2025 / ANNUAL SUSTAINABILITY REPORT

SDG 9 | Industry, Innovation, Infrastructure

Khazar University · Baku, Azerbaijan

REPORTING PERIOD JANUARY–DECEMBER 2025

Institutional Approach

Khazar University supports industry, innovation and infrastructure by connecting research with practical challenges, expanding digital research tools and encouraging students to develop new ideas. In 2025, the University strengthened cooperation with companies, supported technology competitions and shared new work in engineering, artificial intelligence and applied research.

1	**2nd**	**8**
Business-Industry Club launched in 2025	**AirVive at Clima Tech Hackathon**	**Azerbaijani partner universities in DIRNA**

9.1 Research on industry, innovation and infrastructure

In 2025, Khazar University contributed to **73 Scopus-indexed research articles and reviews associated with SDG 9 (Industry, Innovation and Infrastructure)**, comprising 60 research articles and 13 review papers. These publications addressed digital technologies, artificial intelligence, smart manufacturing, sustainable infrastructure, industrial efficiency, and environmentally responsible innovation.

Digital technologies and intelligent infrastructure

Digital innovation was an important area of research. Afrin et al. (2025), in *Industrial Internet of Things: Implementations, Challenges, and Potential Solutions Across Various Industries*, examined how connected sensors and intelligent monitoring systems can improve industrial operations. The study explored applications in manufacturing, construction, healthcare, agriculture, and energy systems, while identifying challenges related to cybersecurity, system compatibility, and data management.

Ahmed et al. (2025) investigated how cloud, fog, and edge computing can work together to improve Internet of Things (IoT) systems. Their research examined ways to process information more efficiently, reduce communication delays, and support the operation of intelligent devices across different environments.

Research by AzharShokoufeh et al. (2025) explored methods for improving data collection in IoT networks through federated learning and scheduled information exchange. The study examined how connected devices can share information more efficiently while reducing unnecessary data transmission and network demands.

In related digital research, Afzal et al. (2025), including a Khazar University-affiliated researcher, investigated multilingual semantic search using language models. Published in *Information*, the study assessed approaches to identifying relevant information across different languages, contributing to research on information retrieval and language technologies.

Smart manufacturing and industrial efficiency

Khazar-affiliated researchers also investigated how industries can improve productivity and make more sustainable investment decisions.

Krishankumar et al. (2025) examined energy-efficiency investments in smart manufacturing. The study developed a decision-making approach to help organisations compare investment options and identify factors affecting their effectiveness.

Liu et al. (2025) explored investment strategies combining smart manufacturing technologies with renewable energy efficiency. Their research used artificial intelligence-based decision models to examine how industrial investments can be evaluated against economic and sustainability considerations.

These studies contribute to understanding how technological innovation can support more efficient industrial processes and better-informed investment decisions.

Sustainable infrastructure and circular economy

Research also addressed the development of infrastructure that uses resources more responsibly.

Shahidi et al. (2025) investigated the use of granite-processing waste in producing cement-based artificial stone. The study examined the physical and mechanical properties of the resulting materials and assessed the environmental implications of reusing industrial waste. This research contributes to the development of alternative construction materials and more resource-efficient building practices.

Kou et al. (2025) explored how circular economy projects can be improved through advanced decision-support models. Their research examined factors such as waste management, energy efficiency, and investment planning, contributing knowledge relevant to reducing resource waste and improving industrial sustainability.

Ecer et al. (2025) investigated investment decisions for energy management in smart cities. The study examined how different investment priorities can be evaluated to support more efficient urban energy systems and sustainable infrastructure development.

Innovation and sustainable energy systems

Innovation research also extended to energy infrastructure and long-term technological development. Nuriyev, Nuriyev, and Mammadov (2025), in *Application of the Z-Information-Based Scenarios for Energy Transition Policy Development*, examined possible pathways for Azerbaijan's transition towards a more diversified energy system. The study considered how economic, technological, and environmental uncertainties can influence decisions involving traditional and renewable energy sources.

Together, these research contributions demonstrate Khazar University's engagement in the development of scientific knowledge relevant to industrial modernisation, digital transformation, sustainable infrastructure, and technological innovation. Through international research collaboration and interdisciplinary approaches, the University contributes to understanding how emerging technologies can support more resilient and resource-efficient economic systems.

Selected Research Publications (2025)

Scopus-indexed research associated with SDG 9

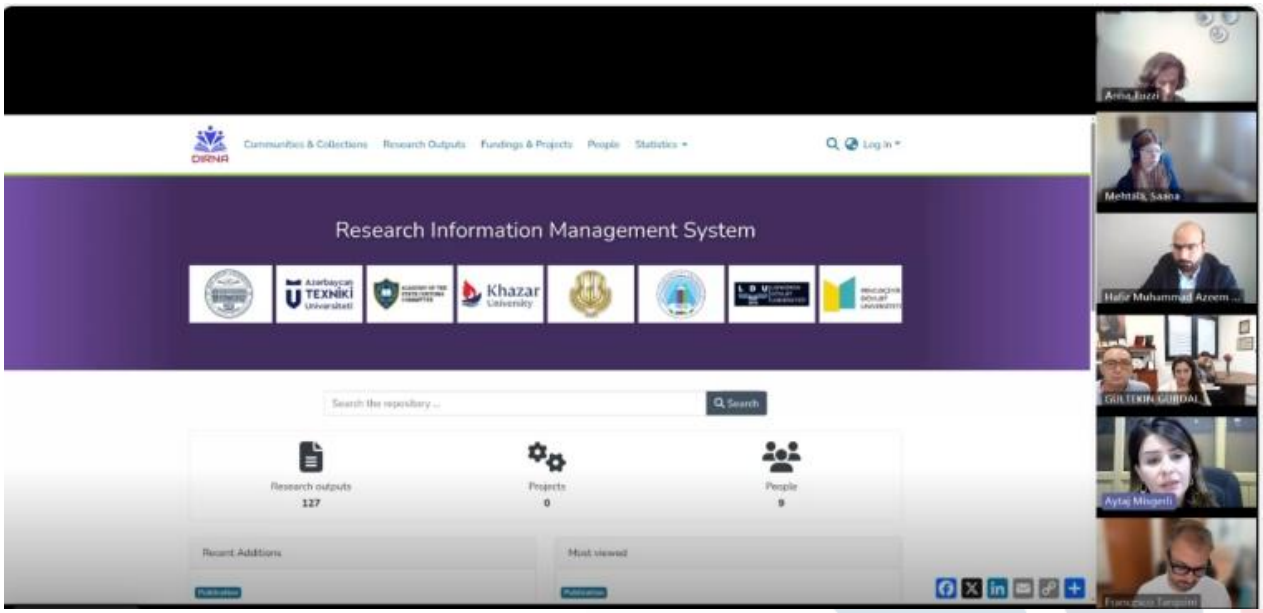
1. **Afrin, S., et al. (2025).** *Industrial Internet of Things: Implementations, challenges, and potential solutions across various industries.* Computers in Industry, 170, 104317. DOI
2. **Ahmed, S. F., et al. (2025).** *Optimising Internet of Things (IoT) Performance Through Cloud, Fog and Edge Computing Architecture*. IET Wireless Sensor Systems, 15(1), e70016. DOI
3. **AzharShokoufeh, D., DerakhshanFard, N., RashidJafari, F., & Ghaffari, A. (2025).** *Optimizing IoT data collection through federated learning and periodic scheduling.* Knowledge-Based Systems, 317, 113526. DOI
4. **Krishankumar, R., et al. (2025).** *Analysis of energy efficiency investments in smart manufacturing via double hierarchy linguistic structure-based hybrid decision-making model.* Energy, 334, 137807. DOI
5. **Liu, P., Dinçer, H., Yüksel, S., & Eti, S. (2025).** *Smart manufacturing investment strategies with renewable energy efficiency using Q-learning algorithm and molecular fuzzy Bayesian networks.* Applied Soft Computing, 185, 114007. DOI
6. **Shahidi, M. R., Reisi, M., Salahshour, S., & Baghaie, S. (2025).** *Using of granite waste as aggregates for production of high strength cement-based artificial stone.* Innovative Infrastructure Solutions, 10, Article 580. DOI
7. **Kou, G., et al. (2025).** *Enhancing circular economy project outcomes via molecular fuzzy-based decision support system.* Ain Shams Engineering Journal, 16(9), 103564. DOI
8. **Ecer, F., Saha, A., Dinçer, H., & Yüksel, S. (2025).** *Evaluating energy management investments for sustainable transition of smart cities through a new intuitionistic fuzzy consensus-based CoCoSo methodology.* Renewable Energy, 244, 122655. DOI

Additional related research

9. **Afzal, T., Abdul Rauf, S., Malik, M. G. A., & Imran, M. (2025).** *Fine-Tuning QurSim on Monolingual and Multilingual Models for Semantic Search.* Information, 16(2), 84. DOI
10. **Nuriyev, M., Nuriyev, A., & Mammadov, J. (2025).** *Application of the Z-Information-Based Scenarios for Energy Transition Policy Development.* Energies, 18(6), 1437. DOI



In September, DIRNA partners reviewed the RIMS platform and its research-management functions.



Khazar also presented a Technologies and Artificial Intelligence Center in May.



9.2 Patents citing university research

The University encourages technological work that may contribute to future industrial applications. In April 2025, the Department of Physics and Electronics held a doctoral research discussion on quantum-dot nanoparticles and photonic devices.





Technical knowledge exchange continued through the Energy Systems Research Center seminar series and industrial learning visits to FAB Group and SOCAR Polymer.

These activities connect scientific ideas with technologies and industry practice.

9.3 University spin offs

Khazar University worked to develop opportunities for entrepreneurship and student-led innovation. At the Business and Science Forum on 27 February 2025, the University introduced the Khazar University Business Industry Club (KUBIC). A follow-up meeting on 1 May brought students together with company representatives to discuss mentoring, startup acceleration and prospective project development.

Students also tested ideas through competitions and public demonstrations. The AirVive smart air-purification project won second place at the Clima Tech & Sustainability Hackathon, while GreenTech II participants from Khazar achieved third place in Digital Ecology. The BeeLance agricultural technology concept was exhibited at Rebuild Karabakh, and the SatWater team advanced to an incubation and acceleration pathway. These examples illustrate early-stage innovation and enterprise development.

9.4 Research income from industry and commerce

Connections with companies help create an environment for applied research and future collaboration. Through the 2025 Business and Science Forum and KUBIC business meeting, academic staff, students and business representatives discussed research applications, innovation needs and possible joint projects. Industry exposure was also strengthened through manufacturing visits to METAK and SOCAR Polymer.



Selected Activities in 2025

2025	ACTIVITY
10 Jan	DIRNA institutional repository demonstrated to university staff
8–9 Feb	AirVive student team won second place at sustainability hackathon
27 Feb	Business and Science Forum introduced KUBIC
17 Apr	GreenTech II award for Khazar engineering students
1 May	KUBIC met students and business representatives
30–31 May	Technologies and Artificial Intelligence Center presented
29 Sep	DIRNA partners reviewed the RIMS research platform
6–7 Dec	SatWater team reached National Space Hackathon final

2025 Overview

In 2025, Khazar University expanded opportunities for research collaboration, digital infrastructure, industry dialogue and student innovation. The introduction of KUBIC, DIRNA platform demonstrations, international academic partnerships and recognised student projects reflected an active approach to linking education, technology and industry.