Austrian Journal of Technical
and Natural Sciences, 2026 No 5–6
ISSN 2310-5607

PREMIER Publishing
ppublishing.org

Section 4. Technical sciences in general

DOI:10.29013/AJT-26-5.6-83-89

TECHNOLOGY INCUBATOR FOR STARTUPS. (Technology incubator as an organizational framework within an ecosystem for the effective implementation of an innovation-driven development model for industrial and agricultural production)

Kamaletdinova Adeliya [1]

[1] Technical Expert Corresponding Member of MAIN (International Academy of Informatization). Semey, Kazakhstan

Cite: *Kamaletdinova A. (2026). Technology Incubator for Startups. (Technology incubator as an organizational framework within an ecosystem for the effective implementation of an innovation-driven development model for industrial and agricultural production). Austrian Journal of Technical and Natural Sciences 2026, No 5–6.* https://doi.org/10.29013/AJT-26-5.6-83-89

Abstract

The article examines the role of technology incubators as an organizational solution within an innovation ecosystem for the effective implementation of innovation-driven development in industrial and agricultural production. Particular attention is paid to the organizational principles that enable the transformation of innovative ideas into commercially viable technologies and market-ready products through structured incubation, technology transfer, and interdisciplinary collaboration. The publication provides an overview of the historical evolution of technology incubators, their organizational framework, and their contribution to accelerating innovation processes in industrial and agricultural sectors. Special emphasis is placed on the integration of advanced technological infrastructure, including testing laboratories, quantum computing technologies, augmented reality visualization, standardization mechanisms, and ecosystem-based management approaches that support the commercialization and scaling of innovative solutions.

The article emphasizes that technology incubators constitute an effective organizational mechanism for strengthening innovation ecosystems by facilitating the development, validation, and market implementation of new technologies. Their application contributes to enhancing the competitiveness, technological modernization, and sustainable development of industrial and agricultural production through the efficient transfer of knowledge and innovative technologies.

Keywords: *Technology incubator; Ecosystem; Effective implementation; Innovation-driven development model for industrial and agricultural production; Structural architecture of the ecosystem framework; Quantum computer; Augmented reality visualization; Testing*

laboratories; Laws of technical systems evolution; Standardization; Technology transfer

Introduction

The rapid development of innovation ecosystems and digital technologies has significantly increased the demand for advanced computational tools capable of supporting the analysis, modeling, and commercialization of complex technical systems. The growing complexity of industrial and agricultural production, combined with the integration of artificial intelligence, artificial neural networks, and emerging quantum computing technologies, requires fundamentally new organizational and methodological approaches to innovation management.

Figure 1. *Example of a startup employee's workstation*

One of the key challenges in the development of high-technology projects is the ability to perform rapid multidimensional analysis of technical, commercial, and patent-related information throughout the innovation lifecycle. Conventional computational methods often provide insufficient processing speed and analytical depth for evaluating multiple design alternatives, forecasting technology evolution, and selecting optimal commercialization strategies. Recent advances in quantum computing have demonstrated the potential to overcome these limitations by enabling substantially more efficient processing of complex multidimensional datasets and system interactions.

At the same time, the increasing complexity of modern technical systems highlights the need to reconsider the traditional principles governing technological evolution. Classical methodologies, including the Theory of Inventive Problem Solving (TRIZ), provide a valuable foundation for innovation analysis; however, they do not fully reflect the multidisciplinary nature of contemporary innovation ecosystems, where technical, economic, organizational, and commercial factors are closely interconnected. The emergence of quantum computing and intelligent analytical technologies creates new opportunities for revising the principles of innovation management and integrating technical system evolution with technology transfer, commercialization processes, and ecosystem-based development models.

The present study is based on the assumption that the effective development of innovation ecosystems requires a comprehensive analytical framework capable of simultaneously considering technological, organizational, economic, and commercial parameters. Such an approach enables more accurate identification of development pathways, optimization of innovation strategies, and acceleration of the transformation of scientific ideas into commercially successful technologies.

From the perspective of investors and project managers, the successful implementation of innovation projects requires a comprehensive analytical framework capable of evaluating how the formulation of an inventive prob-

lem influences the commercial potential of the resulting technological solution. Accurate definition of project objectives and systematic analytical modeling are essential for assessing development pathways, commercialization strategies, and the effectiveness of intellectual property protection. An incorrect formulation of research objectives may lead to inefficient resource allocation, reduced commercialization potential, and insufficient patent protection against unauthorized replication.

The development of innovation projects therefore requires a multidisciplinary approach that integrates technological analysis, patent strategy, licensing, and commercialization throughout all stages of the innovation lifecycle. This approach forms the basis for strategic decision-making and enables the effective transformation of scientific and engineering ideas into competitive industrial products.

Technology incubators represent the organizational infrastructure that supports this process by providing financial, scientific, and managerial resources required for the development of innovative projects. In many countries, these organizations operate under the supervision of ministries responsible for industry, trade, and, where appropriate, agriculture. Dedicated governmental funding mechanisms are typically established to support both innovation projects and the professional management of technology incubators, ensuring sustainable development and efficient allocation of public investment.

An important element of this organizational model is the involvement of highly qualified scientific and technical experts responsible for the evaluation, selection, and continuous monitoring of innovation projects. Their expertise contributes to maintaining high scientific standards, improving investment efficiency, and supporting informed decision-making throughout project implementation.

Technology incubators also maintain close cooperation with export promotion organizations and national standardization institutes. Export support institutions facilitate international market entry by providing methodological assistance, commercialization support, grant funding, and promotion of innovative products in global markets. At the same time, collaboration with standardization and testing organizations ensures compliance with international technical standards through advanced laboratory testing and certification procedures, thereby increasing the competitiveness and export potential of innovative technologies.

Figure 2. *Example of an integrated startup workstation*

Commercial testing laboratories constitute an important component of the innovation ecosystem alongside national standardization institutes. These laboratories provide independent testing and certification services in accordance with regional and international technical standards, including those that may differ from the standards adopted in the country where the innovation is being developed. Their involvement enables technology developers to evaluate product compliance with the regulatory requirements of target export markets at the early stages of product development.

Collaboration between technology incubators and commercial testing laboratories significantly reduces the risks associated with international commercialization by identifying potential regulatory and technical barriers before market entry. This approach facilitates the adaptation of innovative products to local technical requirements and improves their readiness for global commercialization.

Another important element of the innovation ecosystem is cooperation with state-owned infrastructure companies and natural monopolies. In many countries, including Kazakhstan, strategically important infrastructure facilities are managed by government-owned enterprises that establish mandatory technical and operational requirements for products intended for use within national infrastructure systems.

Figure 3. *Example of an innovative startup development: an automated production and assembly line for microelectronic components*

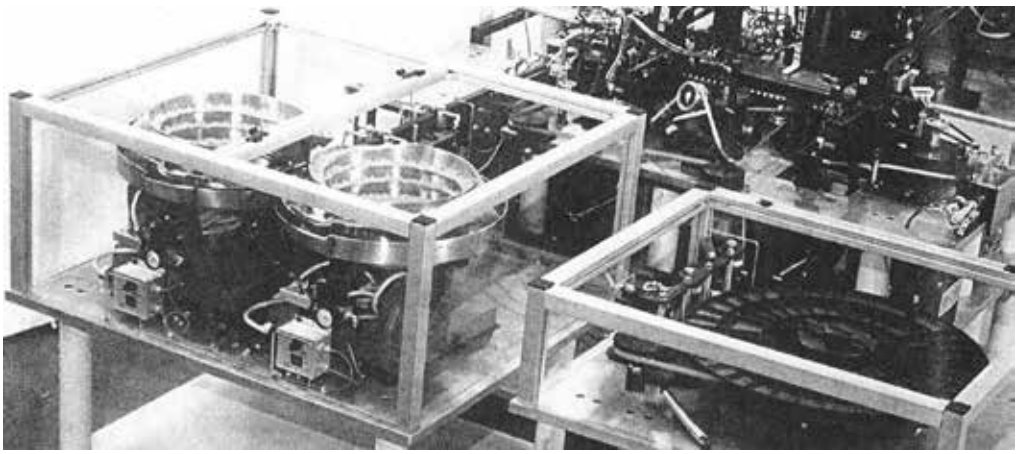
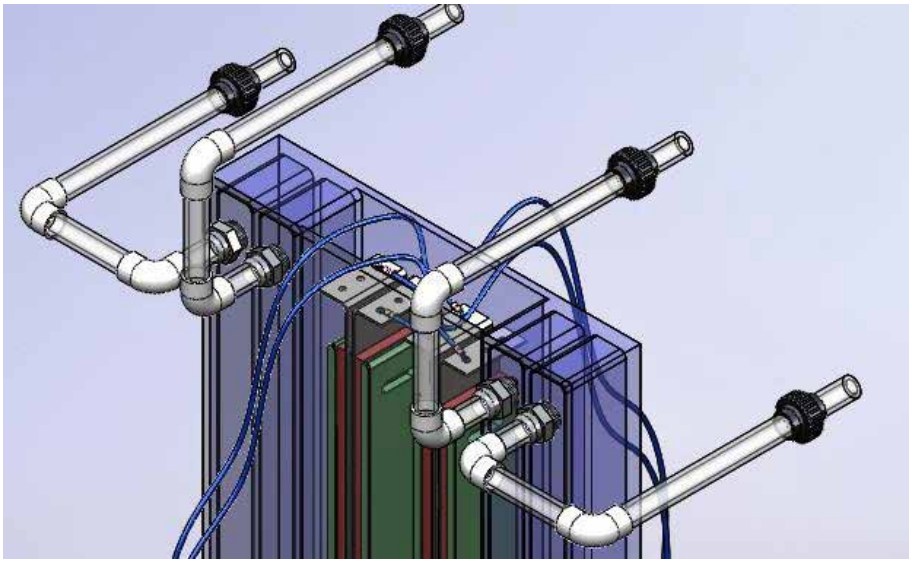
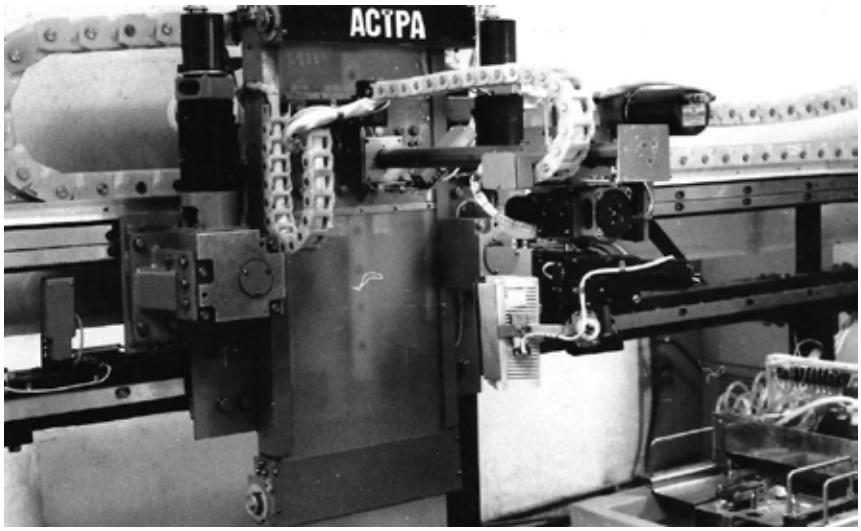


Figure 4. *Example of a startup-developed electrochemical reactor for maintaining the operational cycle of infrastructure components incorporating artificial intelligence and artificial neural network technologies within control and monitoring processors*



When an innovation project is associated with such infrastructure facilities, technology incubators establish close cooperation with these organizations to ensure technical compatibility, regulatory compliance, and successful implementation. Depending on the technical and commercial objectives of the project, state-owned companies may participate as strategic partners or provide the regulatory and technical guidance necessary for the development and commercialization of innovative technologies. This collaborative approach minimizes implementation risks and facilitates the integration of new technologies into existing industrial and infrastructure systems.

Figure 5. *Example of a startup-developed flexible manufacturing module for photolithography on thin-film microcircuit substrates*



Intergovernmental and regional investment funds

Technology incubators make full use of available funding opportunities to ensure the timely financial support of innovation projects. For this purpose, numerous regional and international investment organizations – including European and North American funding programs, as well as specialized financial institutions such as the European Bank for Reconstruction and Development (EBRD)—provide financial support for collaborative research, technology development, and innovation projects.

Since each funding organization applies its own evaluation criteria and eligibility requirements, technology incubators incorporate these requirements into their project management processes from the earliest stages of company formation. This approach enables startup companies to become investment-ready and facilitates access to additional financing during subsequent stages of project development.

Municipal authorities

Technology incubators are frequently located in municipalities where they represent important sources of employment and regional economic development. Consequently, local authorities actively cooperate with incubator management by providing organizational, administrative, and infrastructure support within their areas of responsibility. During the establishment of new startup companies, technology incubators therefore create the organizational and logistical foundations necessary for effective collaboration with municipal institutions.

Professional associations

Professional organizations, including engineering, architectural, and other technical associations, actively contribute to innovation ecosystems by promoting collaboration between experienced professionals and startup companies. In particular, retired specialists frequently provide mentoring, technical expertise, and practical guidance, transferring valuable industrial and commercial

experience to innovation projects whenever appropriate.

Technical universities

Many universities have established their own technology incubators to support promising projects initiated by students, researchers, and academic staff. University-based incubators generally operate under organizational principles similar to those of independent technology incubators while benefiting from direct access to university laboratories, research facilities, and scientific expertise. These resources create favorable conditions for the development, validation, and commercialization of innovative technologies.

Multinational corporations

Large multinational corporations possess substantial financial, technological, and manufacturing resources that enable the rapid commercialization and industrial implementation of innovative technologies. Their participation in innovation ecosystems is naturally driven by strategic commercial interests; however, their contribution to technological advancement and the development of technology incubators remains highly significant. The specific mechanisms of collaboration between technology incubators and multinational corporations represent an important subject for further investigation.

Selection of ideas for project formation

Modern technology incubators typically specialize in specific technological sectors, although during the early stages of their development many incubators supported projects from multiple industrial fields. Increasing specialization, together with the partial or complete privatization of many incubators, has resulted in more systematic project evaluation and selection procedures. This has improved the identification of projects with strong commercialization potential while allowing technically promising but commercially weak concepts to be recognized at an early stage. As a result, financial resources can be concentrated on innovations with greater market potential, significantly improving investment efficiency.

Support mechanisms during the initial stages of project development

Technology incubators are designed to provide startups with favorable conditions during the earliest phases of innovation development. Their operational policies include financial, organizational, and managerial support mechanisms that reduce initial project risks and accelerate technology maturation. One common example is the provision of an advance payment amounting to approximately 10% of the total project funding, enabling newly established companies to recruit qualified specialists and initiate development activities immediately after project approval.

International industrial exhibitions and their impact on successful project commercialization

International industrial and technology exhibitions provide one of the most effective environments for benchmarking innovative products and technologies developed within technology incubators. These exhibitions enable comprehensive comparison of technical performance, commercial potential, market competitiveness, and consumer value against existing domestic and international solutions.

The evaluation of competing technologies presented at such exhibitions constitutes an essential responsibility of commercialization specialists. The quality of this analysis directly influences strategic decision-making regarding product positioning, technology development, and market entry. Accurate competitive assessment increases the likelihood of commercial success, whereas inadequate analysis may lead to ineffective development strategies and reduced market competitiveness.

Technology transfer

Technology incubators frequently serve as platforms for international collaborative research and innovation projects involving academic institutions, industrial partners, and governmental organizations. International technology transfer facilitates the exchange of scientific knowledge, engineering expertise, intellectual property, and advanced technological solutions, thereby accelerating the

commercialization of innovative products and strengthening global innovation ecosystems.

The proposed model of international cooperation between technology incubators is intended primarily for early-stage innovation projects seeking organizational, technological, and financial support. It does not apply to projects that are already fully financed or implemented within established industrial enterprises, nor to technologies that have already been transferred to existing innovation companies for commercialization.

Within this framework, the activities of technology incubators are organized in two complementary directions: support for domestic innovation projects within the host country and the development of international partnerships aimed at expanding research cooperation, facilitating technology transfer, and promoting access to global markets.

Given the rapidly growing demand for intelligent technologies incorporating artificial intelligence and artificial neural networks, numerous national governments have introduced specialized programs supporting research and innovation in these fields. In particular, strategic initiatives have been established to promote open artificial intelligence research, secure and privacy-preserving AI technologies, collaborative software and AI development, and educational and workforce training programs. Such initiatives create favorable conditions for international cooperation and accelerate the development and commercialization of advanced digital technologies within technology incubators.

References and Patent and Licensing Information

Johnson, L. E., et al. *Smart Glasses Having Interfering Light Filtering*. United States Patent Application No. **US 20180031836 A1**, published February 1, 2018.

Kawamura, T. *Head Mounted Apparatus and Gripping Apparatus*. United States Patent Application No. **US 20170307787 A1**, published October 26, 2017.

Kuehne, M., et al. *Method for Operating Virtual Reality Glasses and System with Virtual Reality Glasses*. United States Patent Application No. **US 20150378155 A1**, published December 31, 2015.

Joo, G.-H. *Wearable Glasses and Method of Providing Content Using the Same*. United States Patent Application No. **US 20160034042 A1**, published February 4, 2016.

Park, J., et al. *Glasses-Type Mobile Terminal and Method of Operating the Same*. United States Patent Application No. **US 20180005421 A1**, published January 4, 2018.

Sevostianov, P. V. *Method and System for Displaying Three-Dimensional Objects*. United States Patent Application No. **US 20170366805 A1**, published December 21, 2017.

Liao, C. *Wearable Smart Glasses*. United States Patent Application No. **US 20170371164 A1**, published December 28, 2017.

submitted 18.05.2026;
accepted for publication 02.06.2026;
published 30.06.2026
© Kamaletdinova A.
Contact: adeliya_ka@mail.ru