL BREAKTHROUGH Program is designed for teams of researchers, small and medium-sized technology companies and research centers that develop breakthrough products in the NTI markets.
4. The INFRASTRUCTURE of NTI program is aimed at developing infrastructure projects for NTI markets - test sites, engineering and certification centers, data libraries, and gas pedals.

6.2.1 EXPORT of NTI

Specifically, EXPORT of NTI is a program that provides support for the final stages of the development and introduction of technological products into foreign markets. The program offers grants and investments of 300 million rubles and more with at least 50% off-budget co-financing of the total project budget, participation in the export gas pedal, assistance in finding technological partners in Russia and abroad, as well as international GR. The program was created for medium and large technology companies aimed at creating innovative products and technologies with high export potential³⁸.

On the NTI Project Office side, an initial review is conducted. In the case of a positive decision, the project is assigned a personal manager who helps prepare the project for presentation of the concept to the Project Committee. The NTI Project Committee decides that the project meets the requirements and values of the National Technology Initiative. The project is moved to the

³⁷ <https://nti.fund/support/> (reached 01.06.2022)

³⁸ Ibid.

stage of preparation for obtaining funding -- detailed development. After receiving approval from the Project Committee of NTI -- work on the comprehensive development of the project and its preparation (together with the Project Office of NTI) for obtaining funding³⁹.

6.3 Criteria for selecting companies for NTI support programs (including the EXPORT of NTI)

Applications for funding under one of the NTI support programs are evaluated according to 10 parameters:

1. Technological level - the level of novelty and availability of technology for copying, mastering and promotion.
2. Uniqueness - analogues on domestic and foreign markets.
3. Technology maturity - evaluation of the technology through the Gartner cycle.
4. Technology readiness - determination of TRL and MRL of the project.
5. Experience of the team - successful tech startups in the collection of project initiators.
6. Applicant company - co-financing of at least 50% of the project cost. Profile revenues in the target market.
7. Target market - the capacity of the target market, its competitiveness and growth rates.
8. Investment potential - expectations for revenue and capital intensity of the project.
9. Role for NTI - the systemic effect of the project for the technology initiative.
10. Social effect - social risks and prospects associated with the implementation of the project⁴⁰.

In general, we can conclude that technological startups, and then companies working in the logic of NTI and applying for support, are successful, growing technological businesses with the potential to develop in the global market.

³⁹ Ibid.

⁴⁰ Ibid.

6.4 Peculiarities of consideration of support measures in the logic of the NTI concept

When considering support measures, in particular special programs to support NTI companies, in particular programs aimed at supporting NTI exports, it is worth noting their main difference from standard export support measures. This difference is important when evaluating their efficiency and when making a decision to increase or decrease their financing and their number.

Let us consider in more detail specifically the concept of export support programs, as other measures of support after this consideration can also be considered according to the proposed logic. According to the definition of the Russian Export Center, export is "a type of foreign economic activity consisting in the sale of raw materials, goods and services to foreign partners for the purpose of receiving profit"⁴¹.

Because of the specifics of the concept of the NTI system named earlier, all actions aimed at its development, in a fundamental sense, are ultimately aimed at ensuring the regular sale of goods to foreign partners for profit, in particular at achieving leadership in international new high-tech markets, which determine the specifics of goods. Thus, as a whole, the entire NTI program can then be viewed as one comprehensive export support program, and the support measures are measures at various stages to help technological entrepreneurs develop their projects for export.

In this view, analysis of the effectiveness of the NTI export support programs is directly embedded in an analysis of the NTI system as a whole in terms of the success of achieving the goal of taking a leadership position in new international high-tech markets by 2035. In addition, in this view, NTI export activity can be viewed as activity enabled by the NTI system as a whole: from the first steps related to providing the environment and education, to the final steps that allow entering and scaling up in international markets.

6.5 Analysis of export activity of NTI companies at the moment

The export activity of NTI, as was said earlier, is more rational to analyze, taking into account measures of support for the NTI system as a whole, and not just individual support programs, such as, for example, the EXPORT of NTI program. One of the key indicators will still be the volume of export revenues, but all STI companies will be taken into account, not just the companies that used the EXPORT of NTI program.

⁴¹ <https://www.exportcenter.ru/> (reached 01.06.2022)

6.5.1 Planned additional classification of the analyzed companies

In addition to the classification of NTI companies used by the NTI program to select companies for support programs in the narrow sense and described earlier, it would be important to introduce an additional classification of NTI companies in the analysis process to get a cross-section on trends in the selection of current support measures, dividing companies into the following:

1) Companies that were founded before the start of the NTI program, but have declared themselves as companies with the "NTI gene," that is, operating within the logic of the NTI and being participants in the chosen market.

Such companies usually do not receive financial support, as they need more PR and GR at the expense of mentions on platforms and in NTI documents.

2) Companies that were founded before the start of the NTI program but have benefited from some type of financial support.

Due to the specifics of considering NTI export activity, this classification also includes support measures provided by organizations also associated with the NTI, as reflected on the official platform "1000 NTI companies 20.35" (<https://nti1000.leader-id.ru/>).

Such support measures include support measures from:

- 1) VEB VENTURES Foundation
- 2) SME Corporation
- 3) Rosnano
- 4) Russian Venture Company
- 5) Russian Direct Investment Fund
- 6) Russian Export Center
- 7) Skolkovo
- 8) The MIR Foundation
- 9) Advanced Research Foundation
- 10) Foundation for Internet Initiatives Development
- 11) Industry Development Fund
- 12) Foundation for Assistance to Innovations

3) Companies that were founded precisely due to NTI support.

6.5.2 Sources of information for company analysis and limitations

Qualitative secondary data, as well as in-depth interviews with experts directly working on the implementation of the NTI program, were used as sources of information.

In the process of searching for specific indicators that would contribute to the analysis of the actual picture of NTI export activity, it was possible to find the official reports of the NTI Platform (<https://platform.nti.work/>) for 2019 and 2020, course materials on NTI 2.0 on the University 20.35 platform (<https://edu.2035.university/course/UNIVERSITY2035/NTI/>), and the database of actual companies reflected on the official platform "1000 NTI 20.35 companies" (<https://nti1000.leader-id.ru/>). As a result, 643 NTI companies were available for research.

In addition, since the reports have always reflected generalized information, and "only some of the companies have been transferred to the register of companies by now" (moreover, only NTI-supported companies have been able to find open information on export revenues), the conclusions were discussed with the experts from NTI who are directly involved in developing the NTI Platform, as well as those responsible for support programs of the National Technology Initiative Foundation (<https://nti.fund/>) to see if the conclusions correspond to the real picture, which could be distorted by not enough information.

During the analysis, companies from each of the currently defined NTI markets were taken into account. The companies were reported separately in the total revenue cross-section of NTI companies in each market. The point on the graph corresponds to a specific company with a known name and total revenue figures.

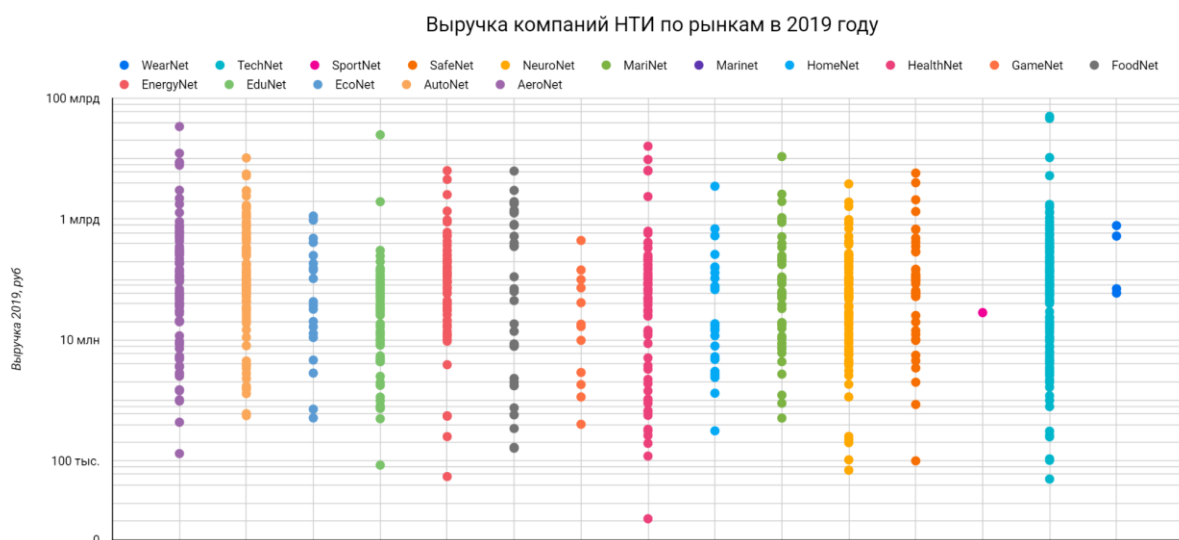


Figure 2. Revenue of NTI companies by market in 2019 (the vertical scale "Revenue 2019, rub" shows companies' revenue values in ascending order: 100 thousand, 10 million, 1 billion, 100 billion).

As additional limitations that open up opportunities for further research, we should point out the limitations that led to the reclassification. As the available data on the receipt of financial support by companies, and not, for example, consulting or administrative support, cannot be obtained through the available tools. In addition, the third criterion, which singles out companies that have already been founded thanks to NTI support, also cannot be applied accurately, as the available sources of information do not allow to obtain specific names or other legal data of such companies, so singling out specific NTI companies will also be the groundwork for further research.

As a result, a two-point classification was chosen for analysis, dividing companies into those that have joined the NTI and benefited from NTI support measures (the list of support measures was retained from the previous classification), and those that only declare themselves as companies that have joined the NTI and are operating within the logic of the NTI.

6.5.3 Results of the analysis and interim conclusions

As a result of the analysis, the selected NTI companies were divided according to a reworked classification. We were able to see that in 2015 46 companies joined NTI, 42 of which benefited from NTI support, in 2016 50 companies joined NTI, 45 of which benefited from NTI support, in 2017 85 companies joined NTI, 70 of which benefited from NTI support, in 2018 101 companies joined NTI, 71 of which benefited from NTI support, in 2019 157 companies joined NTI, 112 of which benefited from NTI support, in 2020 204 companies joined NTI, 107 of which benefited from NTI support.

This led to the following conclusions:

- Every year there is a steady growth of NTI companies
- There is also a growth in the number of the NTI companies themselves
- Even if companies are not supported by NTI, they either have a general response to the idea of NTI, or they find that mentioning it through reports, roadmaps, presentations and events is an effective tool for PR and GR.

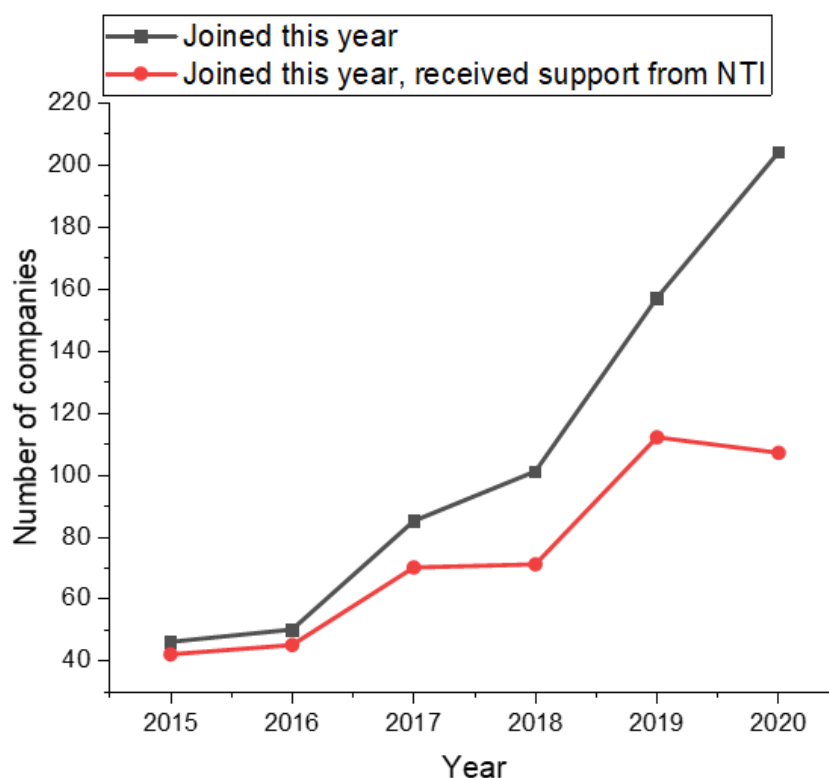


Figure 4 The growth of the number of the NTI companies, reflecting the distribution of analyzed NTI companies according to the selected classification into companies that benefited from financial support and companies that only declared belonging to the NTI logic.

As for the analysis of the volume of export earnings, as mentioned above, the indicators of export earnings of NTI-supported companies are to be considered in this study. However, it is worth noting that considering only companies supported by the NTI will in any case give a clearer picture of how active the NTI system as a whole is, since this eliminates companies that simply declare belonging to the NTI.

We see that the export earnings of NTI-supported companies were 7.5 bn RUB in 2018, 11 bn RUB in 2019, and 20 bn RUB in 2020. This allows us to conclude that the number of companies is not just growing in number, but also receiving export earnings.

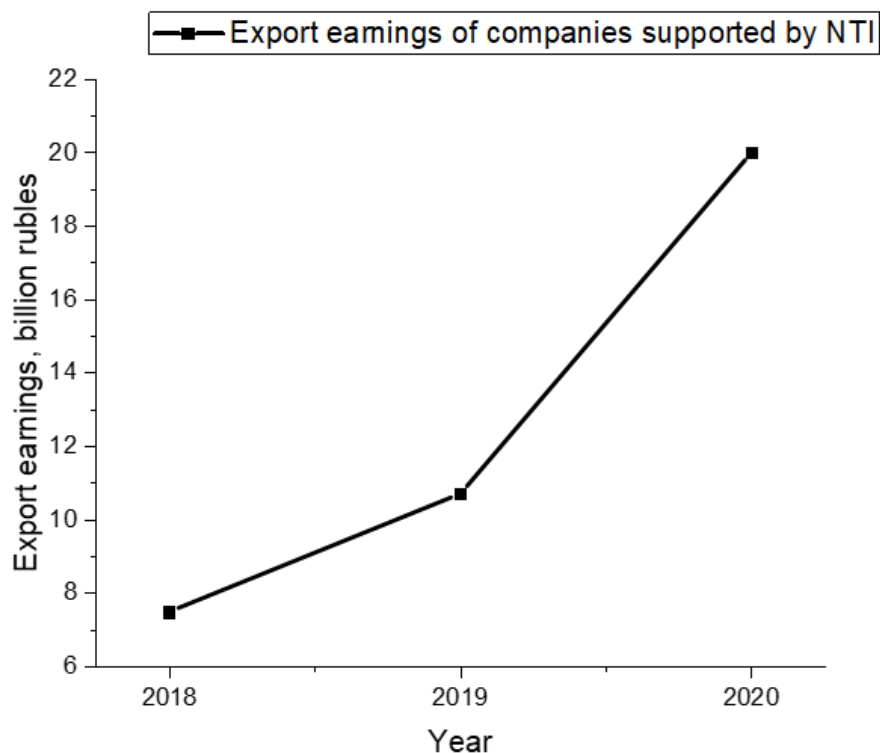


Figure 5. Growth of export earnings of NTI-supported companies

In general, one way to determine how dynamic the growth rate of companies as well as export revenue growth can be considered and whether current performance can be called sufficient to achieve the global NTI program goal of leadership in new international high-tech markets is to compare the current growth rate to the 2035 NTI program targets.

Thus, as part of the development of the strategy, the following expected results of NTI implementation by 2035 were formulated:

- high-tech businesses will account for up to 50% of the Russian economy;
- additional average annual growth of the gross domestic product (GDP) will gradually increase to 1.1 percentage points in 2031-2035⁴².

Exports in 2030 should be approximately \$ 1.438 trillion, i.e. about \$ 2 trillion in 2035⁴³, which at the rate of 70 rubles is 100.66 trillion rubles or 140 trillion rubles. According to the plans of NTI up to 50% of exports should fall on high-tech business, i.e. up to 50.33 trillion

⁴² <https://news.nti2035.ru/wp-content/uploads/2021/01/priority-nti-2035.pdf> (reached 01.06.2022)

⁴³ <http://static.government.ru/media/files/41d457592e04b76338b7.pdf> (reached 01.06.2022)

rubles or 70 trillion rubles in 2035. If we take 2020 with revenues of 20 billion rubles as a base year, the program will be fulfilled with annual growth rate of 72.4%.

At the moment, only the last reporting year showed such growth (87%). In order to maintain such growth rates in NTI, as was discussed earlier, a system of development of technological entrepreneurs from school to export has been built.

It is also worth noting that the specifics of the NTI program involve the long-term development of a base for growing such companies and occupying markets. For example, one of the experts working on the development of the NTI Platform confirmed that "from 2015 to 2018, only less than 5% of the companies that expressed a desire to work with NTI or grow in the NTI had a willingness to export, so the focus shifted to earlier stages of preparation related to education. The expert also noted that "around 2018-2019, there just started to be a greater focus on working through support for companies already in the export readiness stages, and since the NTI is designed to last until 2035, this part of the NTI chain will receive more and more attention."⁴⁴. In addition, the 2020 NTI Platform report set a plan for 2021 to increase the number of projects in the NTI markets by an order of magnitude. That is, in the next reports for 2021 and 2022, we can expect confirmation of the high trend of revenue growth, due to the high potential (the number of companies and the growth of new companies).

In general, the conclusion on this part of the analysis can be formulated as that the base for further growth of export revenues is steadily growing. It is the growth of the number of companies able to export in this case that is one of the key conditions for achieving leadership in high-tech international markets, as the specifics of new high-tech markets (previously discussed in the discussion of NTI markets) suggest a focus on end-to-end technologies and on building technology chains. Thus, a large number of companies will provide a network effect and greater sustainability than a few companies with not fully controlled supply chains.

At the moment, the NTI system needs exponential growth to ensure its own performance and yet does not yet have an extensive amount of data for detailed analysis, because the full potential of projects that have already shown a desire to work with the NTI or grow in the NTI is not realized, as most are not ready for the export stage for a variety of reasons. Realizing the potential of the NTI system can largely allow for the exponential growth needed.

⁴⁴ Expert Commentary

7. Growth points in the NTI ecosystem

In order to ensure that NTI goals are met, it is necessary to eliminate the risk of missing aspects in the ecosystem that could lay down technical debt and lead to the drain on key resources. To do this, an analysis of the current integrated NTI system was conducted, identifying the key aspects whose degradation would be most devastating to the system. The NTI ecosystem from different stakeholder perspectives is reflected in the current NTI Matrix.

7.1 NTI Matrix

The specifics of the NTI Matrix reflect the NTI approach as a whole, allowing for the consolidation of all key stakeholders: representatives of the business community, representatives of the scientific and educational community, as well as international partners and society as a whole. Such consolidation will ensure a synergetic effect and allow the development of new high-tech sectors of the Russian economy⁴⁵.

For Russian high-tech companies, the NTI Matrix is arranged "according to the snail (or spiral) principle," where companies that have already entered international high-tech markets can already develop and implement promising technological solutions together with Russian scientists, as well as companies operating in related fields. In addition, they can engage promising young personnel who have acquired relevant, relevant skills and competencies by virtue of having received prior training organized by the government for the predicted NTI markets. Companies can also take advantage of a suite of government services that have been created or adapted specifically for the key needs of NTI companies⁴⁶

⁴⁵ <https://nti2035.ru/nti/> (reached 01.06.2022)

⁴⁶ Ibid.

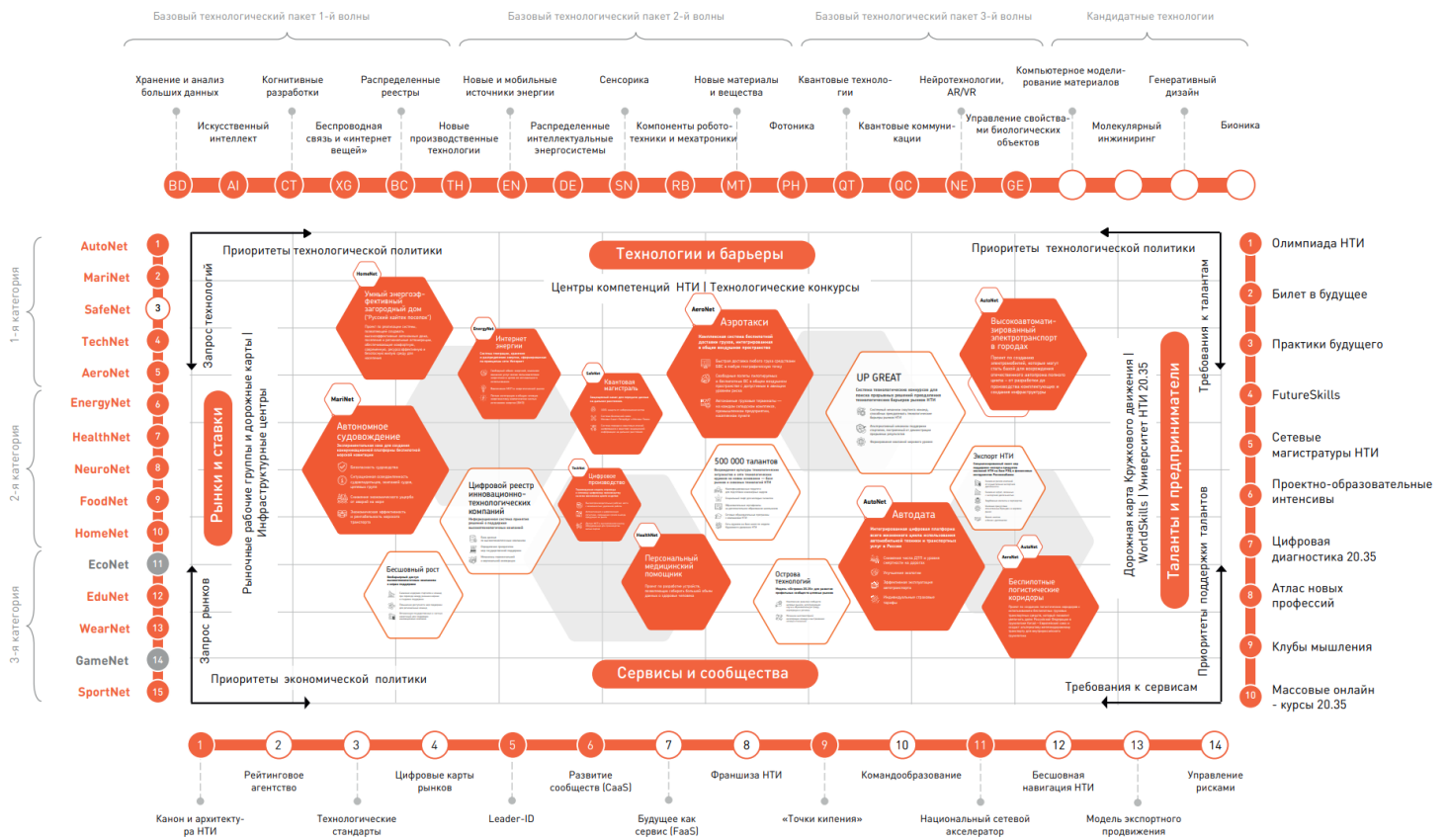


Figure 6. NTI matrix

The axes of the matrix form the subject area. The left axis reflects that STI is working to develop new markets in Russia. The top axis adds that NTI is working to develop markets based on breakthrough technologies. The right axis adds that a minimally sufficient density of talent can be attracted to the development of breakthrough technologies. The lower axis adds that support tools working in a service model are oriented and created to develop talent.

The matrix should be read clockwise, starting with markets (left vertical axis). Thus, you can see the four key questions by which projects are evaluated.

The key issues are as follows:

1) Markets. This key item reflects the idea of the project's target audience and also takes into account what problem the project is solving. That is, this item reflects the market goals of the project.

2) Technologies. This key item reflects the tactical objectives of the project. Tactical project objectives refer to those barriers that the project team plans to overcome during the

development and implementation of the project. This can include the tactical, intermediate indicators to be achieved by the project.

3) Talent. This key point takes into account the team, which must have the competencies needed to implement the project.

4) Services. This key item evaluates the project's resourcing. In addition, this item evaluates characteristics such as the reasonableness of the size and sources of resources for the project.

The NTI Matrix divides markets by capital intensity and presents three categories:

1) Category 1.

This category represents markets that require expensive infrastructure, consequently requiring a high degree of government involvement.

2) Category 2

This category represents markets that require risk sharing with businesses to develop.

3) Category 3

This category represents markets requiring only a rapid response to changes in regulation.

The block Markets and Stakes of the NTI Matrix reflects the key promising STI markets formed at the Foresight sessions of NTI. These markets include the first category markets (AutoNet, MariNet, SafeNet, TechNet, AeroNet), the second category markets (EnergyNet, HealthNet, NeuroNet, FoodNet, HomeNet), and the third category markets (EcoNet, EduNet, WearNet, GameNet, SportNet). EcoNet and GameNet are currently new markets on the list of promising markets.

The block Technology and Barriers presents the basic technology packages of the first, second and third waves, as well as candidate technologies.

The Talent and Entrepreneurs block features activities such as the NTI Olympics, Ticket to the Future, Future Practices, Future Skills, NTI Networking Masters, Design and Education

Intensives, Digital Diagnostics 20.35, New Profession Atlas, Thinking Clubs, and massive online 20.35 courses.

The Services and Communities block reflects institutionalized directions expressed in the following formats: NTI Canon and Architecture, Leader-ID platform, Community Development (CaaS), Boiling Points, National Network Accelerator. In addition, this block reflects initiatives aimed at finding sustainable formats: Rating Agency, Technology Standards, Digital Market Maps, Future as a Service (FaaS), NTI Franchise, Team Building, NTI Seamless Navigation, Export Promotion Model, and Risk Management. Since this paper is devoted, among other things, to examining the effectiveness of the export support programs developed by the NTI, it is worth taking a closer look at the item in the Services and Communities block, which is the Export Promotion Model. This item represents support for promoting NTI projects and solutions on international markets: project support, selection of ratings and contests, expansion of the international partner network, and the creation and development of foreign "boiling points".

7.2 Key elements of the NTI ecosystem

As described above, the ecosystem can be expressed comprehensively through the NTI Matrix. If we summarize the key stakeholders that the leaders directly involved in developing the NTI ecosystem now focus on and plan to pay close attention to in the future, we can distinguish two large groups: 1) Those gaining skills and knowledge; 2) Those already realizing themselves as technology entrepreneurs with the "NTI gene."⁴⁷

In addition, the key elements of the NTI ecosystem were highlighted in parallel, based on the requirements for NTI markets discussed earlier. Thus, it was also possible to see a significant emphasis on training, so that the condition of a sufficient number of motivated and competent technological entrepreneurs is met, and also to see the importance of competent and maximally targeted support for companies already entering export markets to successfully and timely occupy the projected market shares.

⁴⁷ Opinion of interviewed experts crossed with expert opinion in presentation articles and lectures

Thus, the analysis of key points of growth will select elements of the ecosystem that focus on training (so that more companies will emerge in the future), as well as elements that focus on helping companies enter the export market.

7.3 Perception of the NTI system by different NTI stakeholders

The primary results of the in-depth interviews (a detailed description of the types of in-depth interviews is described in the Methodology chapter) with stakeholders concluded that most perceive the concept of NTI as holistic, or nearly as holistic, as it appears in official reports. However, there is a tendency for respondents to not always associate available institutions and support measures with the global goal of NTI.

Among respondents, in-depth interviews were conducted with the following stakeholders of the NTI ecosystem:

- 1) Recipients of educational services;
- 2) Providers of educational services;
- 3) Recipients of support for companies entering the export market;
- 4) Leaders working directly on the development of the NTI ecosystem on multiple aspects.

To this point, 15 in-depth interviews with Category 1 (educational recipients) and 15 in depth interviews with Category 2 (educational providers) have been conducted. In addition, 3 in-depth interviews with representatives of category 4 (recipients of support for companies entering the export market), as well as 6 in-depth interviews with category 5 (leaders working directly on the development of the NTI ecosystem on multiple aspects).

7.4 The system's growth points according to NTI ecosystem stakeholders

The study presents the results generated from the information after the in-depth interviews. The results of the in-depth interviews with the stakeholders of the NTI in various aspects were then cross-checked. The main conclusions that have been obtained to this point on issues related to the work of the NTI chain are the following:

1) At this point in time, there is an observation of an excessive focus of NTI on the technology area, which is exposed to high risks from outside. There was a big focus on IT technologies, while the crisis that came with the coronavirus exposed problems in the real sector (i.e. the "hardware sector"), which led to some compression of the IT area.

2) Not enough attention has been given to working with the chemical and biological industries, although their promise in terms of talent potential in a global sense is also enough to give them attention.

3) While markets involving attention to the chemical, pharmaceutical, veterinary, and livestock industries have been formed, development in them does not yet show sufficient efficiency. This may be due to the fact that the focus is more on IT-technologies.

4) In addition, the focus in the chemical industry is more on raw materials, such as isotopes in the case of nuclear medicine, on basic elements in the case of the chemical industry, on the simplest precursors in pharmaceuticals. This also results in a decrease in the profitability of these industries, even if they are presented as redefined markets, since the industries so far produce products with low surplus value.

5) In addition, there is the hypothesis of insufficient infrastructure readiness to strengthen the key aspect related to education. Thus, the commercial departments of educational institutions of secondary and higher education are not active enough to search for customers to implement projects, incubators do not actively establish communication with research schools, which greatly affects the level of elaboration of the idea and the quality of competence in market analysis on the specifics chosen by the project participants.

6) As for projects themselves, most educational programs and competitions now focus on working with a ready-made idea. Nevertheless, it is becoming a tendency that because of the inability to approach idea generation competently and systematically, young and established professionals with often unique sets of skills and competencies, "come up with" project ideas that have long been implemented in too many places and their ideas just "hang in the air" and that do not realize their potential as professionals at all. So, for example, instead of being involved in the development of a new DNA sequencer a professional studies an app builder to develop another app with fitness exercises and a tracker.

7) In addition, there is a serious difficulty for technology entrepreneurs who do not have startup capital to decide to seriously develop their project. The fact is that there is now a severe shortage of support for early-stage projects. An entrepreneur without additional resources often cannot get enough resources at the Seed stage. Despite the fact that there are funds that provide support at these stages, such as the Innovation Promotion Foundation, a large number of grant support measures have been moved to later stages, as a result, even with initial basic funding it is extremely difficult for an entrepreneur to meet the criteria for further resources for startup development (such as stable sales already available, etc.) until it reaches self-sufficiency. That is why from the point of view of the state there is a deficit of demand for financing projects of technological entrepreneurs at the later stages, as far fewer projects grow to these stages than could be the case.

8) Also highlighted is one critical growth point related to promoting and improving the NTI experience in the digital space. Often users find that most of the important material from meetings or lectures that could increase their loyalty to NTI is not retained. Also, target audiences periodically encounter outdated pages that claim to have presentation or video materials of interest to them. In addition, a lack of understanding of some of the key points of the holistic logic by which the NTI program is implemented is often due to the fact that key lectures are viewed by a very small number of users compared to the size of the target audience.

7.5 Using the results of the NTI ecosystem growth point search

The listed results can be attributed to the following aspects: uncovered technology areas, skewed focus on one type of technology, insufficient activity of educational institutions due to a lack of understanding of the value of working on NTI development for students, lack of competence in generating ideas, which hinders the provision of the system with projects, the perceived gap in funding between early and late project stages, lack of awareness of the NTI concept, and not always sufficient work with user engagement in the already created field

All of these points are worth paying attention to for managers who are going to work with the development of the NTI ecosystem to ensure that there are enough startups in the areas that have been developed and to ensure that there are enough startups in the areas that have not yet been fully covered. These findings are especially important if managers are to work in the aspect of training the people who will become technology entrepreneurs, in the aspect of helping projects that are starting their journey and testing hypotheses, and in the aspect of holistically informing different segments of the target audience, increasing engagement with

content and therefore increasing loyalty and participation levels in activities to increase the number of potential technology entrepreneurs at all possible entry points into the NTI ecosystem.

In addition, going beyond NTI, we can say that in general an ecosystem that reproduces innovations to achieve leadership in the international arena can be considered as an independent product. Therefore, knowledge of the peculiarities of building such systems (given knowledge of the key aspects of the system without which it cannot work) thus prove to be key when working with the design of strategic development programs and supervising them in the role of a manager.

8. Summary

As we can observe, the NTI ecosystem is a set of multifaceted measures that are all aimed at building a development path for technological entrepreneurs, as well as ensuring the cultivation of companies that can occupy leading positions in high-tech markets and be as resistant to external influences as possible through control of technological chains and the network effect in general.

When analyzing the indicators available at the moment, one can observe a positive trend in the growth of new companies, as well as a gradual increase in export revenues of companies that have received NTI support of various kinds. Nevertheless, in order to achieve the exponential growth that is necessary for international technological leadership, it is necessary at this point in the development of the program to actively focus on the training aspect to make the number of technological entrepreneurs greater and increase the number of profile companies on the necessary end-to-end technologies.

Nevertheless, there are now important points of growth in the ecosystem, previously either noticed by leaders developing NTI in a fragmented fashion or not noticed at all. These growth points relate to key aspects of the NTI ecosystem, so ignoring them in the long run can lay down some technical debt that may not allow timely achievement of goals.

These points of growth and an understanding of how such ecosystems work in general are necessary for managers who will also be involved in the future, both in improving the NTI ecosystem, designing other comprehensive country development programs, and building similar systems for other countries by selling them as a product.

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