Цифровые платформы для взаимодействия и управления инновационно-образовательным процессом университета наукограда

Введение. В настоящее время актуальна проблема развития наукоградов и других объектов с высокой концентрацией научно-технического потенциала как составной части национальной инновационной системы. Существует потребность в подготовке научных кадров, ориентированных на генерацию новых идей, трансфер технологий и создание стартапов в области прорывных технологий.

Цель исследования — проанализировать цифровые платформы в информационно-образовательном пространстве для решения задачи эффективного взаимодействия и управления инновационно-образовательным процессом университетов наукограда с научно-исследовательскими институтами и бизнес-сообществом.

Материалы и методы. Для проведения анализа существующих цифровых платформ использовался метод анализа информационных ресурсов сети Интернет. С целью накопления достаточного объема материала для проведения анализа цифровых платформ применялся описательный метод. Метод классификации позволил систематизировать цифровые платформы, повысить качество проводимого исследования за счет структурирования и систематизации полученной информации. Метод сравнительного анализа позволил выявить общие черты и положительные особенности отдельных платформ, с целью дальнейшего обсуждения возможности преемственности позитивного опыта.

Результаты исследования. Для анализа взяты следующий платформы: Digital Futures – платформа для исследователей в Манчестерском университете (Великобритания); Краудсорсинговая сетевая платформа InnoCentive (США); Trello-сервис управления командой и проектами; Акселератор ИТМО. Актуальность темы исследования обусловлена необходимостью изучения особенностей, механизмов взаимодействия на основе рассмотренных технологий с целью определения критериев и требований к цифровым платформам. Представлен сравнительный анализ цифровых платформ взаимодействия университетов наукограда с научно-исследовательскими институтами и бизнес-сообществом с учетом следующих критериев: назначение платформы, результат деятельности на платформе, группы участников, функции платформы, структура цифровой платформы.

Заключение. Представленный анализ цифровых платформ позволил выявить классы современных цифровых платформ, определить требования к разработке такого вида платформ, обосновать концептуальные подходы развития университета наукограда как инновационной научно-образовательной платформы.

Ключевые слова: цифровая платформа, прорывные технологии, сетевое взаимодействие, наукоград

Ссылка для цитирования:
Introduction. Currently, the problem of the development of science cities and other facilities with a high concentration of scientific and technical potential as an integral part of the national innovation system is urgent. There is a need to train scientific personnel focused on the generation of new ideas, technology transfer and the creation of startups in the field of breakthrough technologies.

The purpose of the study is to analyze digital platforms in the information and educational space to solve the problem of effective interaction and management of the innovation and educational process of universities in the science city with research institutes and the business community.

Materials and methods. To analyze the existing digital platforms, the method of analyzing the information resources of the Internet was used. In order to accumulate a sufficient amount of material for the analysis of digital platforms, a descriptive method was used. The classification method made it possible to systematize digital platforms, improve the quality of the conducted research by structuring and systematizing the information received. The method of comparative analysis made it possible to identify common features and positive features of individual platforms, in order to further discuss the possibility of continuity of positive experience.

Results. The following platforms were taken for analysis: Digital Futures, a platform for researchers at the University of Manchester (UK); Crowdsourcing network platform InnoCentive (USA); Trello team and project management service; ITMO accelerator. The relevance of the research topic is due to the need to study the features, mechanisms of interaction based on the considered technologies in order to determine the criteria and requirements for digital platforms. As a result of the study, a comparative analysis of digital platforms for the interaction of science city universities with research institutes and the business community is presented, taking into account the following criteria: the purpose of the platform, the result of activities on the platform, groups of participants, platform functions, and the structure of the digital platform.

Discussion and Conclusion. The presented analysis of digital platforms made it possible to identify the classes of modern digital platforms, to determine the requirements for the development of this type of platforms, to substantiate the conceptual approaches to the development of the University of science city as an innovative scientific and educational platform.

Keywords: knowledge-intensive technologies, common and specific in the training of students, knowledge-intensive cutting-edge technologies, science city

Currently, “according to the UNESCO strategy for technological innovation in education (2021-2025), it is necessary to use technology and digital innovation to ensure inclusive, effective and relevant learning” [1]. State programs for the digitalization of the economy are being successfully implemented in Russia, using the latest online technologies to improve the efficiency of modern education [2].

In the context of digitalization in the field of education, various digital technologies are being actively developed: digital libraries, network communications [3], virtual communities, digital platforms for organizing collaboration [4]. So, Zhukovskaya I.E. notes that “digital platforms are currently one of the most important components for a university to achieve the status of a "digital university'', they contribute to the development of the digital infrastructure of the university, increase the level of digital competence of all participants in the educational process at the university, the possibility of using digital technologies such as the Internet of things, blockchain, machine learning and artificial intelligence, Big Data, quantum technologies, robotization, etc., which ultimately contributes to the training of highly qualified specialists for the industries and sectors of the country's economy” [5]. The study by Sheveleva N. considers the possibilities of "SberUniversity", "Lectorium" digital platforms for conducting online courses [6]. The features of the use of digital educational platforms in vocational education organizations are revealed by Korneeva N.Yu. According to the author, “technological advances in the Internet, cloud computing, big data, 5G, artificial intelligence and blockchain have significantly changed the way of teaching and learning” [7]. In his works Sakharov D.A. considers “the possibility of creating a digital instrument-making platform that combines industries, specialized educational resources (higher educational institutions and secondary specialized educational institutions), research centers, as well as private manufacturing companies, with the possibility of scaling and merging with the federal Unified Digital Platform” [8]. A prototype of the ActivePlay digital platform was developed by Kalmpourtzis G. et al. to collect and analyze the needs of teachers and potential users of the platform in order to improve the educational process [9]. “A prototype model of a digital cross-platform is presented, its structure is substantiated, its functions are identified and interaction channels are considered by Chvanova M.S. As a result of the study, a prototype of a digital cross-platform for interaction and management of the innovation and educational process of the university of naukograd was developed” [10].

It should be noted that crowdsourcing platforms, which allow interaction between scientists-engineers and the business community [11] are currently being actively developed. “Crowdsourcing technology involves the use of intellectual resources external to the company by involving volunteers in solving innovative problems” [12]. For example, Sundukova I.Yu. “considers the options for using crowdsourcing in the educational process of students for mutual cooperation of IT specialists with the non-profit sector to optimize the quality of educational products and implement significant projects” [13]. Yu-Ming Wang investigated the factors influencing the participation of students in crowdsourcing events [14]. Regina Lenart-Ganzinet considers the stimulation of innovations in higher education institutions using crowdsourcing technology in the field of management and organization, promotion, distribution and pricing policy [15]. Based on crowdsourcing technology, the InnoCentive platform (Massachusetts, USA) was developed. The platform allows scientists...
in the field of chemistry, biology, engineering, computer science to interact with well-known companies such as Precyse Technologies, IBM, Solvay, Johnson&Johnson. Using the Kaggle crowdsourcing platform (California, USA), experts in the field of Data Science have the opportunity to implement their innovative projects. Potential investors and researchers solve their innovative problems using the PRI ACADEMIC NETWORK crowdsourcing platform (London, UK) [16]. In Russia, such platforms in the scientific community are just beginning to develop. Scientists have developed a crowdsourcing model for effective work at the universities of the Russian Federation and Kazakhstan. Key indicators for intellectual classes were considered, including adaptability, self-learning and self-organization [17]. An example is the "crowdsourcing educational platform" S24 ", implemented by the "Synergy " University. The platform functions as a practice-oriented platform in the field of creative industries» [18]. Currently, crowdfunding digital platforms are also being developed, designed to attract external investment for the implementation of innovative projects. Scientists from the California Department of Education note that crowdfunding resources have a positive effect on academic performance, the academic performance of students improves with an increase in project proposals [19]. Based on data from the UK higher education system and two crowdfunding platforms, the authors conducted a study that shows that crowdfunding is a means of obtaining additional funding for students' educational activities [20]. RICEBA University (Latvia) has developed and implemented a new learning model based on a crowdfunding digital platform. The authors consider crowdfunding as a new source of funding, introduced into the curriculum of a business management or entrepreneurship course for undergraduate students [21].

Thus, digital platforms, crowdsourcing online platforms, crowdfunding digital platforms allow the exchange of scientific ideas and research results, interaction between the professional community, the business community and scientists, to attract external investments for the implementation of innovative projects.

The problem of “development of science cities and other facilities with a high concentration of scientific and technical potential as an integral part of the national innovation system is quite relevant at the present time. The necessity of Russia's transition to an innovative advanced strategy of scientific and technological development based on IT technologies has been identified. The role of technological platforms for the effective functioning of the national innovation system has been defined” [22].

In his research Prokopovich V.P. conducted an analysis of the current state of technology platforms and concluded that “it is necessary to organize the interaction of currently existing naukograds, technological sites, technological platforms, technology parks, scientific and educational technological clusters, technopolises and other structures in order to coordinate and increase the efficiency of their innovative activities” [23].

In our study, it seems possible to analyze digital platforms that help to implement innovative projects in the process of interaction between the business community, as well as scientists, students, graduate students of universities, universities of the science city. This analysis will identify conceptual approaches to the development of the University of naukograd as an innovative scientific and educational platform and determine the requirements for the development of this type of platform.

*The purpose of the study* is to analyze digital platforms in the information and educational space to solve the problem of effective interaction and management of the innovation and educational process of universities in naukograd with research institutes and the business community.
Materials and methods

The research materials were the works of scientists published in leading foreign ("Smart Innovation", "Systems and Technologies", "Journal of Marketing Research") and Russian ("Bulletin of Eurasian Science", "Perspectives of Science and Education") periodicals, as well as materials of International and All-Russian conferences on education and new learning technologies (10th International Conference, July 2-4, 2018, Spain; III All-Russian Scientific and Practical Conference, March 11-12, 2020, Moscow), Internet resources (digital platform Digital Futures (Great Britain); crowdsourcing network platform InnoCentive (USA); Trello service; ITMO accelerator).

In our study, we used the method of analyzing Internet information resources, which made it possible to analyze existing digital platforms to enhance the research and innovation activities of students, masters students and scientists. Given the specifics of the subject area under consideration, it should be noted that it is the global Internet that is the most relevant source in which, thanks to online access to the resources of foreign and Russian digital platforms, it is possible to quickly obtain information on the formation of a modern online platform designed for management and work on joint projects. The data obtained in the network will serve as a basis for choosing the best directions for comparative analysis, and thus will contribute to improving the quality of the planned studies. In order to accumulate a sufficient amount of material for the analysis of digital platforms, a descriptive method is used. The classification method allows us to systematize numerous digital platforms designed for interaction and management of innovative activities, and also it allows us to improve the quality of the study by structuring and systematizing the information received.

The method of comparative analysis, based on the criteria we identified for comparing digital platforms (the purpose of the platform, the result of activities on the platform, groups of participants, the functions of the platform, the structure of the digital platform) is an important method of our research, as it allows us to identify, first of all, common features and positive features of separate platforms, with the aim of further discussing the possibility of continuity of positive experience.

Results

The analysis of sources devoted to research and reviews of modern digital platforms related to work on joint projects allows us to distinguish three main groups of such digital platforms: crowdsourcing platforms, crowdfunding platforms, services and project management systems (see Fig. 1).

Crowdsourcing digital platforms involve, first of all, the search for project executors with the appropriate competencies necessary to complete the specific task of this project. The crowdsourcing platform is presented as “a platform that creates a link between the physical space, the environment where a request arises to solve a problem, and the online space where people come together for this” [4].

Crowdfunding digital platforms are designed to attract external investment for the implementation of the proposed project. Moreover, it is worth noting that investing in projects using crowdfunding digital platforms is possible in various ways: from charitable contributions, which actually represent donations for a particular project, to the “shareholder
crowdfunding” option, when an investor receives a share in the capital of a business project and can claim to receive profit [25].

Figure 1 Types of digital platforms for interaction and management of innovative projects

A separate type of digital platforms under consideration, in our opinion, is project management services and systems, the main task of which is to support project management and increase the efficiency of their implementation. Such platforms solve a wide range of different tasks, including organization of the work of employees on projects, distributing tasks and responsibilities, scheduling, and collaborating on documents.
Among the digital platforms for working with projects, there are platforms-accelerators, platforms-exchanges of projects. We do not single out such platforms as a separate type according to our classification, since we believe that accelerator platforms and project exchanges can combine the functionality and implement the tasks of both crowdsourcing and crowdfunding platforms, and project management systems at the same time. Often accelerators and project exchanges can target projects around specific themes (e.g. environment, innovation or digital technologies) or can be organized around universities or naukograds.

As part of our study, it seems necessary to conduct a comparative analysis of individual digital platforms for cooperation between universities, science cities and the business community, taking into account the following criteria for comparing digital platforms:

1. Purpose of the platform. This criterion involves determining the main type of activity that is carried out using the digital platform.
2. The result of activity on the platform. What is the main result of platform user interaction?
3. Groups of participants. What potential users is the platform designed for?
4. Platform functions. Description of the main functionality of the digital platform.
5. The structure of the digital platform. The main sections of the digital platform.

Further, Table 1 presents a comparative analysis of digital platforms, taking into account the criteria identified above.

### Table 1

<table>
<thead>
<tr>
<th>Resource</th>
<th>Digital Futures - platform for researchers at the University of Manchester (UK)</th>
<th>Crowdsourcing network platform InnoCentive (USA)</th>
<th>Trello- team and project management service</th>
<th>ITMO Accelerator</th>
<th>Generalization according to the criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose of the platform</strong></td>
<td>Bringing together scientists, students and representatives of industry and business to implement joint projects in the field of digital technologies of the future in various fields of activity</td>
<td>The platform allows users to post relevant projects for implementation, designated as (problems, challenges), which can be taken up by specialists of different profiles</td>
<td>Team management, project collaboration</td>
<td>Development of a startup culture, support for startups from the leading technological university in Russia</td>
<td>Bringing together scientists, students and industry and business representatives to implement joint projects; team management; joint work on the project; support for startups.</td>
</tr>
<tr>
<td><strong>The result of activity on the platform</strong></td>
<td>Completed projects in the field of social networks, the Internet of things, digital transformation of public policy, data science and artificial intelligence, digital security, etc.</td>
<td>Completed projects in various fields according to the stated “challenges” with the involvement of the required number of specialists</td>
<td>Organization of teamwork</td>
<td>Entering the market with a finished project and monetizing the development</td>
<td>Implementation of projects involving the required number of specialists; entering the market with a finished project</td>
</tr>
<tr>
<td><strong>Groups of participants</strong></td>
<td>Scientists, students, representatives of business, industry, state and local government</td>
<td>A group can be external (more than 400,000 individuals) or internal (employees, partners or customers of the organization).</td>
<td>The team of the project</td>
<td>Students, graduate students, staff</td>
<td>Scientists, students, graduate students, representatives of business, industry, state and local government</td>
</tr>
</tbody>
</table>
Platform functions

<table>
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<tr>
<th>Function</th>
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<tbody>
<tr>
<td>Viewing current and possible projects; application to the university for the implementation</td>
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<tr>
<td>of a specific project by an external professional community, viewing events on selected</td>
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<tr>
<td>topics in interdisciplinary areas and registration for them, supporting applications for</td>
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<tr>
<td>research funding</td>
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<tr>
<td>Posting information about the &quot;challenge&quot; and searching for participants for the</td>
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<tr>
<td>implementation of this project at the same time, the platform indicates following</td>
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<tr>
<td>functionality: planning, placing and implementing new technologies, planning work with a</td>
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<tr>
<td>supplier, instantly connecting to millions of potential participants, transforming the</td>
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<tr>
<td>organization's business processes, and so on.</td>
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<tr>
<td>Organization of joint work, creating a meeting, assigning tasks, adding files</td>
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<tr>
<td>Sales funnel design, team building and work attraction of investments, obtaining a patent,</td>
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<tr>
<td>effective networking, building a marketing strategy</td>
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<tr>
<td>Viewing ongoing and possible projects; submitting an application for the</td>
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<tr>
<td>implementation of a specific project; search for participants for the implementation of the</td>
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<td>project; distribution of tasks between project participants; adding files.</td>
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</table>

Structure of the digital platform

<table>
<thead>
<tr>
<th>Section</th>
<th>About Us</th>
<th>What we do</th>
<th>News</th>
<th>Events</th>
<th>Contact us</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation_360</td>
<td>Programs</td>
<td>Wazoku Crowd - potential participants who are specialists in various fields</td>
<td>Resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commands, boards, lists, cards, checklist, participants, deadlines, comments, action history, attachments</td>
<td>For whom Programs Investors Mentors Volunteers Coworking</td>
<td>Purpose of the platform (about us, for whom) Potential participants (investors, mentors, specialists in various fields) Events, programs Project card Resources (attachments)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Digital Futures – is a platform for researchers at the University of Manchester (UK),</td>
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<tr>
<td>designed to bring together education (teachers, scientists, students) and industry in</td>
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<td>various fields in order to implement joint IT projects. In fact, it is an interdisciplinary</td>
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<tr>
<td>network that covers the entire spectrum of the university's digital research. The purpose</td>
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</table>
| of implementing this project is to solve specific problems and tasks using the latest digital technologies, ensuring the growth of the real sector of the economy or public life (health, state and local government, the environment, urban development, the media). Digital Futures brings together more than 1,700 researchers (including teachers, undergraduate and graduate students) from different disciplines across all faculties of the university into interdisciplinary communities. On this digital platform, the “About us” tab introduces the overall idea of the project, the opportunities and problems that Digital Futures can solve (social and institutional problems, cross-cutting opportunities), supervisors for each task, as well as specific examples of ongoing projects and initiatives. The “What we do” tab reveals interdisciplinary connections to meet both cutting-edge research challenges and the external requirements of government, business, and communities. The “News” tab brings you up to date with all the latest news and updates from Digital Futures. The “Events” tab presents a program of internal and external events on selected topics or groups of topics, designed to promote more interdisciplinary work, as well as enhance work with external stakeholders. Digital crowdsourcing platform InnoCentive (USA)**, which is used to search for scientific, intellectual personnel via the Internet, thereby "connecting" customers and researchers around the world with each other, which makes it possible to use the colossal layers of the world's intellectual resources.

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* [https://www.digitalfutures.manchester.ac.uk/](https://www.digitalfutures.manchester.ac.uk/)
** [https://www.innolicentive.com/?page](https://www.innolicentive.com/?page)
Organizations have the opportunity to publish their project (on the platform these are referred to as "problems" or "challenges"). This process typically begins with a workshop led by InnoCentive in which appropriate problems and needs are identified. InnoCentive’s PhD-educated Challenge Experts then work with clients to decompose and formulate the problem or need as a Challenge. The problem or need is abstracted to allow for insights across industries, perhaps even one that shares the problem and has already solved it. The Challenge description clearly defines the problem or need, the solution and Intellectual Property requirements, and the award amount that will be paid out for the project implementation.

All users separately register on the platform and indicate their experience in various fields, including chemistry, biology, engineering, statistics, information technology, food and crop production and business.

The results can be fully completed projects with the necessary specialists involved, and may also include consulting, task planning, training and software maintenance services to enable organizations to develop solutions both from outside and inside the organization.

The "Innovation_360" Tab is an innovative operating system that brings all the actions and data of users in one place. The «Challenges» tab publishes the latest and most important issues in a particular area or organization (for example, emerging economies, sustainable and renewable energy, global health, civil society, ecology, education, etc.).

The "Wazoku's Crowd" tab actually represents all the possible participants in the "challenge". The site states that it is a collective intelligence that allows clients to solve problems outside the framework of organizational and industry thinking: implementing a streamlined and new approach to problem solving.

*Trello* – is a well-known service for managing a team and projects, workflows and tasks of any type, collaboration. It allows users to effectively organize work according to the Japanese methodology of kanban boards. Using stickers, the team notes which tasks need to be completed, which are already in progress, and the deadline for each of them. The service gained popularity during the pandemic.

With the help of Trello it is possible to organize your activities in a digital environment:
1. Drawing up a curriculum. It can be viewed in a convenient format, and task lists and due date reminders will help you stick to the plan.
2. Organize joint work with colleagues when working on a project.
3. Plan the meeting, assign tasks, and set deadlines.
4. Add documents and files to the attachment card.

The work on a project is organized in Trello using the following main elements: commands, boards, lists, and cards.

**ITMO Accelerator** – is a startup support ecosystem from Russia’s leading technological national research university. The digital platform helps in the implementation of technological startups from the creative industries: smart cities, artificial intelligence, computer security, virtual and augmented reality, financial technologies, voice assistants, robotics, healthcare, education.

The main functions of the accelerator are: organizing traction meetings, holding individual expert consultations, business intensives, specialized events, presenting the services of service partners, coworking jobs, searching for investments, networking, business expertise. ITMO Accelerator provides assistance in product development, promotion, advertising, sales and investment attraction.

* https://trello.com/
** https://accel.itmo.ru/
The structure of the ITMO accelerator is represented by the main sections: For whom, Programs, Investors, Mentors, Volunteers, Coworking. Registration is required to work in the accelerator. A registered user of the ecosystem has the opportunity in the "Programs" tab to take a course on preparing startups for entering the market. In the "Investors" tab, potential investors can access the database of innovative projects and developments. The accelerator helps users find experts in business, marketing, sales, as well as practicing entrepreneurs and experts in the technology industry. An invitation to cooperate can be submitted in the "Mentors" tab. Users can join the ITMO accelerator team as volunteers in the tab with the same name. Volunteers provide assistance in working with startups: they write texts, help organize events, and deal with SMM. Users can fill in the form for booking a room or a meeting room at ITMO University's technology park in the "Coworking" tab. Coworking or a collective office is an approach to organizing the work of people with different jobs in a common space.

Thus, as a result of a comparative analysis according to the identified criteria, it seems possible to identify the general requirements for digital platforms for cooperation between universities, research institutes, naukograds and the business community in the process of innovative project activities.

1. The digital platform should be able to bring together scientists, students, industry and business representatives to implement joint projects; manage team work; organize joint work on the project; provide support to startups.
2. The result of the activities of the digital platform is the implementation of projects involving the required number of specialists; entering the market with a ready-made innovative project.
3. Groups of participants are: scientists, students, graduate students, representatives of business, industry, state and local government.
4. The main functions of the digital platform are: viewing ongoing and possible projects; submitting an application for the implementation of a specific project; search for participants for the implementation of the project; distribution of tasks between project participants; adding files.
5. The structure of the digital platform should contain the following elements: purpose of the platform (about us, for whom); potential participants (investors, mentors, specialists in various fields); events, programs; project card; resources (attachments).

Discussion of the results

We agree with I. E. Zhukovskaya [5] that digital platforms currently contribute to the development of digital infrastructure, increase the level of digital competence, and have an impact on the training of highly qualified specialists for industries and sectors of the country's economy.

The need for the analysis of digital platforms for interaction and management of the innovation and educational process of the university of naukograd is also consistent with the opinion of V. P. Prokopovich [23] that “for the effective functioning of the national innovation system of science cities and other facilities with a high concentration of scientific and technical potential, scientific and technical development based on IT technologies and technological platforms is necessary.”

At the same time, an overview in the context of determining the basic requirements for digital platforms has not been previously presented. The results obtained can be compared
with the analysis of the use of digital educational platforms in vocational education organizations [7]. For the first time, a classification of digital platforms is presented, criteria are defined as well as requirements for digital platforms for effective interaction and management of the innovation and educational process of the business community, research institutes, universities, universities of the science city. In the future, the authors intend to develop a digital platform, taking into account the identified criteria and requirements, defining the boundaries and conditions for its use.

**Conclusion**

A comparative analysis of digital platforms based on the identified criteria made it possible to determine the main requirements for digital platforms in the information and educational space to solve the problem of effective interaction and management of the innovation and educational process of the business community, research institutes, universities, universities of naukograd.

A digital platform developed on the basis of the requirements presented in the study can become an important component of the modern educational system, primarily in the leading universities of naukograd in Russia. The presented analysis of digital platforms can be used for other subject areas for training high-level specialists, which involve the dynamic formation of network structures of interaction between the business community, universities, research scientists, and enterprises.

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