Iran Nano and Micro Technologies
Innovation Council
(INIC)

Progress Review of Iran Nanotechnology Plan:

From Vision to Reality

November 2024

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About the cover: Hafez Tomb Ceiling, Shiraz, Iran

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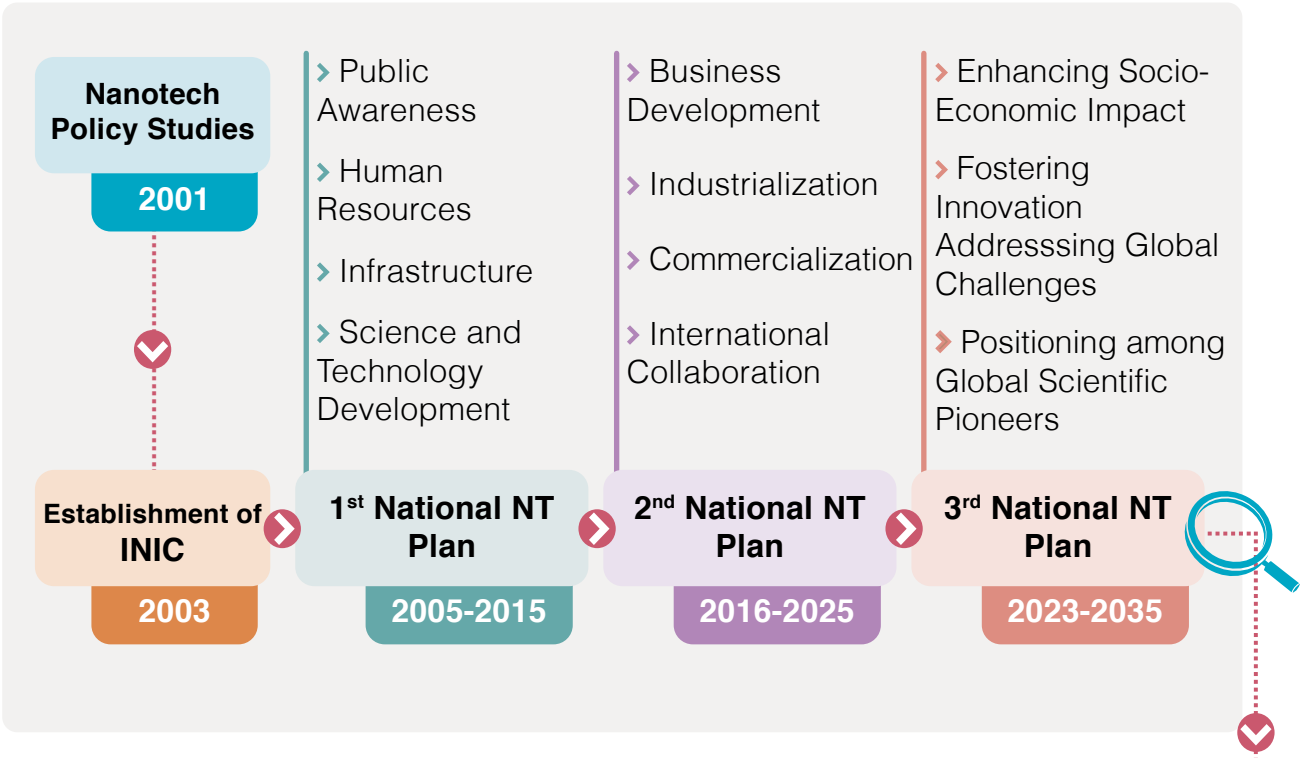
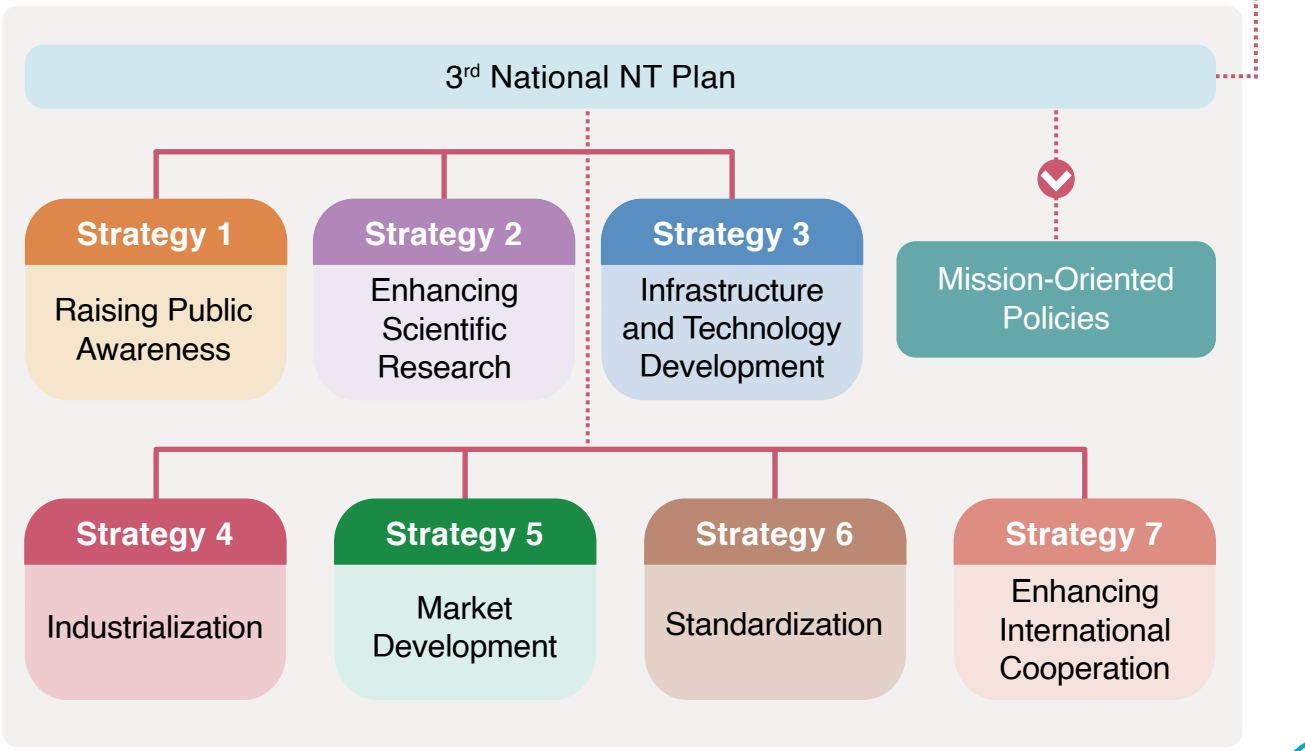
Iran Nanotechnology Policy Timeline



Structure of Iran's 3rd Nanotechnology Plan



Cost-Effective and Efficient Wastewater Treatment With Nanobubbles

Mission-Oriented Policies

Iran's 3rd nanotechnology policy has shifted towards mission-oriented innovation, focusing on meeting key national needs.

The 2035 vision prioritizes five areas for nanotechnology development to enhance economic growth and quality of life.

Structure of Implementation Plan for Mission-Oriented Policy

Key Industrial Sectors	5 KISs
Special Missions	11 Missions
National Actions	27 National Actions
Mission Projects	136 Mission Projects (2023)

Achievements

Industrial Outcomes	Technological Outputs	Socio-Economic Impact
Industrial Products	Developed Technologies	Wealth Creation
Production lines		Social Well-being
		Employment of Specialists

National Partnership

The Participation of 17 Ministries & Executive Agencies

Applied Research	Government procurement	Authorization & Approval
Standards & Regulations	Pilot Development	Industry Encouragement

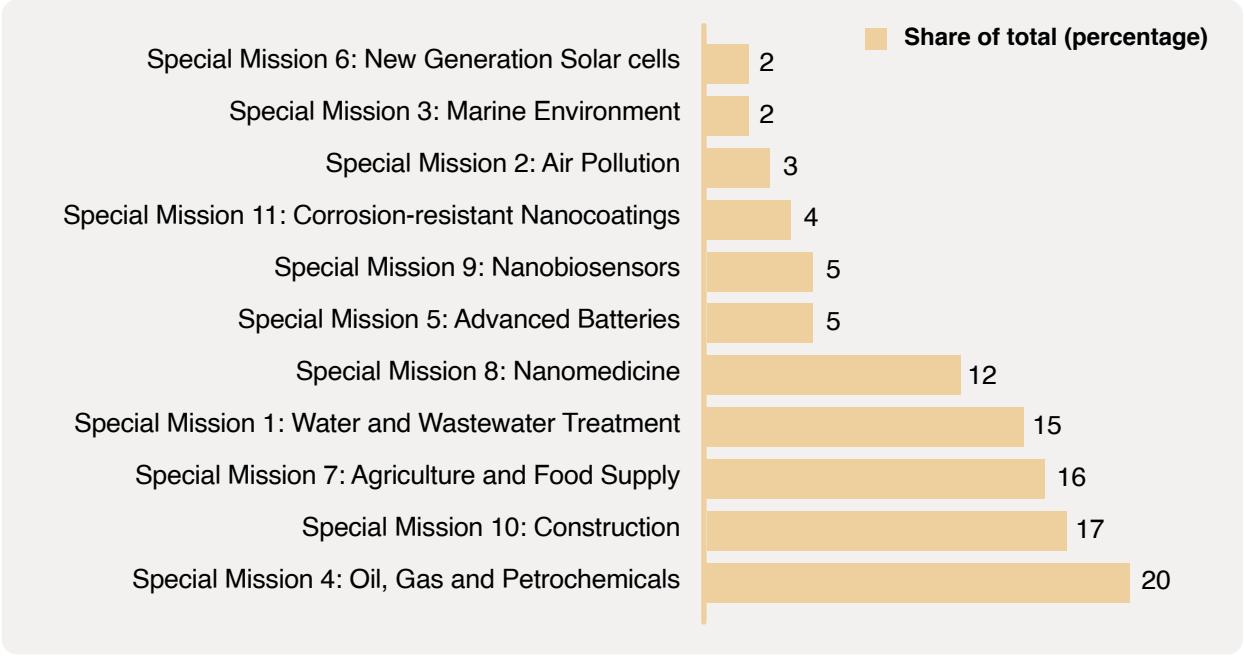
Financing & Investment

Government Investment	Private Investment	Foreign Investment

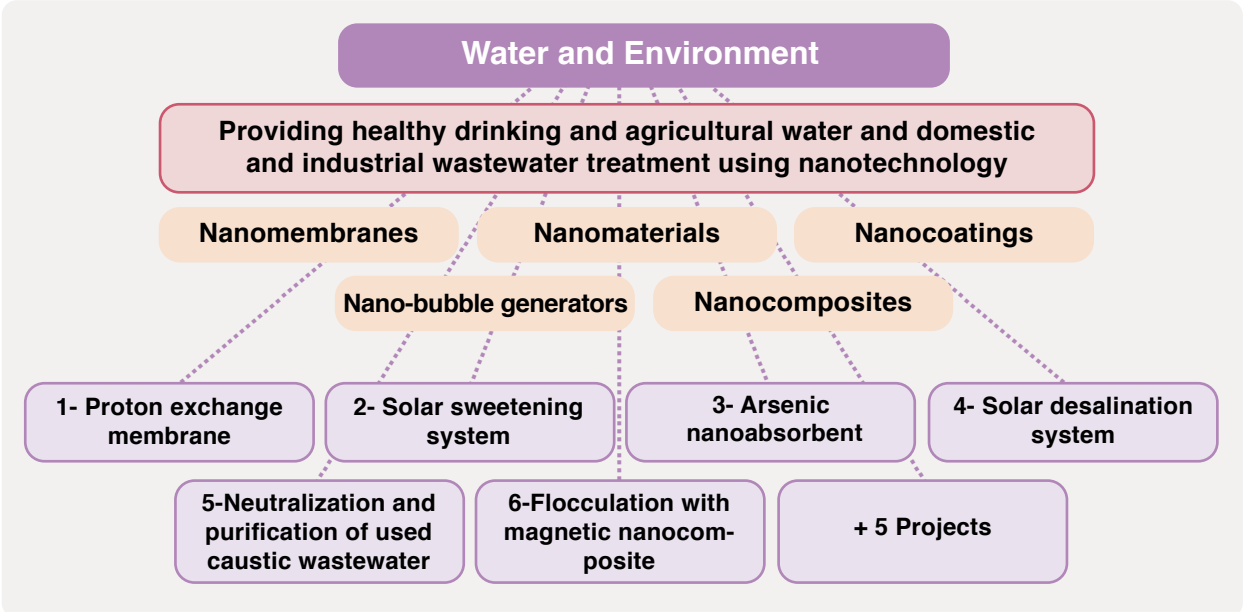
Key Industrial Sectors of Nanotechnology and Their Special Missions

Key Industrial Sectors	Special Missions
Water and Environment	1 Providing healthy drinking and agricultural water and domestic and industrial wastewater treatment using nanotechnology
	2 Developing Indigenous nanotechnology-based solutions for air pollution reduction
	3 Enhancing marine environmental health against ship-borne pollutants
Energy	4 Enhancing the competitiveness of the oil, gas, and petrochemical industries through nanotechnology
	5 Creating a value chain for advanced batteries used in electric vehicles and renewable energy
	6 Establishing a semi-industrial production line for new-generation nanostructured solar cells generation nanostructured solar cells
Agriculture	7 Developing advanced nanotechnologies to enhance agriculture and food security
Health and Medicine	8 Industrial production of nano drugs and nano nutrients based on advanced nanotechnology
	9 Industrial production of nano biosensors
Construction	10 Enhancing construction industry products using nanotechnology
	11 Developing corrosion-resistant nanocoatings

Breakdown of Technology Development Projects by Mission



For Example: Mission-Oriented Policy Landscape in Water and Environment



Strategy 1: Raising Public Awareness

High School Students

2001 — Beginning of Nanotechnology Promotion among High School Students

2008 — Establishment of *Nanoclub*

- Raising Awareness about Nano Science and Technology among Students
- Training of Skilled Human Resources for Nanotechnology in Iran.

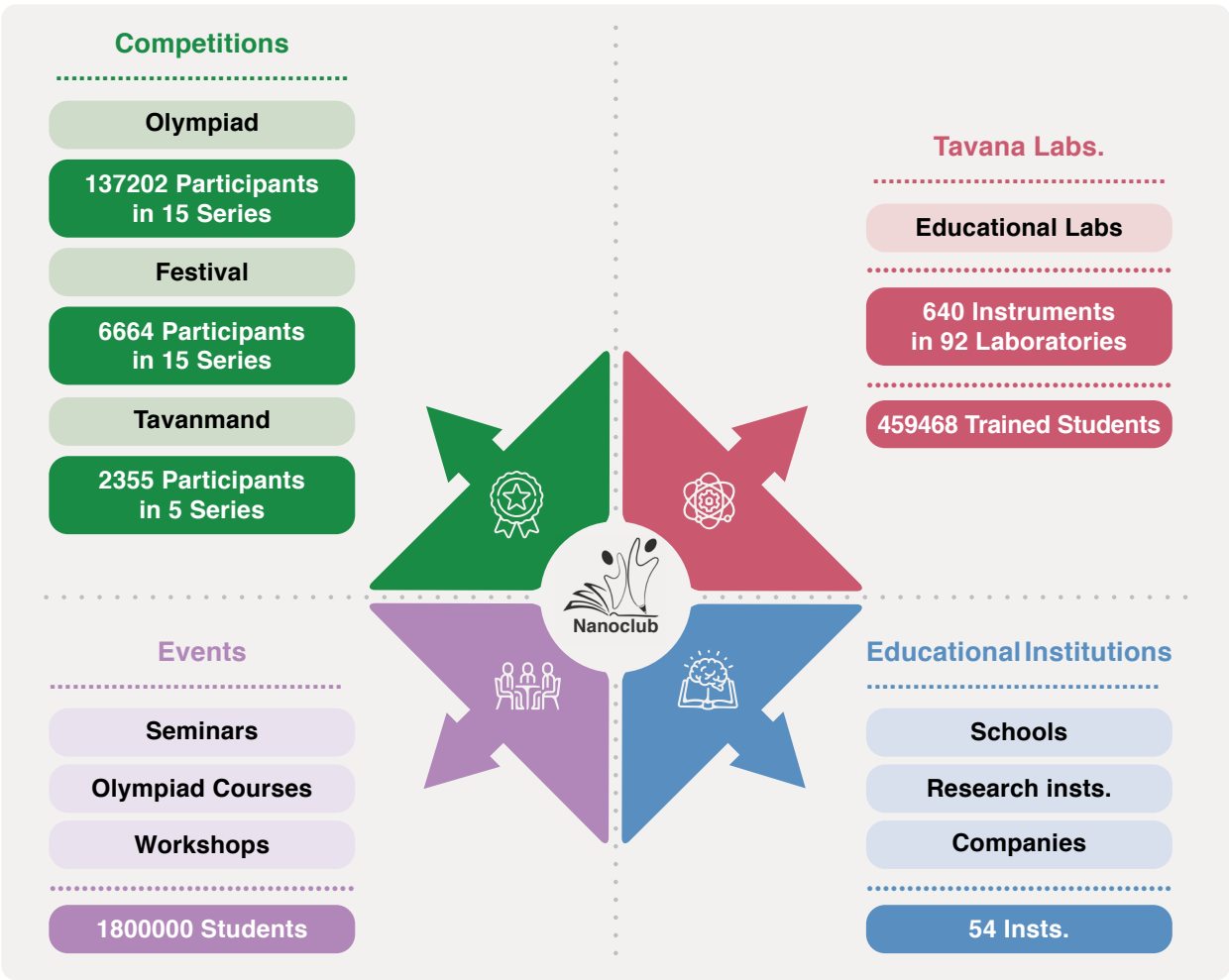
2010 — First Olympiad of Nano Science and Technology

2014 — Establishment of the Network of Nanotechnology Educational Laboratories *(Tavana[1])*

- Simple and practical teaching of Nanotechnology
- Familiarizing Students with Laboratory Equipment
- Strengthening students' teamwork skills

2016 — First *Tavanmand*[2] Competition

- Increase the Benefit of Students from Tavana Network Laboratories
- Encourage Students to Do Problem-oriented Research



1- Tavana is a Persian word that means powerful.
2- Tavanmand is a Persian word that means capable.

University Students

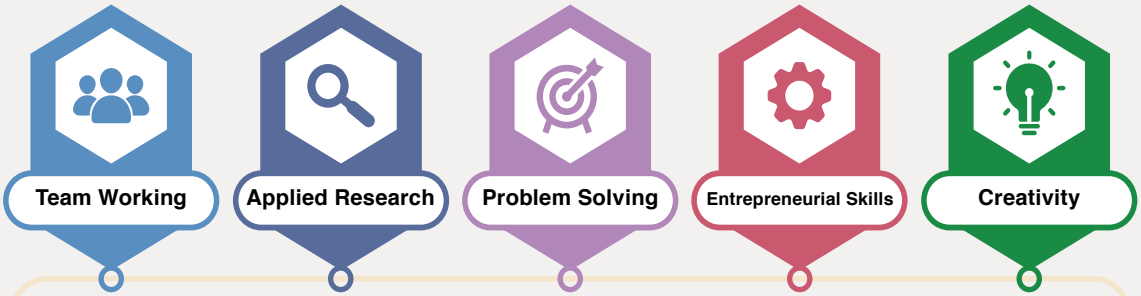
1999 — Beginning of Nanotechnology Promotion among University Students

2010 — First National Nano Competition

2011 — First *Karno*[1] Courses

2015 — Establishment of Nanotechnology Education Foundation

- Nano Human Resource Empowerment Courses
- Graduate Students to Develop Entrepreneurial Skills
- Familiarizing Students with the Needs of the Market



Karno

61 series

4670 Participants

Nanotechnology Education Foundation

National Nanotechnology Competition

13 series

58645 Participants Including

5947 PhD Students

17771 PG. Students

34927 UGStudents

Nanotechnoligy Teachers Network

100 Members Including

41 PhDs.

31 PGs.

28 UGs.

Events

Seminars

Workshops

178626 Trained in 2172 Events

-1 Karno is a Persian word that means new work.

Strategy 2: Enhancing Scientific Research

Nanotechnology Academic Human Resource

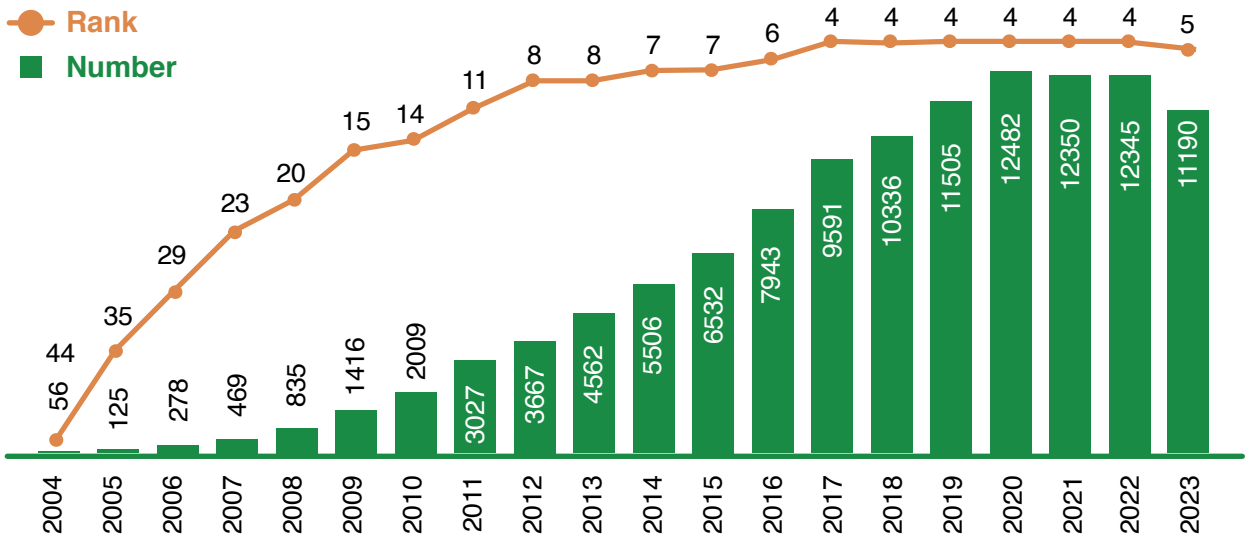
About 42,000 MSc and Ph.D. active Experts Participating in Nanotechnology Research

30 Universities Organizing Nanotechnology Phd Courses

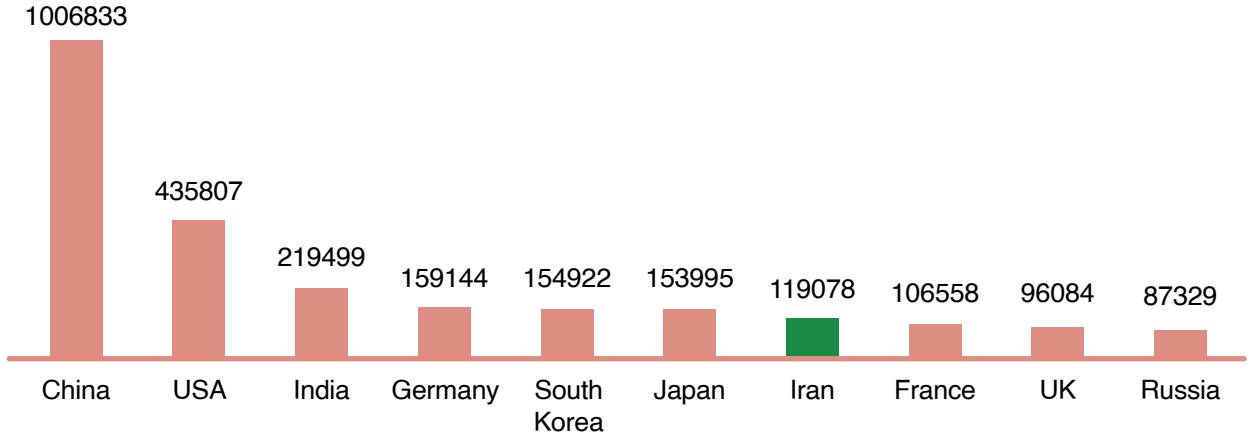
79 Universities Organizing Nanotechnology MSc Courses

Nanopublications

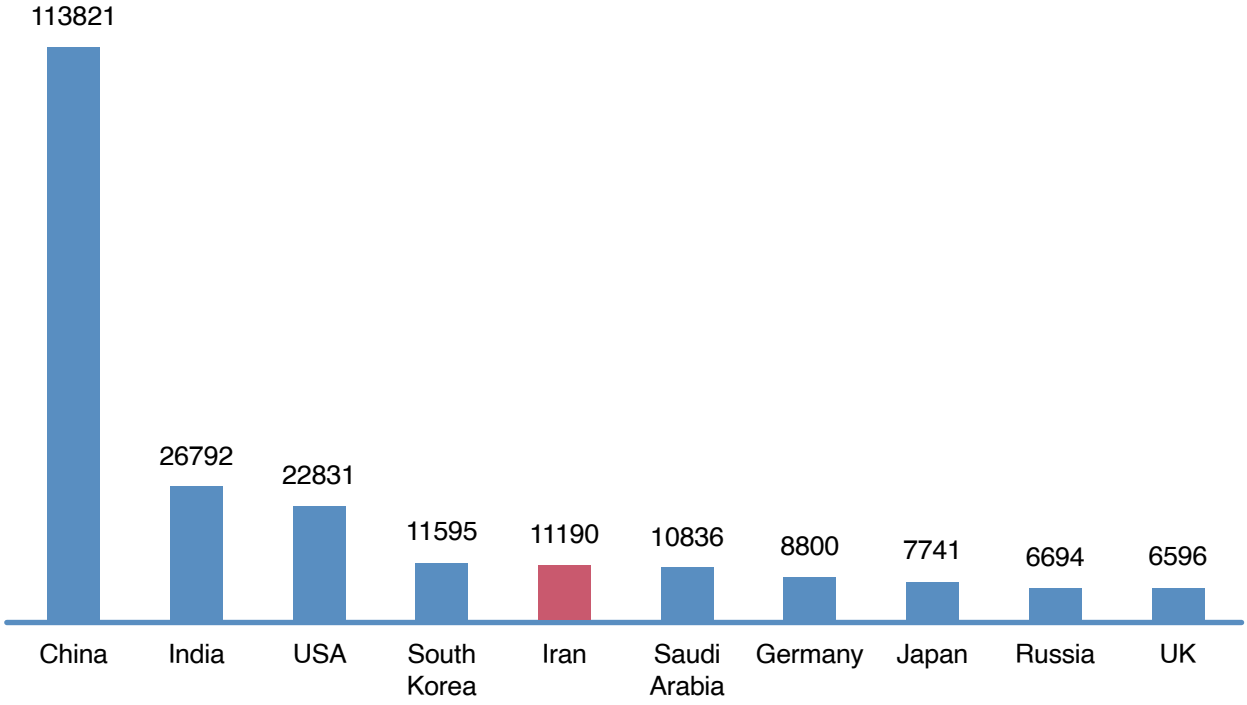
Iran's ISI-Indexed Nanotechnology Articles (Number and Rank) (2004-2023)



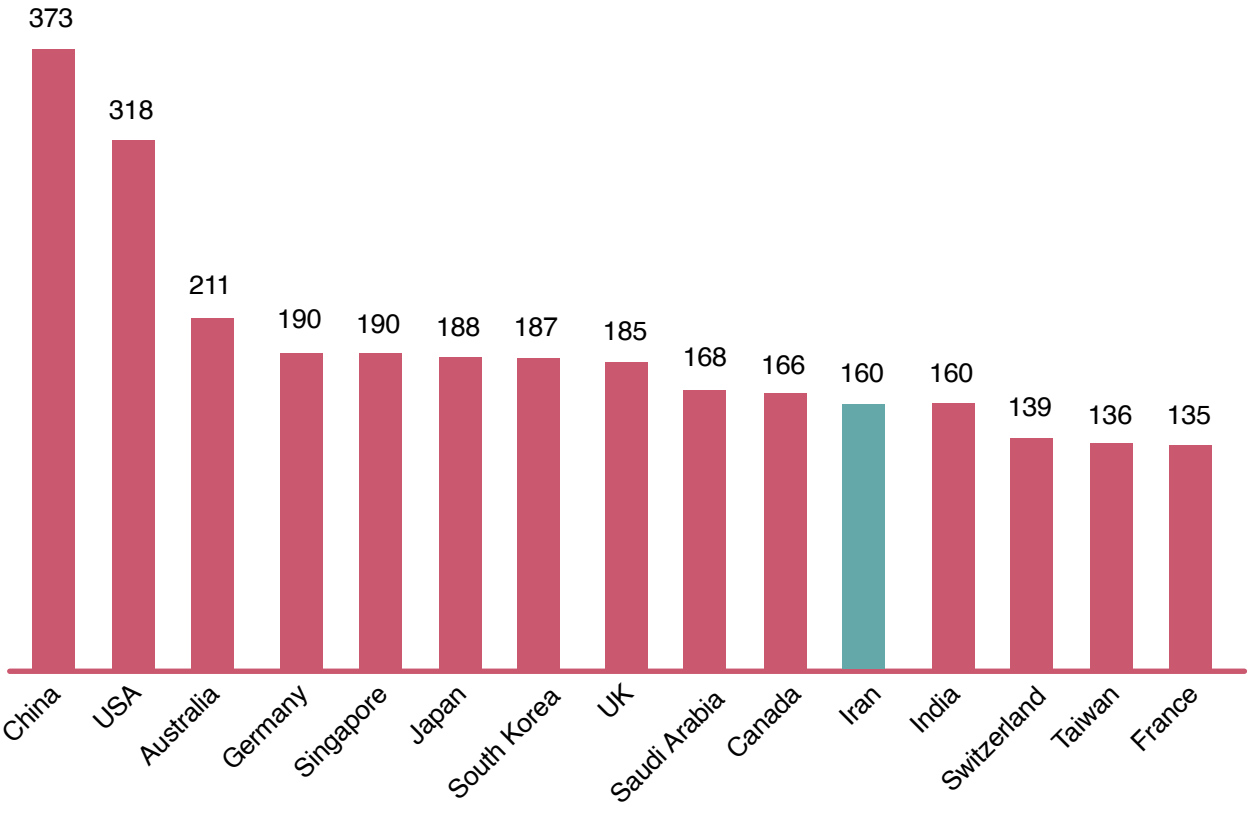
10 Leading Countries in Nanotechnology Publications (Cumulative-2000-2024 [May])



10 Leading Countries in Nanotechnology Publications (2023)



15 Leading Countries in h-index of Nanotechnology Articles (2019-2023)



Number of Iran's Nano-articles

119078

2000-2024 (May)

Iran's Global Rank in Publishing Nano-articles

7

2000-2024 (May)

Iran's Rank in Nano-articles H-index

11

2019-2023

Share of Iran's Nano-articles of Total Iran Articles

20.5%

2024 (May)

Share of Iran's Nano-articles of Total Nano-articles

4.2%

2000-2024 (May)

Average Annual Growth Rate of Iran's Nano-articles

45%

2000-2023

Iran's Rank in Article per GDP Based on the Purchasing Power Parity

1

2024 (May)

Citations to Iran's Nano-articles

33861

2023

Share of Iran's International Joint Nano-articles of total Iran Nano-articles

32.6%

2023

Iran's h-Index of Nanotechnology Publications

36.00

2023

Iran's Nano-articles in Q1 Journals

4235

2023

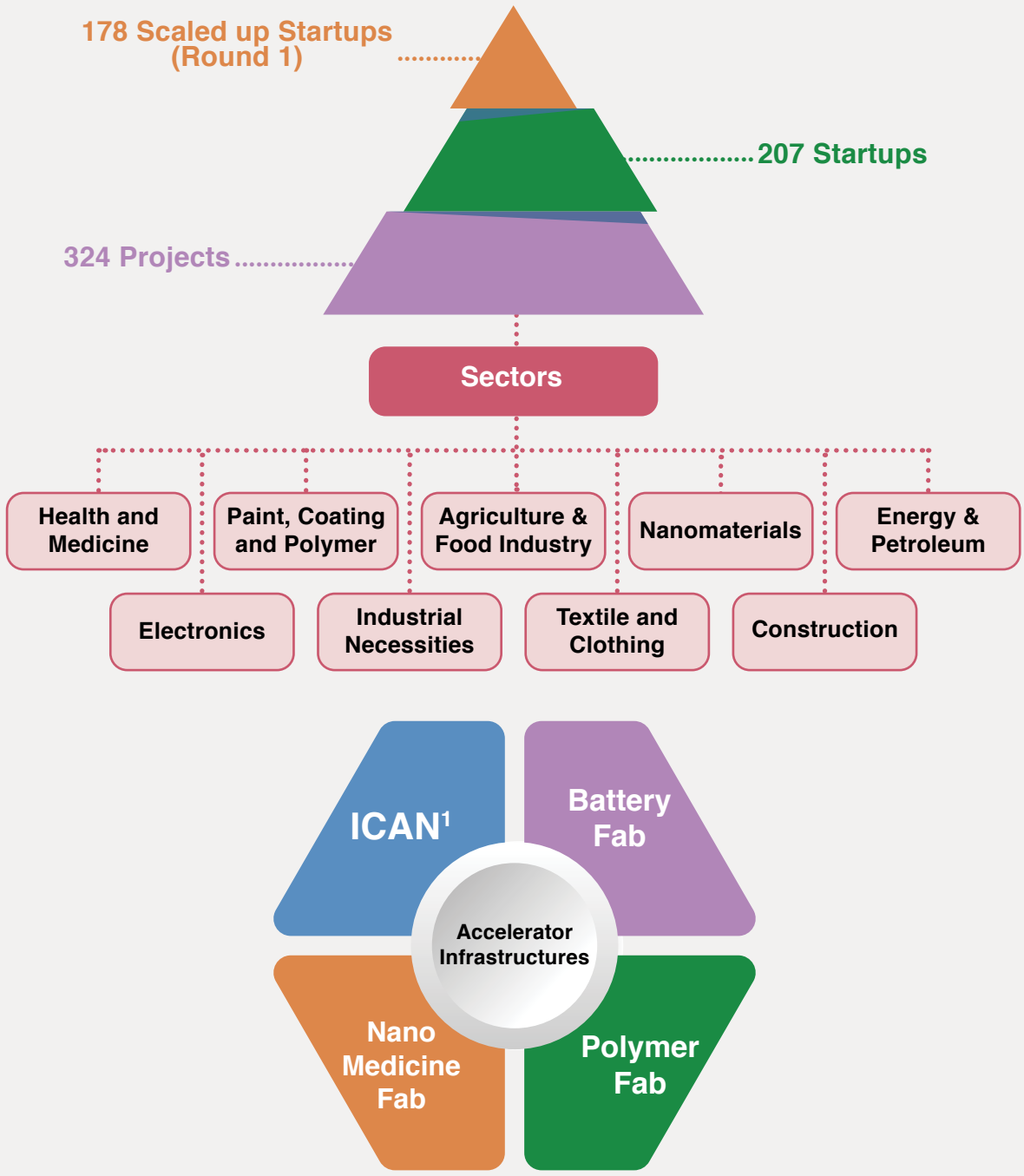
The largest share in publishing joint Nano-articles with Iran

1-CHN 2-USA 3-TUR 4-IRQ 5-CAN

2023

Strategy 3: Infrastructure and Technology Development

Nanotechnology Startups



1- Industrialization Center for Applied Nanotechnology

Nanotechnology Laboratory Network

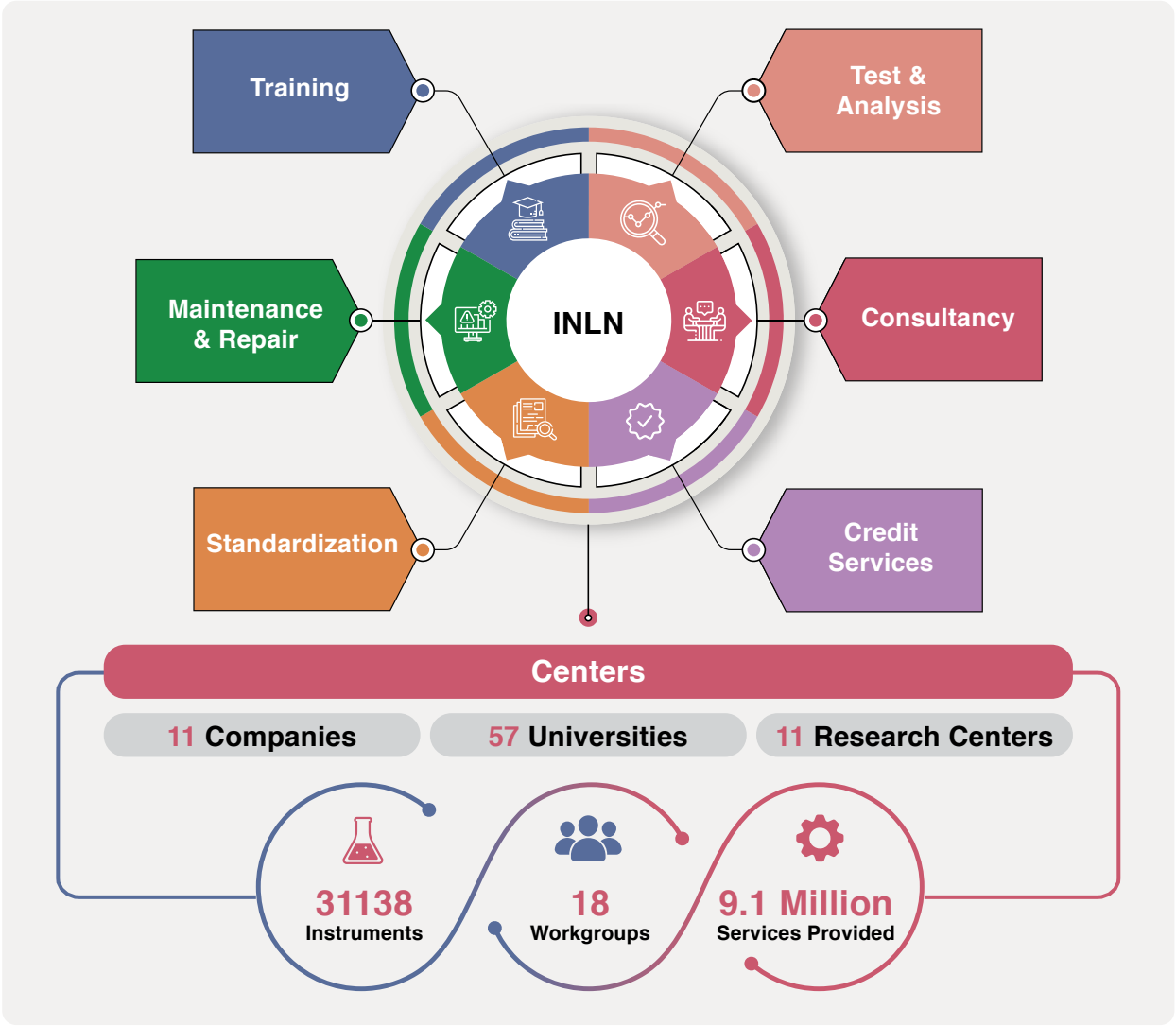
2004

Establishment of Iran Nanotechnology Laboratory Network (*INLN*)

Providing laboratory services to academic and industrial researchers through a network of universities and research centers.

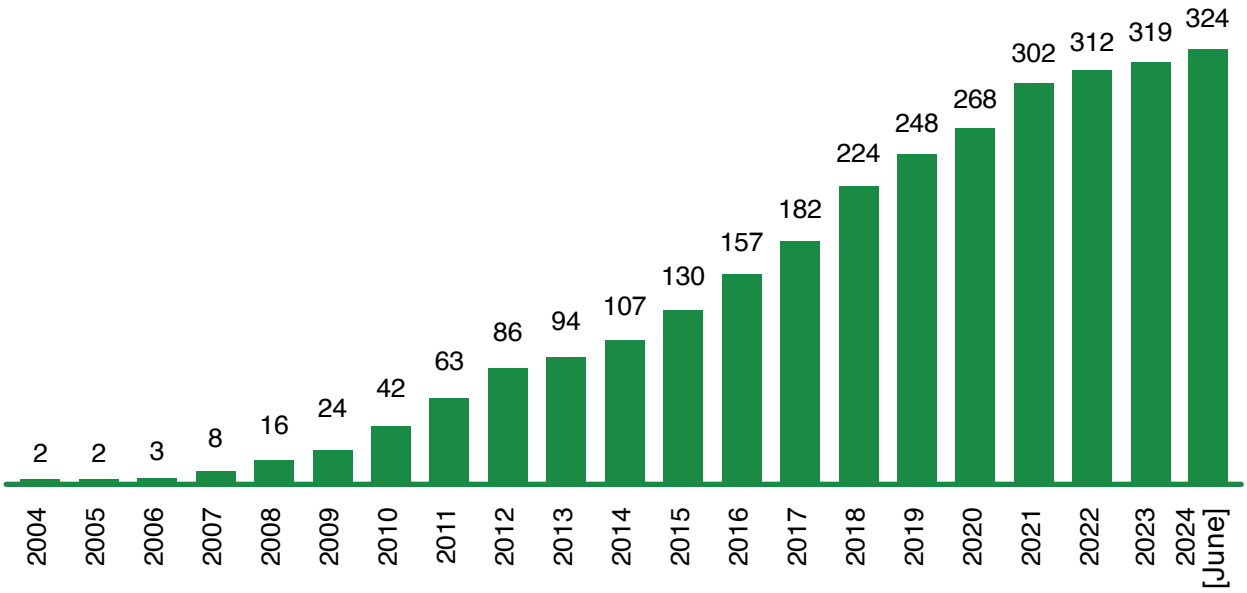
Facilitating easy access to lab resources for specialists, supporting the development of nano-related laboratory equipment.

Offering support for equipment maintenance, ISO certification, procurement of lab instruments, and advisory services for lab setup and management.

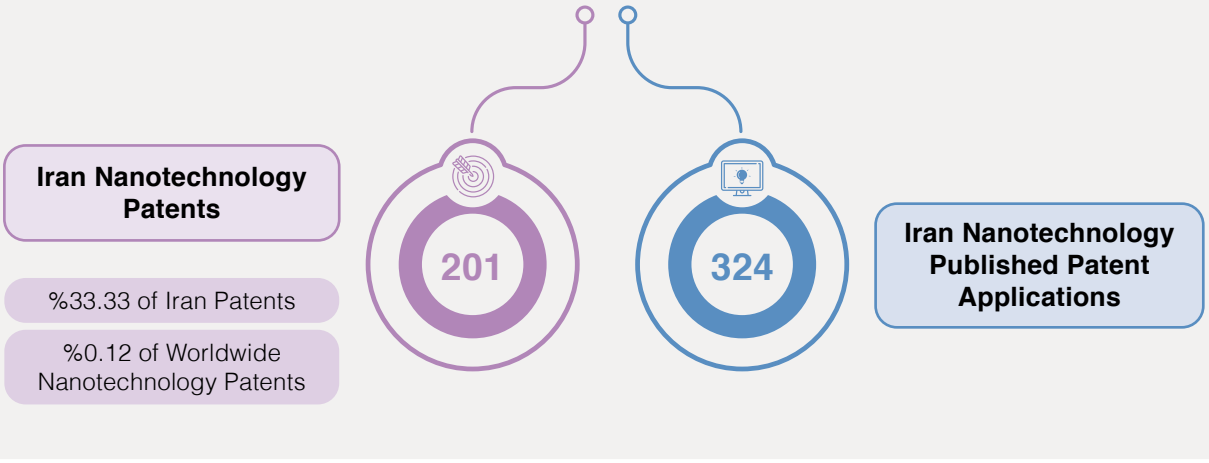


Nanotechnology Patents

The number of Iran's nanotechnology published patent applications (2006-2024 [June])



Iran Nanotechnology Patents - By the End of June of 2024

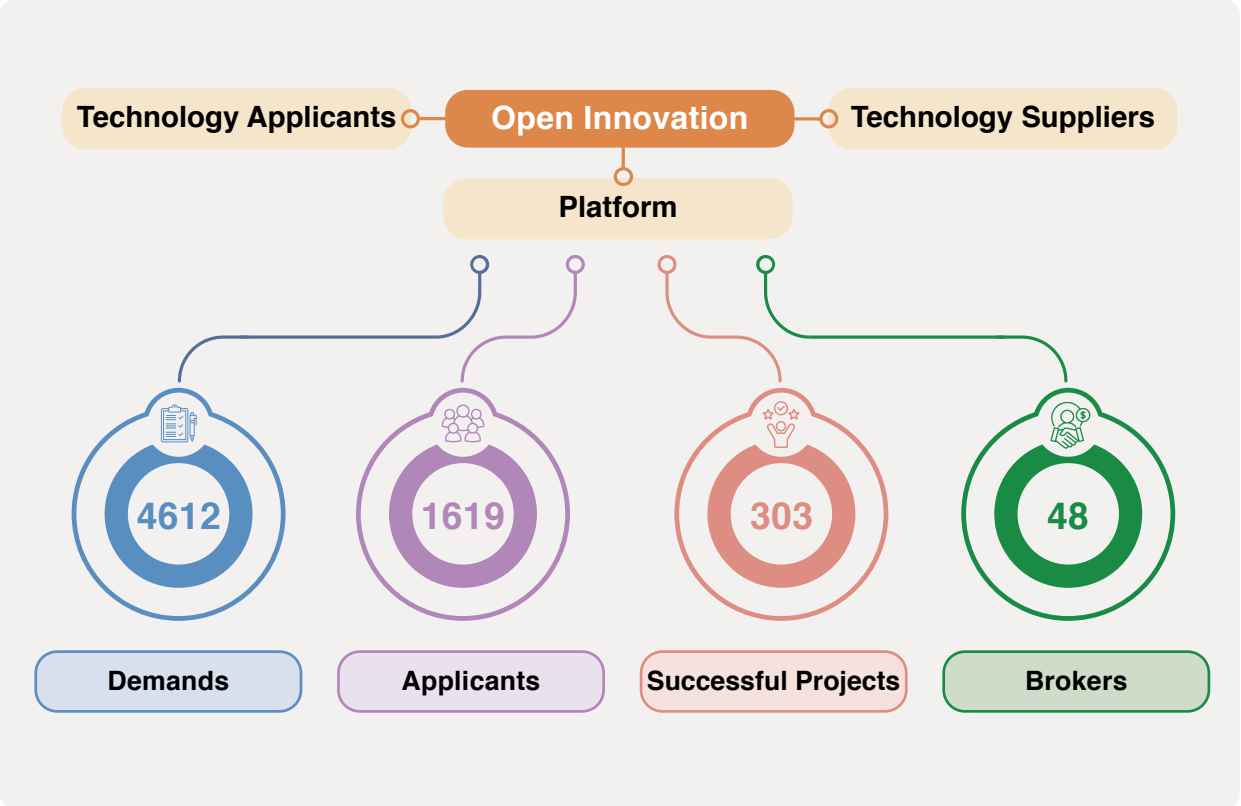


Strategy 4: Industrialization

Nanotechnology Exchange Network

Identifying and addressing technological needs of industries using domestic companies and research institutions.

Offering innovation challenges, consulting for technology management and nano-scale certification, and guidance for obtaining tax credits and knowledge-based certification.

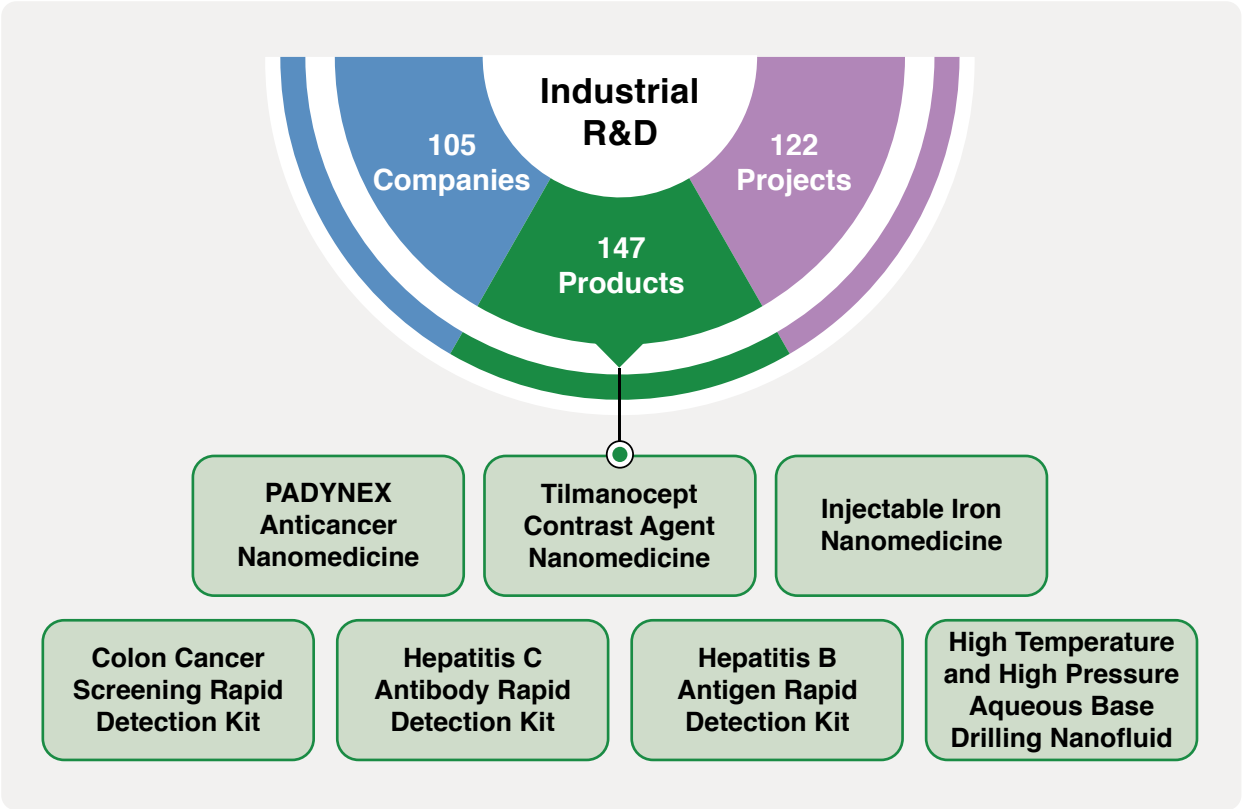


Nanotechnology Industrial R&D

Providing financial and non-financial support to industries to mitigate risks associated with adopting nanotechnology, particularly in research and development (R&D).

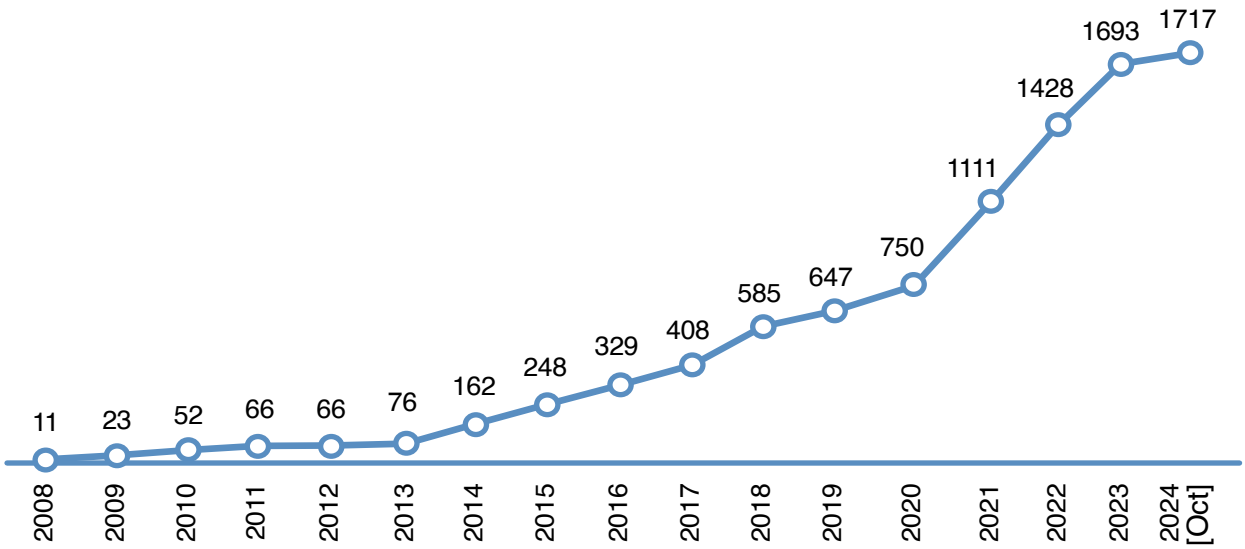
Offering low-interest loans, with options for partial grants or reduced repayment based on progress in R&D, product certification, and commercialization.

Supporting companies through consultancy on product development, obtaining knowledge-based certification, and inclusion in nano product vendor lists.

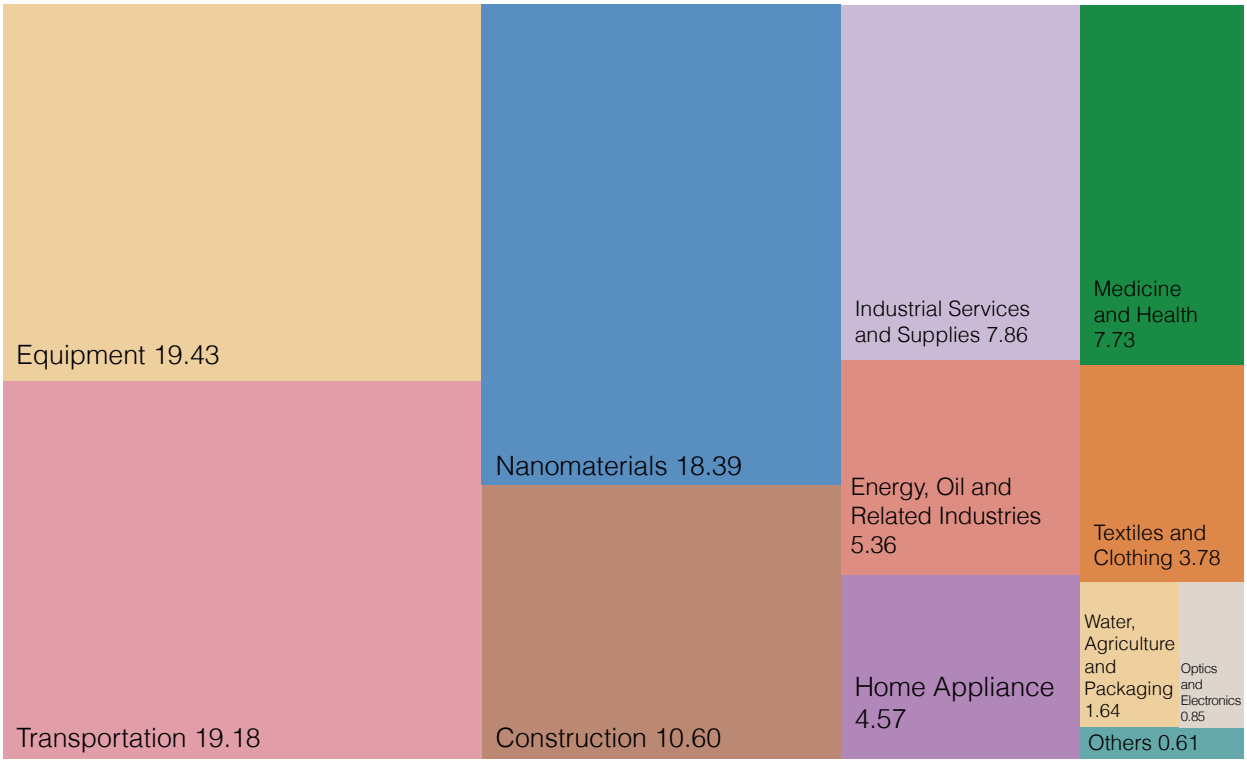


Nanoproducts

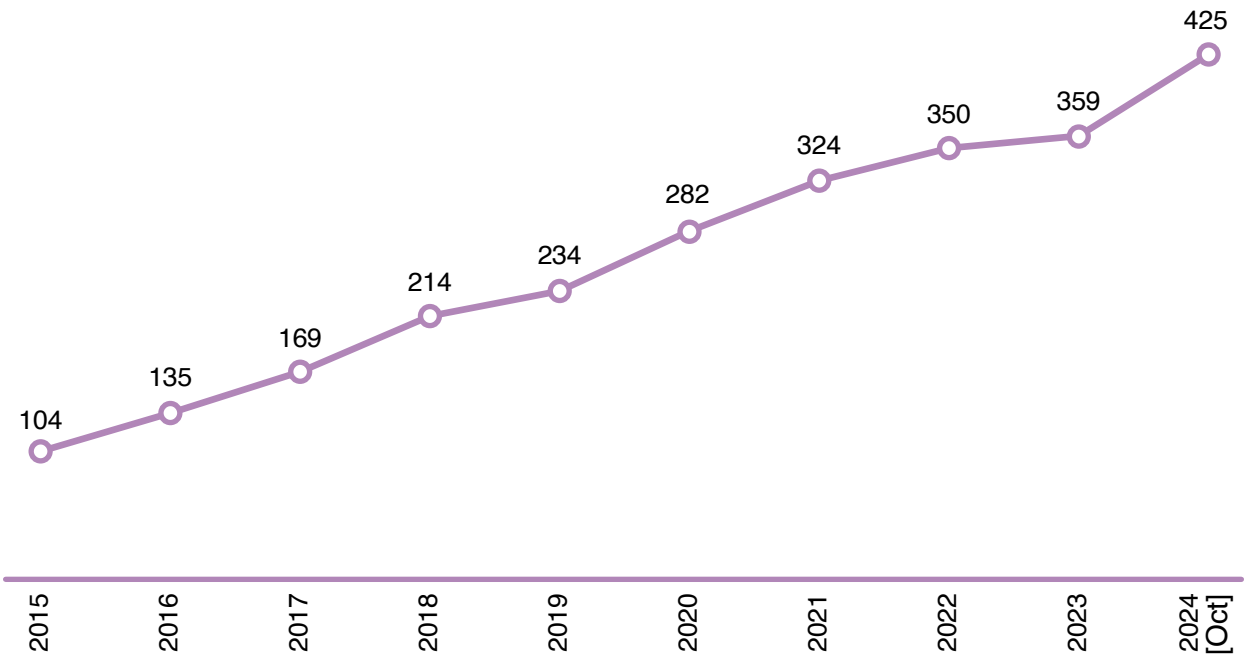
The Number of Iran Nanoproducts (2024-2008 [Oct])



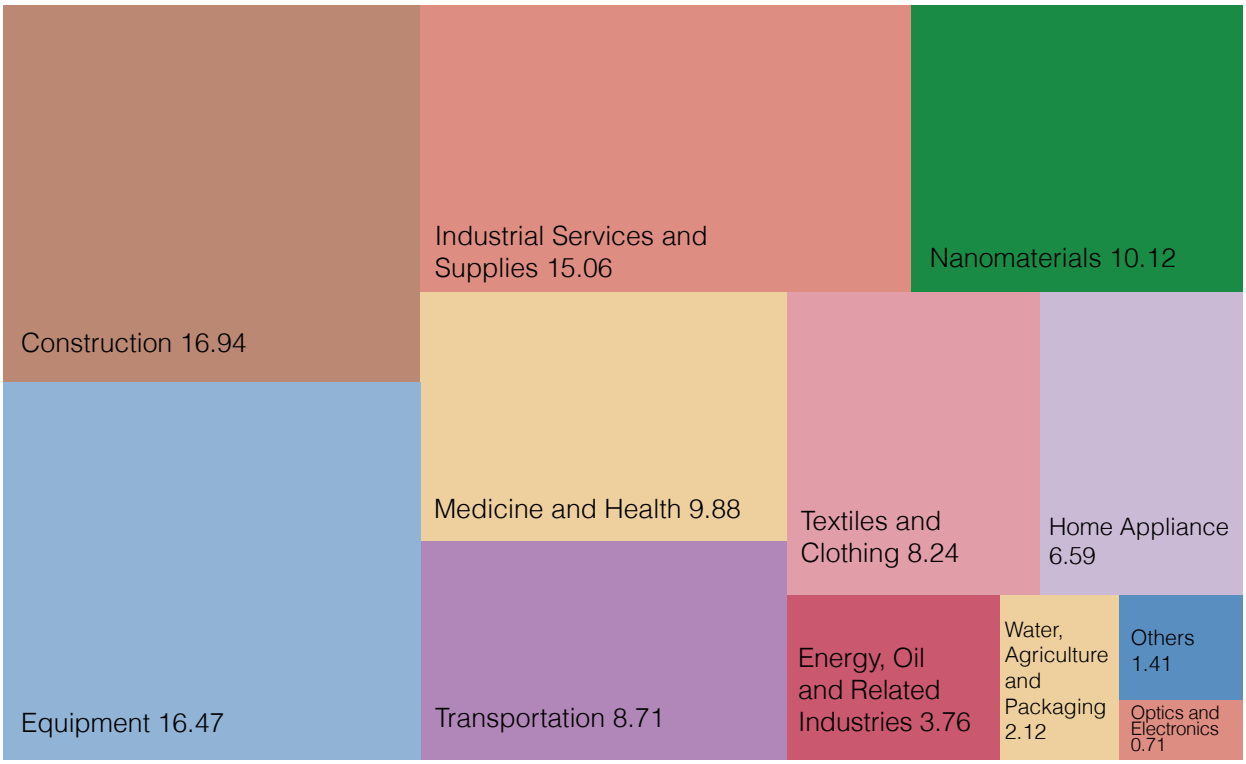
Share of Industrial Sectors in the Total Nanoproducts (%) (2024 [Oct])



The Number of Iran Nano Companies (2024-2015 [Oct])



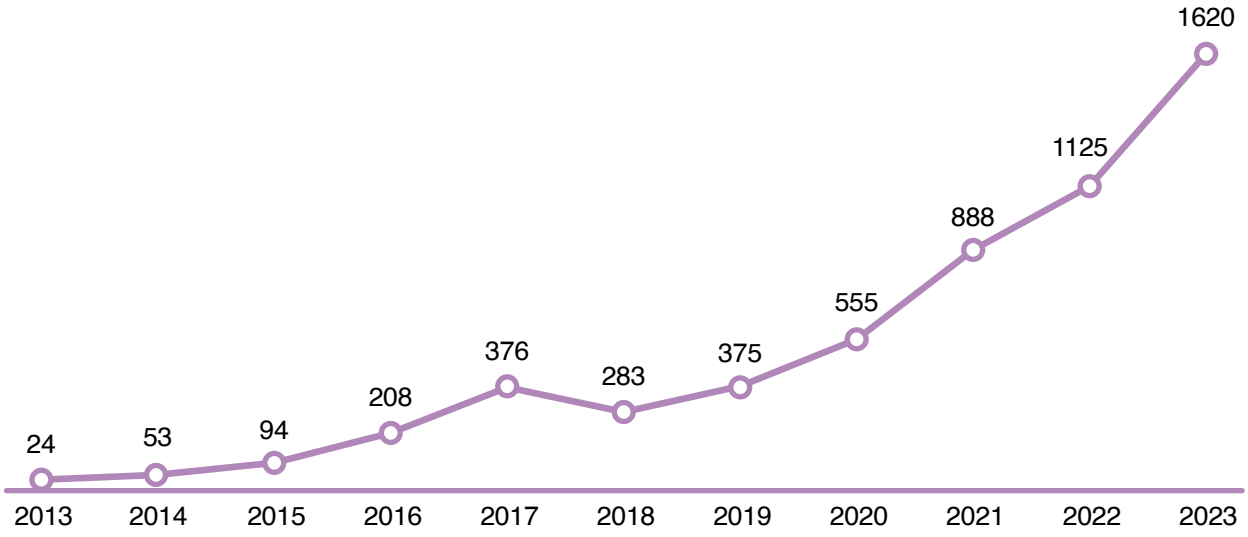
Share of Industrial Sectors in the Total Nano Companies (%) (2024 [Oct])



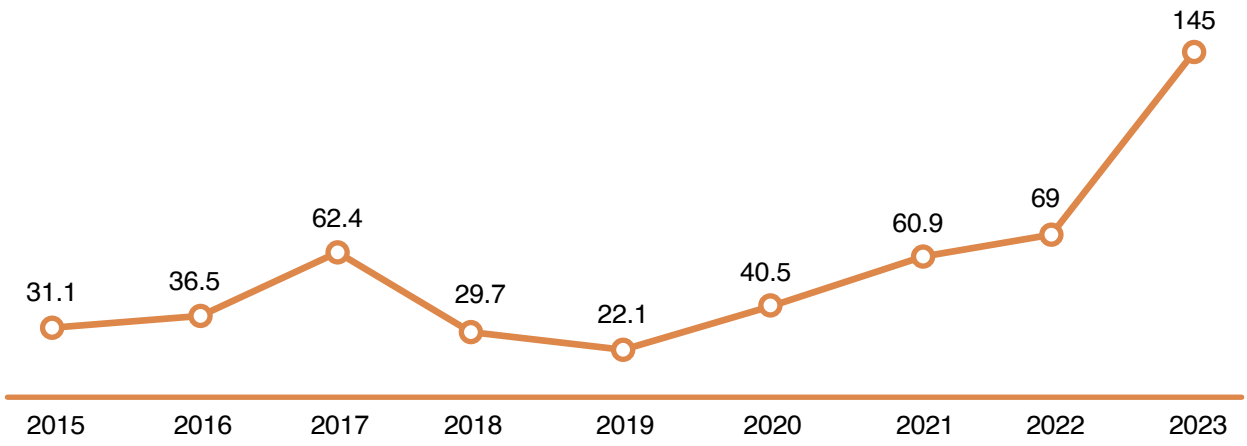
Strategy 5: Market Development

Nano Market Size

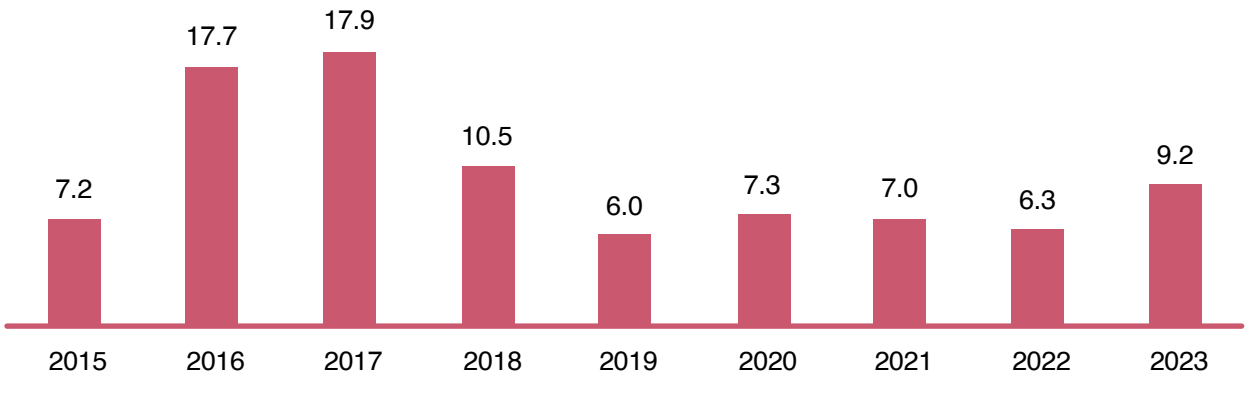
Iran Nanoproducts Market Size (Million $) (2023-2013)



Iran Nanoproduct Export Size (Million $) (2015-2023)



Share Of Export in The Total Market (%) (2015-2023)



Strategy 6: Standardization

National & International Nanotechnology Standards

2006

Establishment of Iran Nanotechnology Standardization Committee

ISO/TC229

A Member of ISO Technical Committee on Nanotechnologies

Developing national nanotechnology standards in collaboration with the National Standard Organization of Iran and experts from universities, research institutes, and industrial companies through specialized sessions.

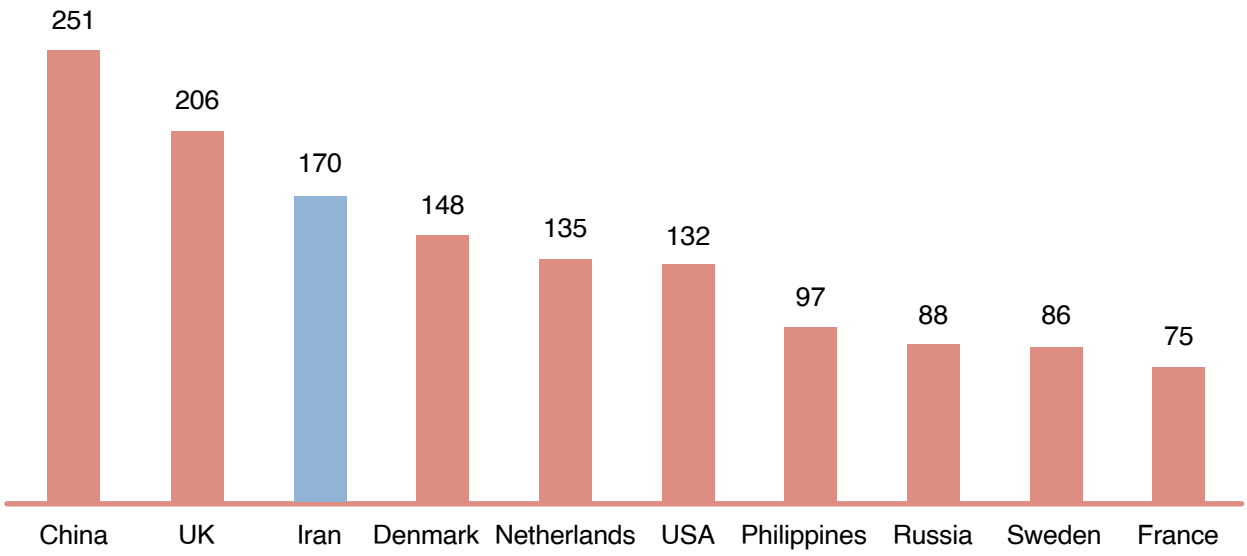
Iran participates in international nanotechnology standardization by establishing a national committee aligned with ISO/TC229, becoming one of the top ten countries responsible for developing international standards.

Nanotechnology Standards

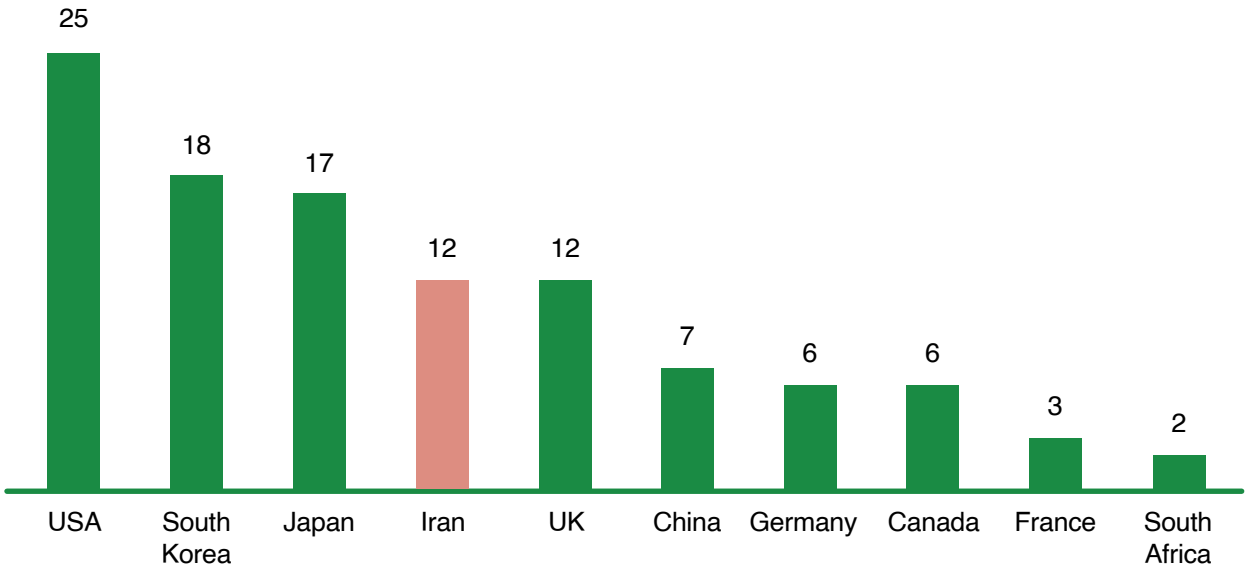
International nanotechnology starndards under Iran's leadership

Number	Title	Year
ISO/TR 11360	Nanotechnologies — Methodology for the classification and categorization of nanomaterials	2010
ISO/TS 16550	Nanotechnologies — Determination of silver nanoparticles potency by release of muramic acid from Staphylococcus aureus	2014
ISO/TS 18110	Nanotechnologies — Vocabularies for science, technology and innovation indicators	2015
ISO/TS 20787	Nanotechnologies — Aquatic toxicity assessment of manufactured nanomaterials in salt-water lakes using Artemia sp. Nauplii	2017
ISO/TS 21236-1	Nanotechnologies — Clay nanomaterials — Part 1: Specification of characteristics and measurement methods for layered clay nanomaterials	2019
ISO/TS 21237	Nanotechnologies — Air filter media containing polymeric nanofibres — Specification of characteristics and measurement methods	2020
ISO/TS 21975	Nanotechnologies — Polymeric nanocomposite films for food packaging with barrier properties — Specification of characteristics and measurement methods	2020
ISO/TS 23459	Nanotechnologies — Assessment of protein secondary structure during an interaction with nanomaterials using ultraviolet circular dichroism	2021
ISO/TS 23650	Nanotechnologies — Evaluation of the antimicrobial performance of textiles containing manufactured nanomaterials	2021
ISO/TS 4988	Nanotechnologies — Toxicity assessment and bioassimilation of manufactured nano-objects in suspension using the unicellular organism Tetrahymena sp.	2022
ISO/TS 10818	Nanotechnologies — Textiles containing nanomaterials and nanostructures — Superhydrophobic characteristics and durability assessment	2023
ISO/TS 10689	Nanotechnologies — Superhydrophobic surfaces and coatings: Characteristics and performance assessment	2023

10 Leading Countries in National Nanotechnology Standards (Cumulative-2023))



10 Leading Countries in International Nanotechnology Standards (Cumulative (2023))



Strategy 7: Enhancing International Cooperations

Interaction among International Organizations

Significant collaborations have been carried out among various international organizations to promote advancements in nanotechnology safety, standardization, and innovation.

International partnerships aim to address global challenges and foster cooperation across regions.

INN[1]

- Signing MOU between INIC and INN to develop human resources and improve nanotechnology management in Islamic nations
- Establishing digital infrastructure, including websites and social media, to enhance information exchange among member countries

ECO[2]

- Hosting two steering committee meetings, both in-person and virtual
- Establishing a website to enhance networking and information exchange
- Conducting the project titled "Prefeasibility Study of Application of Nanotechnology in Arsenic Removal" in ECO Countries

INO[3]

- Creating a global network of students and startup teams to solve world challenges
- Hosting 1st INO

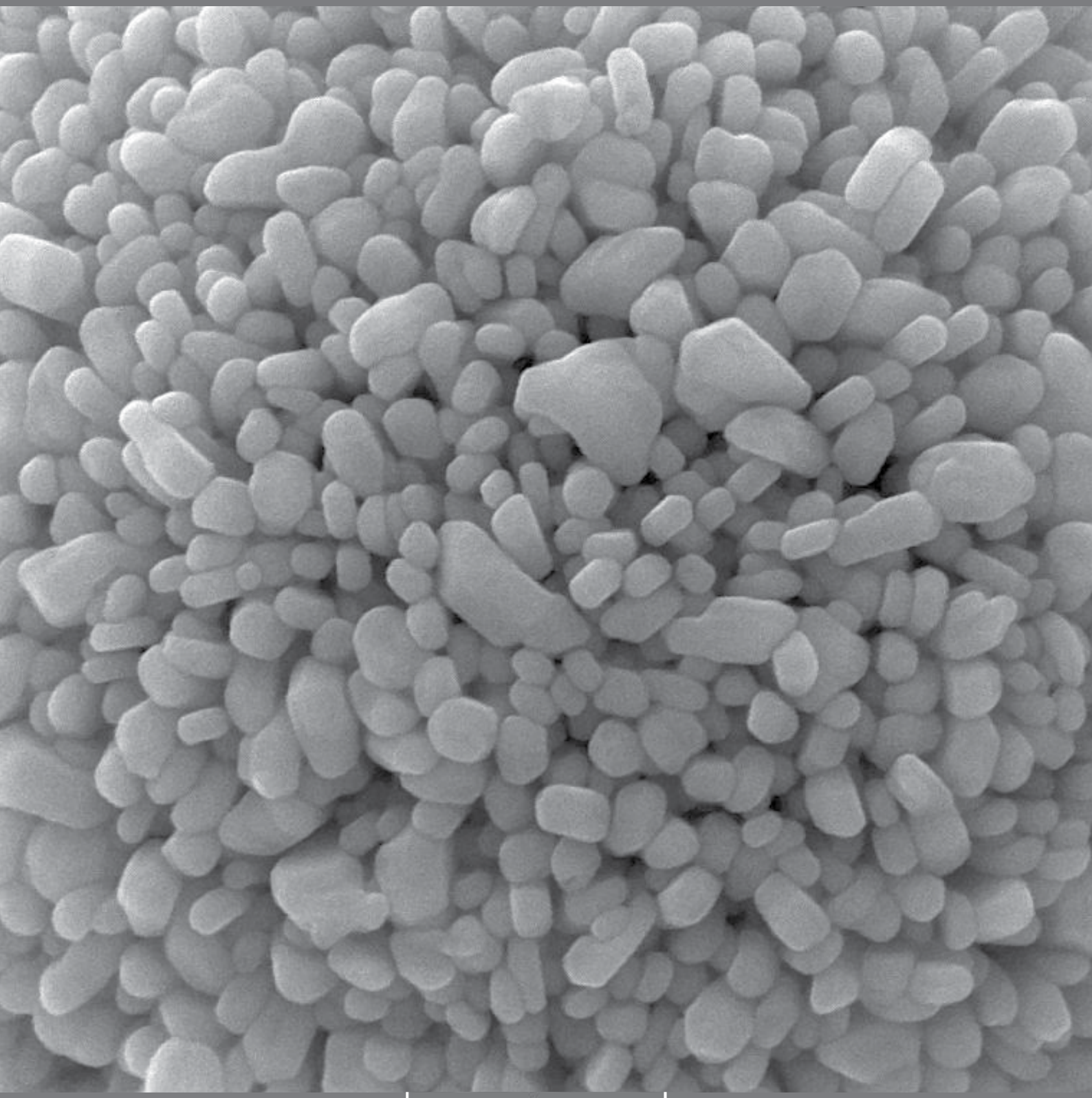
BRICS-NCMSN[4]

- Presenting proposals for enhancing collaboration in nanotechnology standardization and nanotechnology laboratory network (at the sixth BRICS working group meeting)

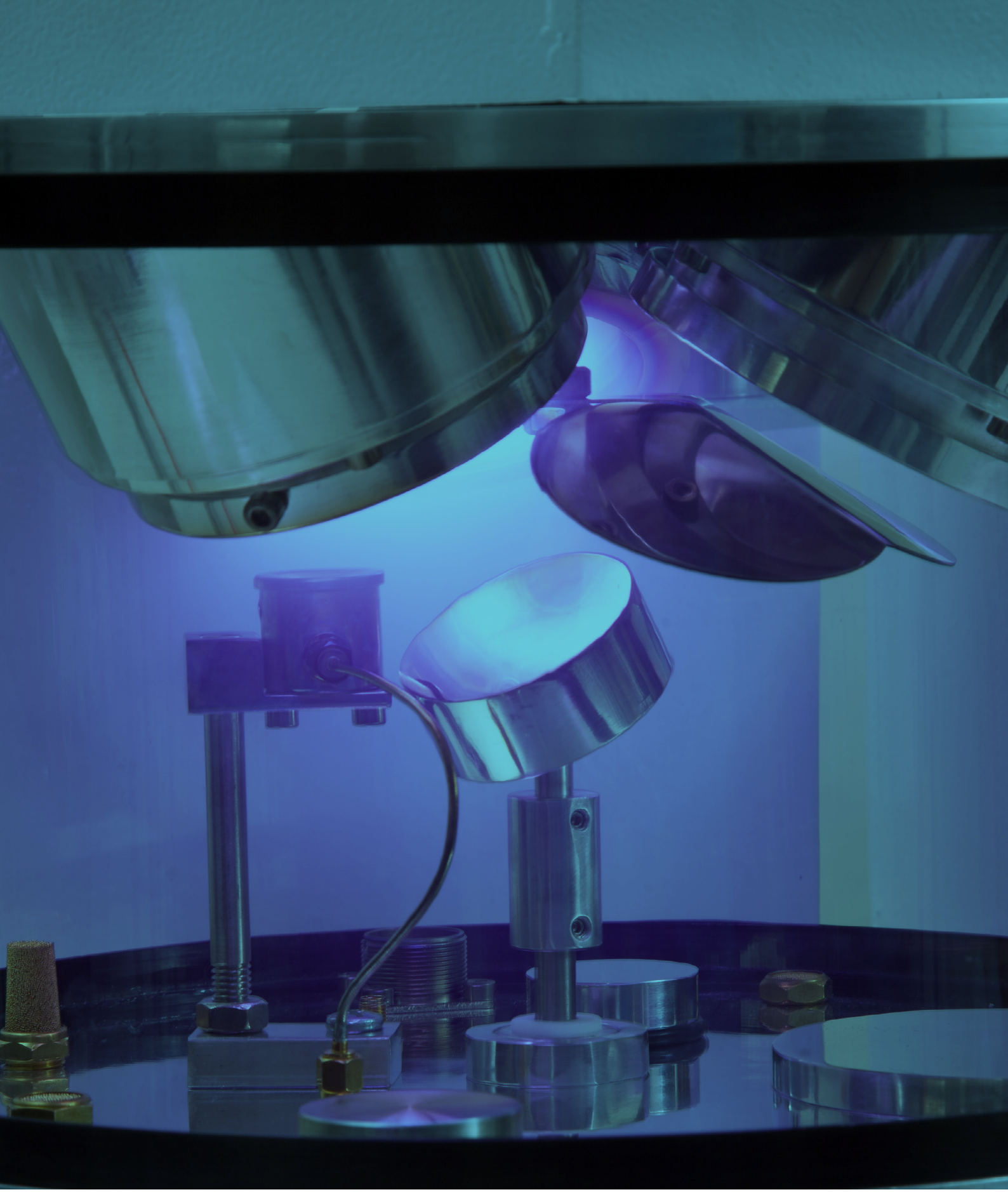
EU-Asia Dialogue on Nanosafety

- Hosting the first Dialogue event to present countries' plans for nano-standardization and safety, and the evaluation and certification method of nanoproducts
- Presenting a proposal to create a cooperation nanosafety platform in the fourth Dialogue event
- Developing the conceptual design of nano safety standards and infrastructure sharing along the formation of INISS
- Taking the responsibility for the standard pillar
- Holding a workshop on the international needs and challenges of nanotechnology standardization and safety

1- Inter-Islamic Network on Nanotechnology
2- Economic Cooperation Organization
3- International Nano Olympiad
4- The BRICS Network Centre for Materials Science and Nanotechnology



Field Emission Scanning Electron Microscopy Image of Nano Silver Powder Taken by Iranian Equipment



Iranian Desk Scanning Electron Microscopy Coater

Iranian Electrospinning Machine

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