Executive report of the

1st International Nanotechnology Olympiad

April 20-25, 2018

The International Nanotechnology Olympiad Permanent Secretariat (INOPS)

Iran Nano and Micro Technologies Innovation Council (INIC)

Saman Sadra Dana Sharif Company (Danasharif)

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1. Introduction

This report outlines the journey of organizing the first International Nano Olympiad, starting from the initial concept to its execution. Initially, the history of international collaborations during the Olympiad is reviewed. The sponsors and the schedule of the inaugural Olympiad are then highlighted. Following that, the training and mentorship provided during the Olympiad are detailed. The report continues with an examination of the submitted plans and the standard judging procedures used in the Olympiad. Subsequently, the report provides an in-depth description of the event's logistics and concludes with information about the staff and the financial framework governing the Olympiad. Attached are notes and experiences from both the successful and challenging aspects of the first Olympiad's implementation. It is hoped that this report will serve as a valuable resource for the Executive Secretariat of future Olympiads in host countries.

2. The History of the International Nano Olympiad

The concept of the International Nano Olympiad was first introduced approximately four years ago in the spring of 2014 by experts from Iran's Nanotechnology Innovation Council (INIC). It was then proposed at the management levels of INIC in the fall of 2014. Following thorough investigations and feasibility studies by the relevant managers, the plan received initial approval in the spring of 2015. Subsequently, preliminary studies were conducted over about six months, examining the structure of other established Olympiads worldwide. The initial proposal for hosting the Olympiad was presented in the fall of 2015 and was well-received by the INIC Promotion Working Group. This proposal, alongside other studies, underwent review and revision for approximately six months. Eventually, with coordination from the INIC International Working Group, it was presented at the first meeting of the International Nano Olympiad on May 17, 2016, in Tehran, Iran. Notably, prior to this event, an online meeting was held with stakeholders from Malaysia, Singapore, Thailand, and Taiwan, where the Olympiad idea was introduced. During the first in-person meeting, the initial regulations and goals of the Olympiad were unveiled. The following countries and organizations were represented at this meeting:

- Iran
- Taiwan
- Thailand
- Russia
- Malaysia
- South Korea
- ANF

The final decisions in this meeting were as follows:

1. Sustainability and innovation will be key components of the Olympiad.
2. During the meeting, it was resolved to establish the steering committee by the end of June 2016.
3. The steering committee is tasked with finalizing the bylaws and organizing the Olympiad process at the ANF meeting in July 2016.
4. The matters of funding and identifying potential partners and sponsors were discussed.
5. Iran committed to hosting the first Olympiad in late November 2017.

Figure 1- A picture of the first in-person meeting of the International Nano Olympiad

Following further studies and incorporating feedback from the participants of the first meeting, the second face-to-face meeting took place on the sidelines of the ANF meeting during a working breakfast on July 15, 2016, in South Korea. This meeting included representatives from Taiwan, Thailand, Malaysia, Singapore, Russia, and Iran. Discussions covered topics such as the origins and governance structure of the Olympiad, its characteristics and goals, financial challenges, and coordination among participating countries and teams, leading to several agreements. During this meeting, previous regulations of the Olympiad were reviewed and critiqued. Some of the key points and decisions made are as follows:

1. The Olympiad should be organized with the assistance of the ANF.
2. The initial concept of holding the Olympiad is considered highly positive and beneficial.
3. A new governance structure should be established, independent of previous frameworks.
4. The Olympiad should diverge from the current school-student-based model.
5. The current members will constitute the core of the steering committee.

Figure 2 - The second in-person meeting of the Olympiad during the ANF meeting

Additionally, the third in-person meeting of the International Nano Olympiad took place at the Nano Festival 2016, attended by representatives from Iran, Taiwan, and South Korea. During this meeting, participants discussed various topics, including the objectives and outcomes of the Olympiad, the organization of the event, the awards, strategies for attracting participants and countries, and more. The final decisions made in the meeting are as follows:

- Prepare and send the initial draft of the Olympiad Bylaws according to the proposed ideas within two weeks, and gather feedback from other countries (sent to all ANF members).
- Conduct web meetings every month or every two months.
- Hold the fourth face-to-face meeting at the Japan Nanotech event to finalize the bylaws, with at least two web meetings before this meeting.

- Determine the timeline and organizational structure of the Olympiad in the bylaws.
- Conduct the fifth face-to-face meeting in Malaysia at the ANF meeting.
- Finalize the date of the Olympiad based on the calendars of the participating countries.
- Provide a report on the activities carried out on the Olympiad website and its content.
- Announce the International Nano Olympiad.

Finalize the name of the Olympiad from the proposed options: International Nano Competition, International Nano Olympiad, or International Nano Challenges. Following this, according to the schedule, the fourth face-to-face meeting of the Olympiad was held on the sidelines of the ANF meeting at Japan Nanotech on February 15, 2017. During this meeting, an initial multilateral agreement (MoU) was signed to hold the first International Nano Olympiad. This memorandum was signed by representatives from INIC of Iran, Rusnano of Russia, Moscow State University of Russia, Academia Sinica of Taiwan, and Kontras of South Korea. Attached to this memorandum was a general regulation that outlined the overall framework for organizing the Olympiad. This memorandum included the following six clauses:

- **The first clause:** Formation of the steering committee of the International Nano Olympiad from among the representatives of the partners mentioned in the memorandum.
- **The second clause:** Establish an annual executive committee that rotates among the countries hosting the Olympiad.
- **The third clause:** To foster long-term cooperation in the Olympiad project and to promote, manage knowledge, and facilitate necessary communication, INIC accepted the responsibility of managing and supporting the permanent secretariat of the Olympiad.
- **The fourth clause:** The International Nano Olympiad is organized annually by interested partners. The organizing institution must adhere to the regulations and ensure equal cooperation with other partners.
- **The fifth clause:** The bylaws attached to this memorandum are acknowledged as the general framework of the Olympiad.
- **The sixth clause:** All partners will participate in the first International Nano Olympiad in November 2017 in Tehran for 7 to 10 days. The executive details of this event will be governed by supplementary regulations and finalized by the steering committee.

Figure 3- The signing of the memorandum in the fourth in-person meeting of the International Nano Olympiad

After the signing of the memorandum of understanding, promotion of the Olympiad commenced, and the official website was launched. The fifth in-person meeting of the Olympiad was held on May 9-10, 2017, in Tehran, attended by representatives from Taiwan, Russia, and Iran. During this meeting, the theme of the first International Nano Olympiad was established, focusing on the applications of nanotechnology in the field of water and wastewater. Additionally, the process of organizing and judging the first Olympiad was discussed, and preliminary decisions were made.

Following the fifth meeting, the secretariat of the first Olympiad began its operations, initiating formal correspondence with the members of the steering committee.

Figure 4- The fifth in-person meeting of the International Nano Olympiad

The sixth and final meeting was held during the ANF meeting on August 20 in Malaysia. In this meeting, the activities of the Olympiad secretariat were reviewed for the steering committee, and an overview of the Olympiad was presented to those unfamiliar with the event. As a result of this presentation, the European Union and Malaysia joined as participants in the first Olympiad.

Figure 5- The sixth in-person meeting of the International Nano Olympiad on the sidelines of the ANF meeting in Malaysia

It is worth mentioning that during the International Nano Olympiad in the spring of 2018, two steering committee meetings were held to discuss the future direction of the Olympiad. Based on the initial decisions, the Olympiad will be held every two years. Additionally, Russia, South Korea, and Taiwan have expressed their readiness to host the next round.

Figure 6- Olympiad steering committee meeting during the first INO

Initially, before the international meetings, the Olympiad was intended to be conducted in a purely scientific manner, similar to other student Olympiads worldwide. However, after the formation of the core steering committee, which included representatives from Iran, South Korea, Taiwan, and Russia, the format of the Olympiad underwent a significant transformation. It evolved from a purely scientific competition to a startup challenge aimed at addressing environmental and global issues. The goals of this Olympiad, in addition to encouraging young nanotechnology students to become entrepreneurs and supporting nano startup teams, include creating a network of experts, entrepreneurs, researchers, and investors in the field of nanotechnology. This network facilitates not only the sharing of knowledge but also fosters entrepreneurial collaborations at an international level. It leverages the capabilities of various countries in the field of nanotechnology to tackle global environmental problems. Coordination and interaction with international institutions and stakeholders have resulted in an event with a completely innovative format, aligning with the aspirations of the participating countries and ensuring the continuity of the Olympiad.

3. Introduction of the First international Nano Olympiad

The first International Nano Olympiad was held competitively over five days in the spring of 2018 in Tehran. In this event, nine teams from various countries participated, including two teams from Iran, and one team each from Taiwan, Malaysia, South Korea, and Russia, as well as three teams from the European Union. The competition took place from April 10th to 15th. During the event, efforts were made to familiarize participating teams with key topics related to entrepreneurship in the field of nanotechnology. Various educational workshops were organized, covering areas such as safety, environmental considerations, patents, business models, and creativity. Each team presented their technical and business ideas to the judges. Ultimately, three teams were recognized in the categories of science and technology, innovation, and business, with one team selected as the overall winner across these domains. The winning teams received prizes of €2000 and €3000, respectively.

3.1. Schedule of Event Days

The schedule for the 5-day INO is presented below. It is worth noting that all the events mentioned in this timetable were conducted with minimal delays.

Day/Time	The day before the event	1st day	2nd day	3rd day	4th day	5th day	6th day
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	9 April	10 April	11 April	12 April	13 April	14 April	15 April
7:00-9:00	Transfer to hotel	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
9:00-10:30		Admission (until 9:30)	Creativity Blossoming Workshop	Steering committee meeting	Product commercialization training workshop	Presentation Day - Business and Innovation Session	Closing Ceremony and prize giving (from 10:00)
		Opening Ceremony		Business model workshop			
10:30-10:50		Resting	Resting	Resting	Resting	Resting	
10:50-12:00		Olympiad briefing session	Environmental Aspects of Nanotechnology Workshop	Presentation to investors' workshop	Product commercialization training workshop part 2	Presentation Day - Business and Innovation Session	
12:00-13:30		Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
13:30-14:45		Standard, regulatory, and safety training workshop	Team competition on air pollution	Tehran sightseeing tour and dinner at INIC	IP and Patent Workshop	Presentation Day - Business and Innovation Session	Departure and return to the country
14:45-15:45		Steering committee meeting / Visiting the Pardis Park	Resting		Presentation Day - Science and Technology session	Arbitration meeting	
15:45-17:40		Judging Session / Teamwork	Team competition on air pollution			Tehran sightseeing tour and dinner	
17:40-19		Dinner and networking (starting at 18:30)	Teamwork				
19-20	Dinner		Dinner		Dinner		
20-21	Networking and familiarization of participants	Teamwork	Teamwork		Teamwork		

3.2. Participating Countries

In the first International Nano Olympiad, teams from the following countries participated: Iran, South Korea, Malaysia, Taiwan, Russia, and the European Union. The European Union teams consisted of members from England, Germany, and Italy.

Due to their hosting privilege, Iran introduced two teams, while the European Union, given its vast scope, put forward three teams to the Olympiad secretariat. The Iranian teams were selected from among the top competitive teams within Iran, known as “Nanostartup.” Additionally, Moscow State University, in collaboration with the RUSNANO Corporation, nominated one team to represent Russia in the Olympiad.

3.3. Supporters and Founders

The initial members of the steering committee are recognized as the founders of the International Nano Olympiad. These founding members include the Iran Nanotechnology Innovation Council (INIC) from Iran, Rusnano and Moscow State University from Russia, the European Union representing European countries, the Korea Nanotechnology Research Society representing South Korea, and Academia Sinica representing Taiwan. The Asia Nano Forum (ANF) is acknowledged as the sponsor of the first INO.

4. Training and Mentoring

In this Olympiad, participating teams received both online training (prior to the start of the Olympiad) and in-person training (during the event). Additionally, each team selected one or two mentors from their country who participated in the Olympiad alongside them.

4.1. In-person Training

In-person training focused on workshops that required physical attendance. For instance, a presentation workshop for investors necessitated face-to-face interaction. Moreover, with the participation of prominent nanoscience experts in the Olympiad as members of the steering committee or judges, several technical and scientific workshops were organized and presented. The in-person training took place over four days during the Olympiad, and the topics of these workshops are detailed below.

4.1.1. Introduction of the workshop, topics, and content

Standard, Regulatory, and Safety Workshop in Nanotechnology: This workshop, conducted by Dr. Beytollahi and Dr. Hazhe, aimed to increase participants' awareness of safety protocols, regulatory requirements, and existing standards in nanotechnology. The duration of this workshop was 75 minutes.

Creativity Blossoming Workshop: Led by Dr. Shin, this 90-minute workshop focused on methods for fostering creativity and innovation. While theoretical knowledge can be acquired through academic study and research, creativity and innovation involve additional approaches, such as adequate rest and thinking outside the box. During the workshop, discussions centered around these techniques, aiming to transform knowledge into alternative ideas.

Figure 7- Dr. Shin's presentation at the Creativity Blossoming Workshop

Environmental Aspects of Nanotechnology Workshop: This 75-minute workshop was conducted by Dr. Gutleb and Dr. Hazhe. During this session, participants explored the applications of nanotechnology in environmental contexts and discussed the environmental implications of technological development. The primary goal was to enhance the awareness of participating teams regarding the environmental effects of nanotechnology.

Figure 8- Dr. Gottlieb's presentation in the workshop on environmental aspects of nanotechnology

Mix Team Challenge Workshop: The goal of this 4-hour workshop was to foster better acquaintance among all team members and execute a group project centered on designing a startup idea. During the workshop, the 9 participating teams were divided into 4 teams of 8 members each. Each team initially selected a technological idea aimed at solving an environmental problem related to air pollution using nanotechnology. They then researched the feasibility of their ideas by exploring relevant articles. Finally, each team presented their proposed solutions in a 5-minute presentation to both the judges and fellow participants. The winner of this workshop was determined by the collective votes of all participants and judges. Members of the winning team were awarded an Iranian handwoven cloth called Termeh with Arabesque (Islimi) motifs as a souvenir.

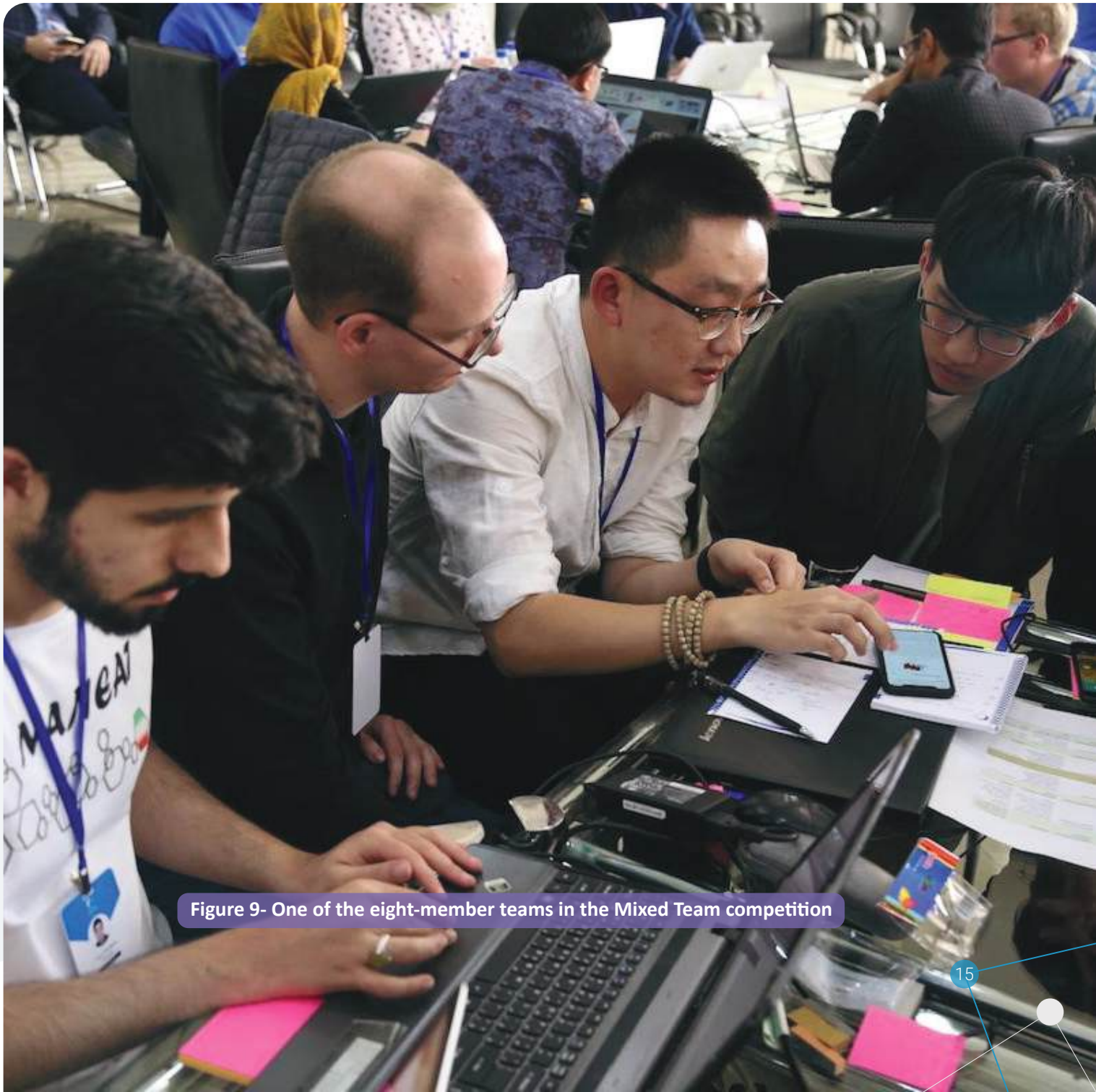


Figure 9- One of the eight-member teams in the Mixed Team competition

Business and Presentation to Investors Workshop: This workshop was conducted in two sessions, each lasting 120 minutes and 85 minutes, over two days. The primary goal was to provide the teams with an initial understanding of business-related topics, especially during the idea selection phase for a startup. The workshop focused on two main topics: how to choose the right idea for a startup and the proper method of presenting the idea to investors. Mr. Yazdifard led this workshop.

Figure 10- Business and presentation to investors workshop

Discussion Panel on Commercialization: The purpose of this three-hour workshop was to familiarize participating teams with the experiences of two successful companies: Parsa Polymer Sharif and Fanavaran Nano-meghyas. Managed by Mr. Marjowi, Mr. Yazdifard, and Mr. Spanov, the panel presented the commercialization experiences of these two companies and facilitated discussions about the important and key decisions made by their founders at critical times. Additionally, participating teams engaged in a case study, where they answered questions about what choices they would make if they were in the place of the entrepreneurs on the panel.

Figure 11- An image from the discussion panel

IP and Patent Workshop: This 75-minute workshop, presented by Dr. Shiva, aimed to familiarize the teams with topics related to intellectual property and the preservation of technological achievements of startups.

4.1.2. Survey and feedback

At the conclusion of the Olympiad, feedback was gathered from participants regarding the educational quality of the workshops. Below is the statistical analysis of their comments.

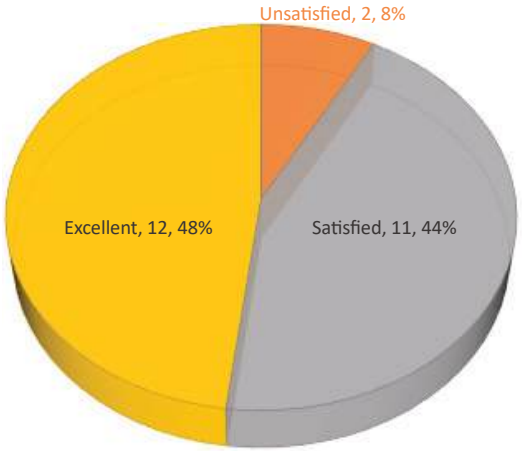


Figure 12- The graph related to the survey of the standard workshop

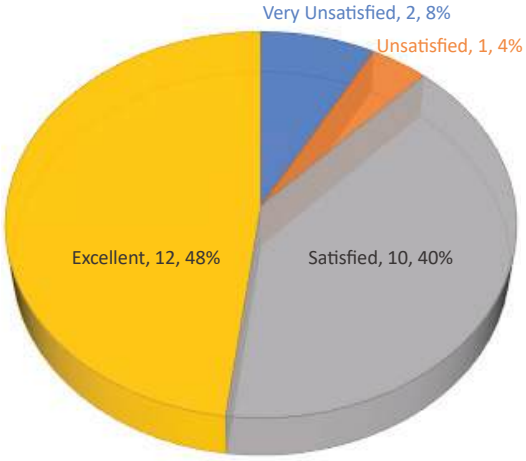


Figure 13- The graph related to the survey of creativity blossoming workshop

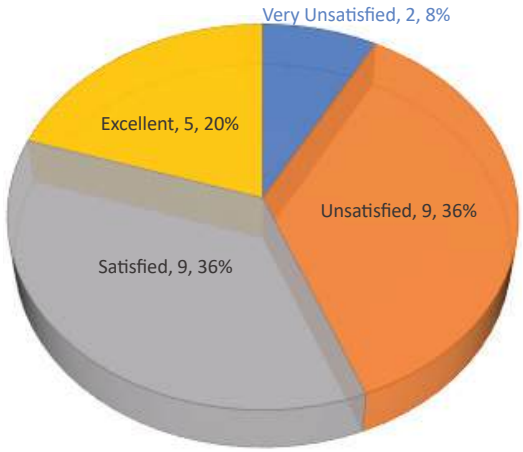


Figure 14- The graph related to the Environmental Aspects of the Nanotechnology Workshop

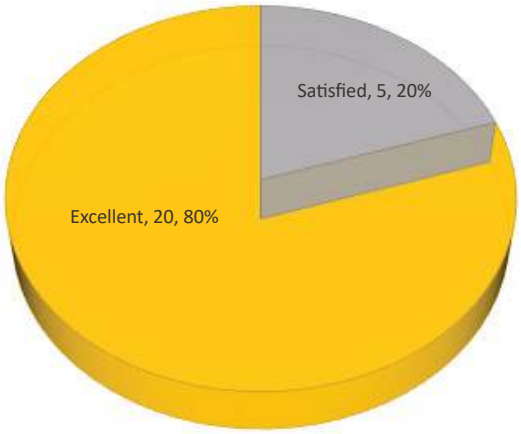


Figure 15- The graph related to the Mix Team Challenge Workshop

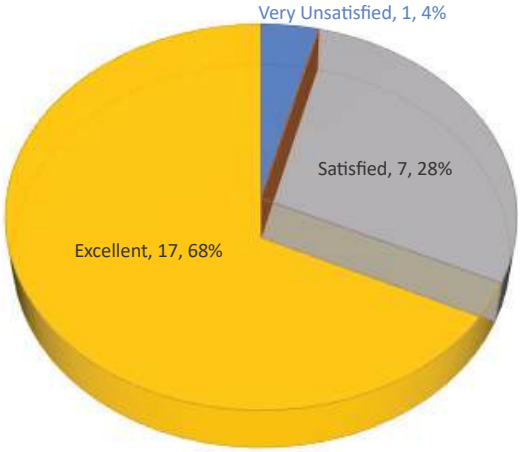


Figure 16- The graph related to Business and presentation to investors workshop

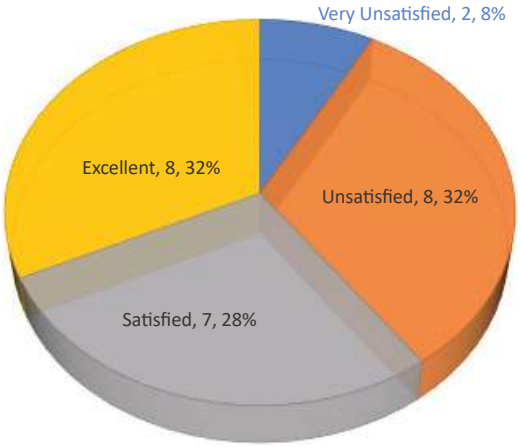


Figure 17- The graph related to the Discussion Panel on Commercialization

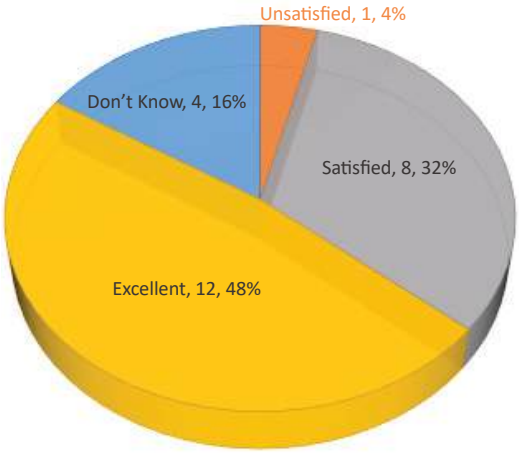


Figure 18- The graph related to IP and Patent Workshop

According to the survey results, the Mix Team Challenge, Business and Presentation to Investors, and Patent workshops were ranked as the top three workshops by the participants. Interestingly, the Environmental Aspects of Nanotechnology workshop received the lowest score. On average, the educational workshops were rated 74 out of 100 by the participants.

4.2. Online training

Olympiad online training was conducted three months before the event to familiarize teams with topics related to entrepreneurship, nanotechnology, intellectual property, and presentations to investors.

The online training content was designed in the following format:

- **How to build a startup (entrepreneurship)**
  - Market research to select ideas
  - Business model
  - Business plan
  - Team building
  - Market entry strategies
  - Human resource management for startups
  - Financial management for startups
  - Marketing for startups
  - Growth strategies for startups
  - Principles of negotiation

- Fundamentals of Fundraising for startups

❖ **Commercialization and Intellectual Property**

- Creativity and innovation
- Different steps in the path of idea to commercial product
- An introduction to intellectual property and its significance
- Intellectual property laws
- Copy right
- Patent
- Trademark
- Industrial Design
- Prototype

❖ **Principles of presentation to investors**

- How to prepare for the presentation day?
- Providing an elevator pitch

❖ **Nanotechnology applications**

- Introduction to Nanotechnology
- Nanostructures: Synthesis, Characterization and Applications
- Environmental aspects of nanotechnology
- Applications of nanotechnology in the discussion of water and water purification
- Challenges facing nanotechnology applications in water and water treatment

4.3. Mentoring

In the first INO, each team was responsible for selecting one or two mentors, who then continued to work closely with the team. These mentors oversaw the teams' progress for several months leading up to the Olympiad, assisting them in preparing their project reports. During the Olympiad, the mentors actively participated in various sessions, providing valuable insights to the decision-making teams. Their guidance helped teams refine their project ideas and improve their presentations.

5. The projects of the teams in the International Nano Olympiad

During the first INO, 9 teams participated and presented their projects on the designated presentation day. Of these projects, all except the South Korean team's project were focused on addressing water and environmental issues.

5.1. European Union First Team

This team consisted of four members, three of whom participated in the Nano Olympiad. The participants included Mrs. Maria Theresia Heilmann, an MSc student in Chemistry at The Federal Institute for Materials Research and Testing; Mr. Tony Bewersdorff, a biology diploma holder from The Federal Institute for Risk Assessment; and Mr. Zengchao You, an MSc student at the Institute for Materials Research and Testing.

The title of this team's project is "**Clean Water is a fundamental right, not a Privilege**".

The project of this team aimed to address the challenge of providing clean water in developing countries. According to the team's explanation, clean water is not readily available in all regions, and the transfer of water to households, as commonly practiced in developed countries, is not feasible. In underdeveloped nations, people often have to travel long distances to access clean water or use water that may contain hazardous pollutants. The team designed a portable and compact filter using nanotechnology. The main focus of the project was to overcome the limitations of existing filters, enabling the removal of pollutants that are not effectively filtered by current technologies. This nanotechnology-based filter was designed to ensure that a broader range of contaminants could be separated from the water, providing safer drinking water.

Figure 19- A picture of the members of the European first team

5.2. European Union Second Team

This team consisted of four members who all participated in the Olympiad. The team members were Ms. Ana Carrazco Quevedo, a Ph.D. student in Environmental Health Risk Management at the University of Birmingham; Mr. Andrea Costa Devoti, a Ph.D. student in Environmental Sciences at Ca' Foscari University of Venice; Mr. Alessandro Bonetto, a Ph.D. student in Environmental Sciences at Ca' Foscari University of Venice; and Ms. Alice Tagliati, a Ph.D. student in Environmental Sciences at Heriot-Watt University.

The title of this team's project was "**NanoMagnetic Solution: New Chances for Wastewater Treatment**".

According to the team's project, the use of nanomaterials for separating pollutants from industrial wastewater has been extensively studied in recent years, but their industrial application has not yet been widely implemented. The innovation in this project lies in combining the adsorption properties of magnetic nanomaterials with the microalgae cultivation process for separating organic pollutants. The adsorption technique proves more effective than other methods for removing organic pollutants.

Recent research suggests the use of magnetically functionalized nanocomposites for the adsorption and separation of organic contaminants from wastewater. By utilizing this framework, magnetically functionalized nanomaterials coated with a very thin layer of silica can significantly enhance the separation of organic pollutants from wastewater. This innovative approach combines the adsorption properties of magnetic nanomaterials with the microalgae cultivation process for the efficient removal of contaminants. The adsorption technique, based on these stable magnetic nanoparticles, ensures both effective separation and straightforward magnetic recovery. The high specific surface area of mesoporous silica, along with the Fe3O4 magnetic core, guarantees successful recovery without altering the remaining separation power of the nanosystem.

The applications of this project span from wastewater treatment plants to groundwater purification and can even be integrated with conventional water treatment processes. For instance, a wastewater treatment system can be upgraded with this design by adding a biological technique. This project employs a zero-waste design to improve the process, based on the use of magnetically functionalized nanomaterials in a microalgae reactor. The methanol used for the regeneration of the nano-absorbent is recycled at the end of the process.

Figure 20- A picture of the members of the European second team

5.3. European Union Third Team

This team consisted of four members who all participated in the Nano Olympiad. The team members were Mr. Yves Uwe Hachenberger, a Ph.D. student in Biopharmaceutical Sciences at the Freie University of Berlin; Ms. Anne Bannuscher, a Ph.D. student in Chemistry at the Technical University of Berlin; Mr. Lars Leibrock, a Ph.D. student in Biopharmaceutical Sciences

at the Freie University of Berlin; and Mr. Fabian Kriegel, a Ph.D. student in Biopharmaceutical Sciences at the Freie University of Berlin.

The title of this team's project was "**Splashy: Point of Care Water Quality Test**".

The project aimed to develop a tool for testing the level of pollutants in water. The detection of microbial, bacterial, and viral contaminants with this device could bring about a significant transformation in developing countries, reducing the risk of using potentially unsafe water. The main cartridge of the device is made using 3D printing technology, which is cost-effective and provides high flexibility for researchers. This cartridge protects the cellulose layer of the device, which retains the water sample and contains colored nanomaterials used for detecting contamination.

The device employs various antibodies to detect contaminants, allowing for the simultaneous identification of multiple bacteria and contaminants. The use of colored nanoparticles makes it possible to detect contamination with the naked eye. With further development, a mobile application can be designed to more accurately and reliably detect the colors produced. This application could also report the quality of the water to the user, suggest solutions for improving water quality, or even identify the nearest place to obtain clean and healthy water.

The team's approach was to design a quick, easy, and inexpensive test. The biosensors used in this project are versatile and can be applied in various locations for different purposes.

Figure 21- A picture of the members of the European third team

5.4. Taiwan Team

This team consisted of four members who all participated in the Nano Olympiad: Mr. Hung-Yuan Tsai, a Ph.D. student in Chemical Engineering at the National Taiwan University; Mr. Hsiang-Chun Cheng, a master's student in Environmental Engineering at the National Cheng Kung University; Mr. Chien-Chung Lo, an undergraduate student in Environmental Engineering at the National Cheng Kung University; and Mr. Kelvin Hadinatan, a master's student in Chemical Engineering at the National Taiwan University.

The title of this team's project was "**Omniphobic Inorganic Porous Membranes: Fabrication, Characterization, and Application**".

According to this team's project, global warming and the shortage of water resources are two pervasive challenges facing humanity today. Various companies have addressed the problem of water purification by producing membranes. However, these membranes still remove water pollutants in a limited and minimal way.

Artificial surfaces that repel both water and oil have simultaneously attracted the attention of scientists. Inspiration from nature, especially the blue water lily leaf, has led to the invention of water-repellent surfaces. The superhydrophobicity of surfaces is determined based on two key parameters: surface energy and roughness. However, liquids with low surface tension, such as alkanes and alcohols, spread quickly on hydrophobic surfaces, limiting their practical use. To solve this challenge, various methods have been developed to make surfaces both hydrophobic and oleophobic. Despite extensive studies on oleophobic surfaces, oleophobic porous membranes have not yet been sufficiently developed. Therefore, this project focused on producing oleophobic porous membranes. To prepare high-strength oleophobic membranes, ceramic membranes were chosen as suitable options. These membranes could also be used for the treatment of industrial wastewater.

Figure 22- A picture of the members of the Taiwan Team

5.5. South Korean Team

This team consisted of 3 members, of which one person participated in the Nano Olympiad. Mr. Gichang Noh, an undergraduate student in Physics at Ajou University, was present in this round of competitions.

The title of this team's project is "**The realization possibility of 'Valley Qubit' in single-layer MoS2**".

According to this team's project, today information is transferred with codes 0 and 1, but in the near future, we will need a large volume of information and its processing. Degrees of Freedom (DoFs) as quantum qubits that can store information have attracted attention. In this project, the features of valley DoFs on a single-layer MoS2 will be controlled and it will be proven that the dream of Valley Qubit is achievable.

Figure 23- A picture of the member of the South Korea Team

5.6. Malaysian Team

This team consisted of 4 members, all of whom participated in the Nano Olympiad. Mr. Kah Chun Ho, a PhD student in Process Engineering and Chemistry from the National University of Malaysia, Ms. Rabi'atul 'Adawiyah Zayadi, a PhD student in Sciences from the University Tun Hussein Onn Malaysia, Mr. Oshua Soo Zheyan, a Master's student in Catalyst from the University of Malaya, and Mr. Muhammad Sollehin Idris, an undergraduate student in Applied Chemistry from the University of Malaya, were present in this round of competitions.

The title of this team's project is "**PFTF Membrane for Cr (VI) Removal (Nano- Palm Frond Titania Fiber (PFTF) Membrane for Cr(VI) Removal)** ".

According to the team's project, water pollution with heavy metals such as chromium, cadmium, arsenic, mercury, and lead is among the most significant environmental challenges facing humanity today. Hexavalent chromium, in particular, is one of the most dangerous pollutants introduced into water sources by various industries such as textiles and leather. Removing this pollutant from water sources is crucial, and this project aims to eliminate hexavalent chromium from the industrial wastewater of factories using nanotechnology.

Absorption by electro-spun fibers is recognized as an effective method for removing hexavalent chromium, but it generally works well for wastewaters with low concentrations of heavy metals. Another method gaining attention in research is the use of nanomaterials and the photocatalyst process. Given the high surface-to-volume ratio of nanomaterials and their resistance to corrosion, this method is suitable for chromium removal.

In this project, PFTF nanofibers are produced using the electrospinning method and are used as a membrane for removing hexavalent chromium. The polymer is produced from nanocellulose extracted from palm oil. To extract nanocellulose from palm oil, a combination of physical and chemical methods with low concentration is used. Since using the membrane alone may not be sufficient for chromium removal, titanium dioxide is also employed. Nitrogen-doped titanium dioxide, due to its appropriate reaction with visible light, is incorporated into the nanocellulose fibers.

Nanocellulose, nitrogen-doped titanium dioxide, and the PFTF nano-membrane are characterized and analyzed using XRD, BET, FTIR, and FESEM methods. The efficiency of hexavalent chromium removal by the membrane is measured in a batch setup with photodegradation.

The photodegradation of hexavalent chromium with the help of the PFTF nano-membrane in the presence of visible light appears feasible. Nitrogen-doped titanium dioxide helps convert hexavalent chromium to trivalent chromium, which has lower toxicity and is easily separable from water. Using nanocellulose to immobilize nitrogen-doped titanium dioxide can simplify the photocatalyst recovery process. Additionally, the use of nanocellulose reduces the amount of waste produced.

Figure 24- A picture of the members of the Malaysian Team

5.7. Russian Team

This team consisted of 4 members, all of whom participated in the Nano Olympiad. Mr. Sadykov Aleksei, a specialist in Fundamental and Applied Chemistry from the Moscow State University, Ms. Belova Elizaveta, a Ph.D. student in Chemistry from the University of Saint Petersburg, Mr. Sanin Aleksei, an undergraduate student in Materials Engineering from the Moscow State University, and Mr. Boiko Daniil, a Chemistry specialist from the Moscow State University, were present in this round of competitions.

The title of this team's project is "**Complex high-tech solution for snow water resources purification**".

According to the team's project, water purification is one of the most significant challenges facing humanity. Although different solutions have been proposed by humans for water purification, this problem remains one of the biggest global and environmental challenges. In this project, a solution is proposed for this challenge, which is a combination of a water purification method based on solar cell technology. This plan is usable for the pharmaceutical and medical industries. In this project, solar cells are used to absorb solar energy and store it in batteries. The stored energy will be used for the electrolysis of water and the production of hydrogen and oxygen. The produced oxygen is converted into ozone. The produced ozone is ultimately used for water purification and the elimination of bacterial pollutants. Also, the produced hydrogen can be sold for green uses.

Figure 25- A picture of the members of the Russian Team

5.8. Iranian First Team

This team consisted of three members, all of whom participated in the Nano Olympiad: Mr. Hooman Bakhshi, a Ph.D. student in Nanotechnology from the Iran University of Science and Technology; Mr. Pouria Paridash, a Master's student in Materials Engineering from Ferdowsi University of Mashhad; and Mr. Mehdi Ghasemi, a Master's student in Chemical Engineering from Ferdowsi University of Mashhad. The title of this team's project was "**Recycling and Removing Chromium from Tannery Wastewater**."

According to the team's project, the primary users of chromium are the cosmetics and hygiene industries, as well as the steel industry. Several techniques for removing chromium from industrial wastewater have been developed, including low-cost methods such as aeration, chemical oxidation, precipitation, and filtration, and more expensive methods like cationic and anionic exchangers, reverse osmosis, electrodialysis, and adsorption by activated carbon and aluminum. However, due to high costs or low efficiency, many of these methods have not been widely adopted in the industry. Currently, only methods involving precipitation with pH adjustment or burying dried wastewater in protected wells are commonly used.

In this project, a process for recycling chromium from tannery wastewater was designed. The wastewater from these factories contains other pollutants such as fats and wool, which are separated through various stages of filtration. The proposed plan separates chromium from the wastewater in the form of chromium sulfate, which is then returned to the factory cycle. Chromium sulfate is highly valuable for this industry.

The plan involves two reactors filled with absorbent granules to reduce the concentration of chromium in the wastewater. In the next stage, an absorbent material with nanoholes captures tetravalent chromium, and a photocatalytic process converts tetravalent chromium to trivalent chromium. Finally, trivalent chromium is absorbed into the ceramic body of the reactor. The reactor body is then acid-washed, allowing chromium sulfate to be extracted as an output.

Figure 26- A picture of the members of the Iranian first Team

5.9. Iranian Second Team

This team consisted of 4 members, all of whom participated in the Nano Olympiad. Mr. Ehsan Ghanbari, a Ph.D. student in Nanophysics from Kashan University, Mr. Hassan Motaghi, a Ph.D. student in Analytical Chemistry from Isfahan University, Mr. Rouhollah Shakernia, a Ph.D. student in Physics from Kashan University, and Ms. Pegah Rezaei, a Master's student in Nanochemical Engineering from Kashan University, were present in this round of competitions.

The title of this team's project is "**Pocket Lab (Paper-based Microfluidic Sensor)**".

According to the team's plan, due to the severe shortage of water resources worldwide today, the development of methods for controlling water safety and health is of high importance. With the expansion of public awareness and increased access to information resources, more people are aware of the pollutants that industries introduce into water sources, and concerns in this regard have increased. With the penetration of social networks, there is a need to create a sense of trust in people's drinking water so that water sources, that are not sure about their safety and health, can be tested with a reliable and accessible method. Today, there are various methods for analyzing water health such as titration, spectroscopic analysis, atomic absorption, electrochemical methods, chromatography, etc.

There are problems such as high production cost, the need for an energy supply source, and the need for a fluid transfer system in conventional microprocessors that use glass, silicon, and various polymers, but the use of a microfluid on paper eliminates the mentioned problems and limitations. Paper production is cheap and fast and eliminates the need for an energy source like a micropump because the fluid flow is done with the help of capillary force. The proposed plan that uses paper has high accuracy and speed and has a very low production cost. Also, its use is easy and does not require any special expertise.

According to the team's plan, a microfluidic-based sensor is designed in this project to provide information about the concentration of pollutants such as arsenic, iron, nitrate, and pH at a low cost. At this stage, the color of the indicators changes according to the concentration of pollutants. The changes made in these indicators are finally analyzed with an application and the results are announced to the audience. This product can be used without a smartphone and application, and even with the naked eye. In the absence of a mobile phone, the user should use the standard table embedded on the back of the product box. The technologies used in this project include the following:

- Use of microfluidic technology to transfer the sample to the location of the indicator
- Use of nanoparticles to increase sensitivity

- Use of cheap sensors
- Quick analysis
- Easy to use without prior knowledge
- Ability to quantify information with the help of a mobile application or a table on the back of the box
- Symmetrical design for simultaneous analysis of different pollutants in water

Figure 27- A picture of the members of the Iranian second team

6. Judgment of the Projects

The jury of the Olympiad, consisting of representatives from various countries, evaluated the ideas in both in-person and remote sections. Each country (or economy) provided two judges, resulting in a judging committee of 12 experts specializing in water, environment, or business, who assessed the projects based on their expertise. However, due to the presence of only one representative from Korea, the final number of judges was 11.

In the remote part, the teams were requested to send the relevant reports in two stages. The first stage report included the following:

1. Title of the project
2. A description of the targeted challenge
3. Suggested solution
4. Background of the challenge
5. Innovation
6. Environmental and social impact of the solution
7. Target market
8. Action plan for the next three months

The second stage report included items from the previous report and new items. The teams should have explained the similar items more fully. This report included:

1. Executive summary
2. A description of the targeted challenge
3. Technical solution
4. Scientific basis
5. Innovation and impact, added value for the customer, environmental and social impact, patent analysis
6. Technical development report including problem framework, solution design, market and technology readiness level analysis, required technologies analysis, modeling/ prototype building report, laboratory tests, field tests, technical risk assessment studies, environmental and health assessment studies, challenges technical
7. Business report including business model development report, marketing process, customer and market communication channels, competitors, market trends, market entry strategy, initial price determination, recognition and communication with initial

customers, financial analysis including cost and Income/time planning/required capital and financial perspective and human resources

8. Business risks and challenges

In the face-to-face section, the teams were asked to integrate their submitted reports with the knowledge gained from the Olympiad training sessions. They then presented their final plan to the judges in two separate sections: the science and technology section and the commercial section

Figure 28- Judgement sessions of the Jury of the 1st INO

6.1. Criteria and Judging Approach

The judging form template consisted of three sections: innovation, science and technology, and business, and all the judges completed these forms. The final grade was determined by averaging the scores.

The judging process took place in two 3-hour sessions. In the first session, the weight of the different sections was determined, and the judging criteria were finalized with the approval of the members. It was agreed that the weights for innovation, science and technology, and business would be equal, each accounting for 33.3% of the total score. Additionally, the project report accounted for 50% of the points, while the oral presentation made up the other 50%.

Initially, each referee was supposed to evaluate teams from other economies. However, according to a new resolution approved before the judging session, referees recorded points for all teams, including their own. Although there was an intention to normalize the scores by removing the highest values, this was not implemented because the judges scored the teams fairly. However, this approach should be considered in future rounds. Some judges did not award any team more than 10 points, while others did not score any team below 17. To address this inconsistency, scale normalization was applied to the scores, converting all referees' scores to a range from 0 to 20.

Checking and entering the data related to the score criteria was done on a screen to minimize the possibility of mistakes in this process. After the judging process was over until the moment the awards were announced, the judges, as per the law, did not talk to each other and their teams about the results of the judging session.

The score criteria are physically documented so that if a country has an objection up to three months after the competition, its request can be processed. These criteria are scanned and archived after three months. These criteria will never be publicly available to applicants and interested parties because the nature of the arbitration in the following periods is fixed to some extent and should not be disclosed.

Judges subjectively scored each criterion but considered the following factors for scoring in each section.

1. Business Category

1.1 Product/Technology

1.1.1 Competitiveness

- Price
- Quality

1.1.2 Market Size

1.1.3 Potential Market Share for the Proposal

1.2 Process

1.2.1 Business Model

1.2.2 Marketing

- Communication channels with the market
- Identifying initial customers
- Studying competitors
- Analyzing market trends
- Developing marketing strategies
- Setting initial prices based on prior research
- Market risk assessment

1.2.3 Teamwork

- Role Alignment
- Expertise cohesion
- Presentation capabilities
- Presentation file
- Time management
- Addressing questions

1.2.4 Financial Analysis

- Revenue/cost analysis
- Timelines
- Required capital
- Vision

- Human resources

2. Technical Development Category

2.1 Technology/Product

2.1.1 Technical Feasibility

- Time required for market entry compared to the industry norms
- Alignment with scientific principles

2.1.2 Production Feasibility

- Potential for production scale-up
- Access to raw materials
- Access to manufacturing technology

2.1.3 Impact and Role of Nanotechnology in Product Development

2.2 Process

2.2.1 Problem Framing

2.2.2 Design Process

2.2.3 Technical Risk Assessment

2.2.4 Environmental, Safety, and Health Risk Assessment

2.2.5 Technical Readiness Level and Production Readiness Level

2.2.6 Supporting Technologies Evaluation

2.2.7 Modeling/Prototype Construction

2.2.8 Laboratory Testing

2.2.9 Field Testing

3. Innovation and Impact Category

3.1 Innovation

3.1.1 Scientific

3.1.2 Technical

3.1.3 Applied

3.2 Proposed Value for Customers

3.3 Environmental and Health Impacts

3.4 Patent Analysis and Registration

It is worth mentioning that the process of presenting the teams took place during two meetings. In the first meeting, the teams presented their plan with a scientific and technical approach. In the second session, the business approach was considered.

6.2. Arbitration Results

The Taiwanese team won first place in almost all criteria. However, according to the ruling law, each team could receive only one award. If a team won in multiple divisions with different types of awards, they would receive only the most valued award, and the second-place teams in the other divisions would be announced as the winners. Based on this rule, the judging results were as follows:

- The selected team of the innovation department: South Korea
- The selected team of the business section: Iran's first team
- Selected team of Science and Technology: Malaysia
- Final selected team: Taiwan

7. Cultural and Entertainment Program

During the first International Nano Olympiad, Tehran tours were organized to familiarize the participating teams with Iranian culture. Efforts were made to include Iranian products in the prizes and donation packs, emphasizing an Iranian theme. A total of two and a half days were allocated for the cultural tours.

7.1. Explanations About the Relevant Time and Place

The tours in Tehran were organized over two and a half days and included two main parts. The first tour involved a visit to Golestan Palace, with all teams, judges, and mentors participating. Following this, the teams visited the INIC headquarters, where they toured the exhibition of the headquarters' products and had dinner at the INIC.

Figure 29 – Visiting Golestan Palace

Figure 30 - Visiting INIC headquarters and product exhibition

On the second day, after the business demo, the teams visited Tajrish market for shopping while the judging committee met to select the winners. After shopping at Tajrish market, the teams went to Lavasanat and had dinner in one of the pleasant gardens there. Simultaneously, the steering committee and the jury also visited Tajrish market for shopping, and their dinner was held at Aali Qapoo restaurant.

Figure 31 - Dinner of the Steering Committee at Aali Qapu Restaurant

8. Steering committee

Each institution participating in the Olympiad has a representative on the steering committee. These institutions are from Iran, South Korea, Russia, Malaysia, Taiwan, and Europe. The Steering Committee is the highest-ranking decision-making body during the International Nano Olympiad.

8.1. Introducing the steering committee

The members of the steering committee in the 1st INO are introduced below:

Dr. Ali Beitollahi: He is the chief of the INO steering committee, the international senior adviser of INIC, and a full professor and member of the academic staff of the Faculty of Materials Engineering of the Iran University of Science and Technology. He was the first person who proposed the idea of the International Nano Olympiad among countries.

Dr. Eugene Goodilin: He is a member of the steering committee of the International Nano Olympiad on behalf of Moscow State University and a faculty member of this university. He is considered one of the representatives of Russia in relevant interactions and has recently become a member of ANF.

Dr. Iseult Lynch: He is the secretary of the environment and nanotechnology committee of the University of Birmingham, a member of the academic staff of this university, and a member of the steering committee of the International Nano Olympiad on behalf of the European Union. He could not attend the first INO due to family problems.

Andrey Melnikov: He is a senior expert of RUSNANO and a member of the Steering Committee of the International Nano Olympiad on behalf of RusNano.

Kyung-Ho Shin: He is a member of the faculty of the Korea Institute of Science and Technology and the vice president of the Korea Nanotechnology Research Society. He is also a member of the Steering Committee of INO on behalf of the Korean Institute of Science and Technology.

Maw-Kuen Wu: He is the director of Academia Sinica and a member of the steering committee of INO on behalf of Taiwan Academia Sinica.

9. Executive affairs

In this section, all the executive measures taken during the International Nano Olympiad are discussed.

9.1. Reception and Package

On the first day of the Olympiad, reception was held in the lobby of Pardis Park Hotel, and the relevant packages were delivered to the participants. This package was prepared after much consideration. The items inside the package were as follows:

1. a zip folder
2. a pen with “International Nanotechnology Olympiad” written on it
3. a booklet with INO cover and back cover
4. the conference booklet
5. the timetable on laminated paper
6. the social media poster
7. the identification card of each person with the relevant holder
8. a number of blank papers with the INO header
9. an explanatory booklet about INIC

Figure 32 – Package items

Figure 32 – Sample of The ID Card

9.2. Opening Ceremony Description

After the reception of participants at the hotel, the opening ceremony began at 9:00 AM in the Seraj Hall of Pardis Technology Park. The ceremony commenced with the recitation of verses from the Holy Quran. Dr. Tabatabai served as the presenter, starting the program. First, Dr. Beitollahi welcomed all the participating teams and individuals. Following his welcome, each member of the INO steering committee delivered a brief speech about the Olympiad. After a short break, Dr. Marjowi spoke about the structure and rules governing the Olympiad, concluding the opening ceremony with his speech.

Figure 34 – Opening Ceremony

9.3. Description of The Presentation Day

The presentation of designs took place over two different days. On the first day, all teams presented their plans from a technical perspective. Each team had 10 minutes for their presentation and 15 minutes to answer questions from the jury. A large screen was installed to display the time for each team, ensuring that presentations were completed on time without any extensions. To ensure coordination and efficiency, the PowerPoint presentations of all teams were copied and tested on the hall's laptop before the ceremony began. Additionally, a backup laptop was set up next to the main one to be used in case of any technical issues.

On the second day, the presentations focused on the business perspective. Each team again had 10 minutes to present their plan and 15 minutes to answer the jury's questions. The procedure for this day mirrored that of the first day.

Figure 35 – Presentation day ceremony

9.4. The Closing Ceremony

The closing ceremony was held in the Seraj Hall, similar to the opening ceremony. The event began with the recitation of verses from the Holy Quran. Dr. Tabatabai served as the host, and Dr. Beitollahi, along with other members of the steering committee, briefly discussed the overall program. Following the speeches, the winners from each category were announced.

Distinguished team members received medals and certificates of appreciation. Additionally, three cash prizes of €2000 each were awarded to selected teams in the fields of science and technology, innovation, and business. The overall winning team was granted a €3000 cash prize. After their introduction, the outstanding teams stepped onto the stage, received their prizes, and posed for commemorative photos with symbolic checks alongside other committee members.

During the ceremony, a video clip showcasing the Olympiad and a memorial clip featuring photographs taken during the event were presented. After the conclusion of the ceremony, news agencies prepared reports on the participating teams and other individuals.

Figure 36 – Closing ceremony

Figure 37 - Praise of the South Korean team

Figure 38 - Praise of the Taiwan team

Figure 39 - Praise of the Iranian team

Figure 40 - Praise of the Malaysian team

9.5. Spatialization

To create the best atmosphere for the ceremony, a large banner was placed behind the stage in the Seraj Hall, and three stands were set up on the ground floor of the hotel and in the central hall. Additionally, the basement of the main hall was prepared with tables, chairs, and screens for team training. Several stands showcasing Iranian products were also installed in the basement to familiarize attendees with Iran's achievements in this field.

Figure 41 - A view of the stage banner

Figure 42 - A view of a product board

Figure 43 - A view of the workshop space

9.6. Accommodation

Participants were accommodated in a hotel located in Pardis Technology Park. The rooms were two-bed suites, arranged in accordance with Islamic customs and considering the nationality of the teams. The hotel lobby was used for teamwork activities, and breakfast was served in the lobby as a self-service arrangement. The scientific committee, referees, and foreign mentors stayed at the Eram Hotel.

9.7. Nutrition

In addition to breakfast, lunch and dinner were served at the restaurant located in the park. Both meals were self-service, offering at least three different dishes along with soup, salad, a vegetable plate, and various drinks. It should also be noted that two dinners were served outside the park. After the first tour, a meal was served as self-service (finger food) at the INIC headquarters. The second dinner was held in Lavasan, where five different dishes were served in the restaurant. For midday snacks between classes and workshops, tea, coffee, two types of cake, and fruit were provided.

9.8. The Venue

The First International Nanotechnology Olympiad took place at Pardis Technology Park. About two months before the Olympiad began, coordination with park officials was conducted. The following venues were reserved for the event:

- Seraj Hall
- The amphitheater
- The Basement of the Fan Bazaar Structure
- The Meeting Rooms
- The restaurant
- The Park Hotel

The opening and closing ceremonies, as well as two workshops on safety and the environment, took place in the Seraj Hall. Other workshops were held in the basement of the Fan Bazaar Structure, and meetings were conducted in the designated meeting rooms.

9.9. Formalities and Transportation

Upon arrival at Imam Khomeini International Airport, representatives from the Nanotechnology Committee escorted individuals to Pardis Technology Park or the Eram Hotel using ceremonial vans. On the final day, passengers were transported from their accommodations to Imam Khomeini International Airport. During the Olympiad, transportation for the steering committee and jury was provided by two ceremonial vans from INIC. Additionally, during the two Tehran city tours, a mid-sized bus and a VIP bus were added to the transportation fleet.

9.10. Gifts and Attendance Certificates

As a commemoration, all participants in the 1st INO received a keepsake and a certificate of appreciation. Each member of the participating teams received a certificate of attendance at the Olympiad. Additionally, each of the judges also received a certificate of attendance at the Olympiad. Below, you can find an example of the certificates awarded to various groups: These certificates serve as a token of appreciation for their participation in this significant event.


CERTIFICATE

OF ACHIEVEMENT

This proudly certifies that

Seyed Mahdi Ghasemi

has been winner of the

Business Prize

INO 2018 COMPETITION

TEHRAN, IRAN

APRIL 10 - 15, 2018

Figure 45 - Sample Certificate for the Top Team in the Business Section


CERTIFICATE

OF PRESENTATION

This certificate is awarded to

Fabian Kriegel

for your outstanding project presented in

INO 2018 COMPETITION

TEHRAN, IRAN

APRIL 10 - 15, 2018

Figure 46 - Sample Certificate of Participation in the Olympiad

To each member of the teams, a small and exquisite enameled plate was awarded, and to each senior participant in the Olympiad, a large and beautifully crafted enameled plate was presented.

Figure 47 – Samples of enameled plates

9.11. Awards and Medals

The awards for winning teams included the following:

- Certificate of Appreciation
- Medal
- Cash Prize

Each member of the selected teams received a certificate of appreciation and a gold medal. For the top teams in the business, innovation, and science and technology categories, a cash prize of €2000 was awarded, while to the team in all the categories received a cash prize of €3000.

Figure 48 – Sample of Olympiad Medal

9.12. Media Coverage

During the Olympiad, Press TV, alongside Iran news agencies such as ISNA, Young Journalists Club, and others, provided media coverage of the event with the assistance of the Media Department of Promotion Working Group of INIC. Notable news articles related to the Olympiad were published on various news websites:

- **ISNA**: Coverage of the first International Nanotechnology Olympiad (Website Link)
- **IRIB News**: Report on the first International Nanotechnology Olympiad. (Website Link)
- **IRNA**: News article about the event. (Website Link)
- **Kanoon**: Introduction of the winners of the first World Nanotechnology Olympiad. (Website Link)
- **SNN**: Commencement of the first World Nanotechnology Olympiad with Iran's innovative idea to address international challenges. (Website Link)
- **YouTube Channel**: A video related to the Olympiad. (Website Link)

9.13. Website and Social Networks

Approximately 6 months before the Olympiad took place, the final Olympiad website was implemented and became operational in several sections. Prior to the implementation of this version, an initial version of the website had been uploaded to the relevant address for a duration of 2 years and was available to users. The official website address for the Olympiad is www.nanoolympiad.org, and it is currently active. Some of the features of the final website include:

- Static Menu and Pages
- Main Page Banner
- Educational Module Containing A Scientific Tree
- Login and Search Functionality
- News Section
- Schedule Table
- Steering Committee
- Scientific Committee
- Collaborators
- Gallery

Figure 49 - Final View of the Olympiad Website

Alongside launching their website, the following channels and social networks began operating, with news content and photos being posted on them during the Olympiad:

- Twitter
- YouTube
- LinkedIn
- Instagram

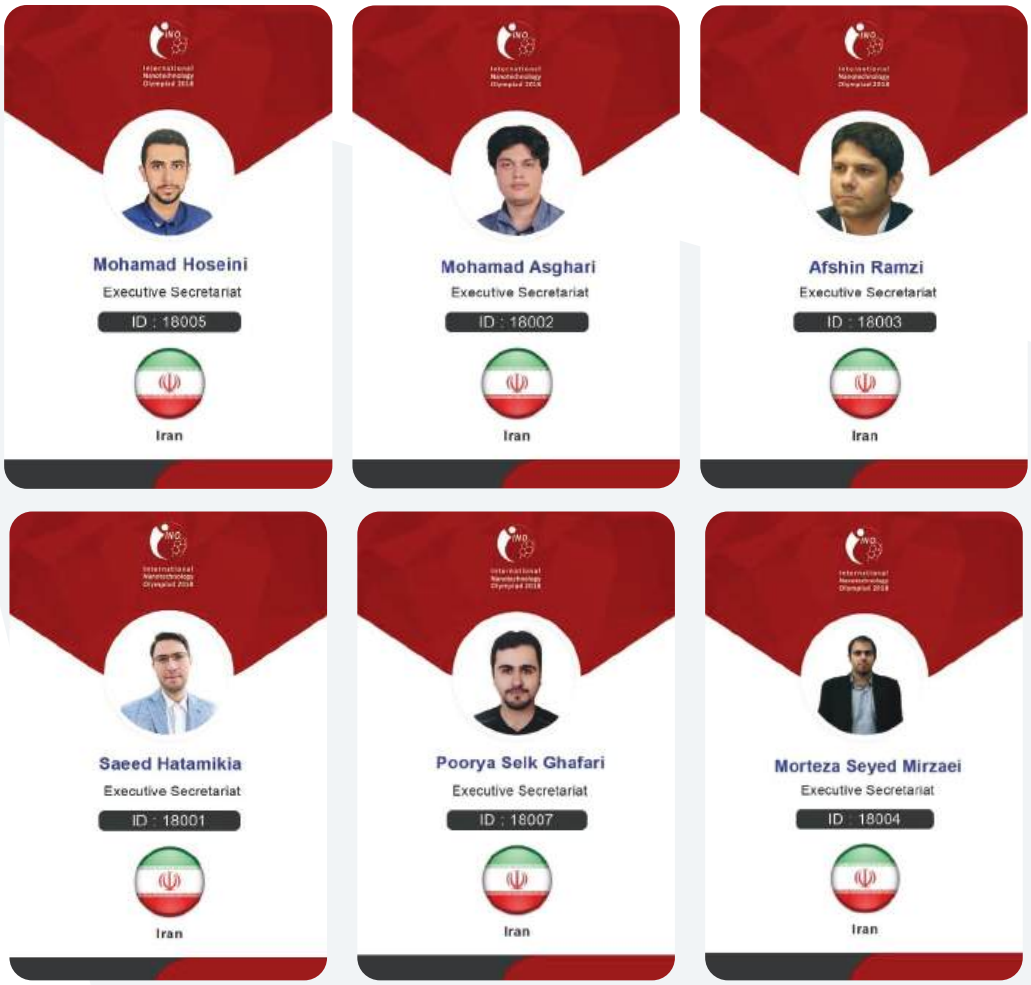
9.14. Visa and Coordination for Entry to and Exit from the Country

For all foreign participants, necessary coordination was conducted with the Iranian embassies in their respective countries, and invitation letters were sent from Iran to expedite visa issuance. This coordination began one month before the start of the INO, ensuring that all individuals were able to obtain their visas without any issues.

10. Staff

In this section, the names of other individuals who were involved in the Olympiad are mentioned. It is worth noting that Dr. Mola and Dr. Yazdifard were among the instructors, and Ms. Keshavarz was responsible for coordinating the education section. The names of these individuals are not listed below.

10.1. Senior Execution Team



10.2. Mentors

Mrs. Lynch was unable to participate as a mentor in the program due to personal issues. She was a member of the steering committee and the program's mentor. It is worth noting that some of the steering committee members also participated as mentors in the Olympiad and are present in the below photos.

10.3. The Jury:

Abd Mutalib Bin Md Jani
Judge
ID : 18518
Malaysia

Khamirul Amin Bin Matori
Judge
ID : 18513
Malaysia

Arno Gutleb
Judge
ID : 18511
Europian Commision

Ali Marjovi
Judge
ID : 18519
Iran

WEN-CHE HOU
Judge
ID : 18514
Taiwan

Boris Stepanov
Judge
ID : 18512
Russia

Kyung Ho Shin
Steering Committee
ID : 18106
South Korea

Ali Beitollahi
Steering Committee
ID : 18104
Iran

MAW-KUEN WU
Steering Committee
ID : 18102
Taiwan

It is worth noting that some of the steering committee members and mentors also participated as judges in the INO, and they are present in the images.

10.4. Supervisors and Observers

During the Olympiad, several individuals served as supervisors and observers. The list of foreign participants is provided below:

11. Appendix: Executive Considerations and Recommendations

In this section, some general recommendations based on the experiences gained during the INO are outlined. These recommendations cover both the strengths and weaknesses of the event from the perspective of the Danasharif Company as INO Executive Secretariat (INOES). It is important to note that these recommendations aim to improve future events and are not intended to blame or assign fault to any individual or group, whether within INIC headquarters or among other countries.

11.1. Policy Matters

The strengths in the policy space of this event are as follows:

1. **Successful Execution Over Three Years:** Despite significant changes, the project was ultimately executed excellently over the course of three years.
2. **Cost Efficiency and Quality:** Financial savings were achieved without compromising the quality of the event. Low costs were balanced with satisfactory execution.
3. **Unprecedented Nanotechnology Competition:** No private or governmental entity worldwide has organized a nanotechnology competition at the regional or international level.
4. **Networking and Interaction:** The INIC headquarters' approach fostered special interactions with other nanotechnology stakeholders, particularly in European countries, initiating a networking trend.
5. **Outsourcing Close to the Event:** Outsourcing for the Olympiad, even just three months before its occurrence, was reasonably executed and significantly accelerated progress.
6. **Dedicated Collaboration:** During the Olympiad, both internal and external INIC headquarters staff contributed wholeheartedly, significantly advancing the project.
7. **International Coordination and Consensus:** Multiple meetings were held to align the project approach with stakeholders outside Iran. The final model was satisfactory to all participating countries.
8. **Promotion Across International Events:** The project was promoted during other international programs and events in Iran and other countries, attracting new stakeholders, including the European Union.

The weaknesses in the policy space of this event are as follows:

1. **Slow Interaction with Countries:** The speed of interaction with other countries was significantly low, making decision-making quite challenging.
2. **Delayed and Disjointed Decision-Making within the Steering Committee:** Due to late and inconsistent decision-making within the INIC headquarters and INO Steering Committee, the available time for implementing decisions decreased, putting considerable operational pressure on the INOES.
3. **Lack of a Concrete Vision and Objective for the INO:** The Olympiad's vision and objective were never outlined in the form of an operational roadmap; instead, they remained mostly

slogans and general statements.

4. **Extensive Organizational Hierarchy:** The organizational hierarchy of the INO was overly extensive, with each individual having limited and shallow responsibilities. This situation led many managers to focus more on justifying and monitoring activities rather than making decisions and advancing the project.
5. **Infrequent Joint Meetings:** Very few joint meetings were held between officials and the INOES during this project, and many decisions were unilaterally made by either the INOES or the INIC headquarters.
6. **Untimely Implementation of Intellectual Outputs:** Most intellectual activities of the INOES were not implemented within the last three months before the Olympiad. This was due to a lack of constructive interaction between the INOES and the INO Steering Committee.
7. **Inappropriate Timing of the Olympiad:** The timing of the Olympiad was highly inconvenient due to holidays in Iran.
8. **Complex Decision-Making:** Many decisions were overly complex. For instance, the initial regulations were intricate, whereas international decisions should have leaned toward simplicity while maintaining comprehensiveness.

11.2. Execution and Financial Matters

Most of the operational activities were allocated to the days of the main event. The strengths in the execution space of this event are as follows:

1. **Scale of Operational Activities:** In comparison to the number of participants, the amount of operational activities was significantly higher. This high level of execution capability by the INOES and the INIC headquarters contributed to project advancement.
2. **Well-Executed Ceremonies:** The ceremonies were executed very well, adhering to the schedule and without delays.
3. **Timely Execution of Planned Activities:** All planned operational activities were carried out on time, except for one or two items. The delay in preparing medals and flags fell outside the INOES's responsibility.
4. **Visa and Invitation Coordination:** Despite the limited time, visa and invitation coordination progressed very effectively.
5. **Competence in English Language:** All members of the execution team demonstrated

satisfactory proficiency in the English language.

6. **Excellent Support for Invited Guests and Participants During the Olympiad**: The support provided during the Olympiad was highly commendable.
7. **Comfort and Well-Being of Invited Guests and Participants During the Main Event**: The level of comfort and well-being during the Olympiad days was satisfactory.
8. **Suitable Venue for the Olympiad:** The chosen venue for this event was highly appropriate.
9. **Food and Hospitality Considerations for Participants:** The quality of food and hospitality provided to participants was relatively good.
10. **Accommodation Facilities for Participants:** The accommodation facilities for participants were very satisfactory.
11. **Quality of Packages and Printed Materials:** The quality of packages and printed materials met expectations.
12. **Recreational Programs Well-Received by Participants:** Recreational programs were well-received by the participants.

The weaknesses in the execution space of this event are as follows:

1. **Global Promotion:** The INO could have been more widely promoted among interested countries worldwide.
2. **Financial Transparency**: A transparent financial approach for both the INOES and the project was lacking. The project budget fluctuated several times during critical periods.
3. **Lack of Documentation and Filming:** No satisfactory documentation or filming was conducted during this phase of the INO.
4. **Absence of Opening and Closing Ceremony Scenarios:** No specific scenarios were planned for the opening and closing ceremonies.
5. **Last-Minute Printing Pressure:** Many printed items, including the main booklet, were finalized just two days before the final INO. This rushed printing not only incurred higher costs but also added significant pressure to the INOES.
6. **Unforeseen Procurement Needs**: Several procurement needs arose during the INO, which had not been anticipated in advance.
7. **Changes in Package Items and Gifts**: Package items and gifts underwent multiple changes, impacting the financial aspect.
8. **Low Financial Allocation for Certain Areas:** Budget allocation for various aspects, such as

documentation and stage design, was insufficient.

9. **Clips Eliminated Due to Budget Constraints:** Many planned video clips for the event were removed due to budget limitations.
10. **Underperformance of Website and Social Media:** The website and social media channels did not fulfill their roles effectively.
11. **Pre-Olympiad Accommodation and Settlement:** The accommodation and settlement of participants before the start of the Olympiad lacked precision and planning.
12. **Currency Exchange and Participant Funds:** No scenario was prepared for currency exchange and handling participant funds, resulting in significant challenges during the event.
13. **Unattractive Design of Items and Packages:** Given the limited time, the design of items and packages was not particularly appealing.
14. **Limited and Basic Stage Decoration and Design:** The stage decoration and design were minimal and elementary.
15. **Lack of Time Management Oversight by Other Team Members:** Other staff members or the INOES did not pay sufficient attention to time management.

11.3. Scientific and Educational Matters

The strengths in the scientific and educational space of this event are as follows:

1. **Pre-Olympiad Educational Content:** Before the Olympiad, relatively desirable educational content was made available on the Olympiad website.
2. **Effective Utilization of Resources:** During the Olympiad, the capacity of the steering committee and other invitees was utilized, and reputable instructors were engaged as educators.
3. **Focused Curriculum:** The educational syllabus primarily emphasized business-related topics, while technical aspects were not adequately covered. This deliberate approach was well-considered.
4. **Participant Satisfaction:** Survey results indicate relative satisfaction among participants with the education provided during the Olympiad days.
5. **Global Relevance:** The overall theme of the Olympiad was highly relevant to the concerns of other countries worldwide and international organizations.
6. **Competitive Approach:** The competitive spirit of the Olympiad added to the program's

appeal.

7. **Innovative Organization:** The competition was organized in a highly innovative manner, distinct from traditional approaches.
8. **Collaborative Environment:** The hotel lobby provided a conducive space for teamwork and collaboration among teams.

The weaknesses in the scientific and educational Space of this event are as follows:

1. **Lack of Scientific Committee Formation:** The scientific committee for the INO was not established as one of its essential pillars.
2. **Inconsistency in Instructor Selection:** Significant discrepancies were observed in inviting and appointing instructors.
3. **Lack of Coordination Between Education and Execution**: The educational and execution activities lacked necessary synchronization.
4. **Timeliness of Educational Syllabus and Instructor List:** The educational syllabus and the list of instructors could have been prepared earlier.
5. **Delayed Coordination for Scientific Committee Members:** The process of selecting scientific committee members could have been initiated sooner.
6. **Diverse Technical Levels of Participating Teams:** The technical readiness of participating teams varied significantly.
7. **Unclear Competition Focus:** The competition lacked a specific focus on whether it aimed at ideas, prototypes, business plans, or other objectives.

11.4. Judgment matters

The strong points in the judging space of this event are as follows:

1. **Thoughtful Division of Judging Sections:** The division of judging sections into innovation, science and technology, and business was very well-considered.
2. **Accurate Timing in Team Presentations and Judging Questions:** The timing for presenting teams and judging questions was highly precise.
3. **Lack of Objections After Results Announcement:** No objections were raised after the announcement of the judging results.
4. **Fair Voting by Judges:** Judges voted very fairly for their own team and other teams.
5. **Effective Management by Dr. Beitollahi:** Dr. Beitollahi excellently managed the judging sessions and presentations.

The weaknesses in the judging space of this event are as follows:

1. **Equal Weighting of Scores Across Different Judging Criteria:** The equal distribution of scores among various judging criteria was not adequately considered. Given the program's approach and the readiness level of ideas, it would have been appropriate for the innovation or scientific sections to carry more weight.
2. **Uniformity of Judges Across Sections:** Despite separating judging sections, the same judges were assigned to all sections. It would have been better for each section to have its unique set of judges.
3. **Appropriate Expertise in the Science and Technology Section:** In the science and technology section, it would have been better to select judges aligned with the scientific domain. Although this approach was implemented in Korea's program, other programs had judges with a general scientific perspective who couldn't deeply evaluate the projects.
4. **Unequal Distribution of Judges:** For instance, while Korea or the European Union had a single representative, Iran had three representatives. During the judging session, their opinions were summarized and presented collectively. However, this approach lacked an appropriate external appearance.
5. **Judges Abstaining from Voting for Their Own Teams:** It would have been better if judges refrained from voting for their own teams.
6. **Disputes During Presentation Sessions Between Russian and European Representatives:** There were indications of disputes during the presentation sessions between Russian and European delegates.
7. **Lack of Mechanism for Handling Potential Objections:** Although no objections were raised, there was a sense of unaddressed gaps in this regard.
8. **Earlier Coordination for Selecting Judging Committee Members:** The coordination for selecting judging committee members could have been done sooner.
9. **Visual and Decorative Consistency in Presentation Sessions:** The presentation sessions could have adhered more closely to conventional norms in terms of appearance and decoration.Alitiant aut amus aut enit reperro reheni dolenti usanimu saniendunt.

International Nanotechnology
Olympiad Permanent Secretariat

Tehran, Iran

1447685163

+98 21 88486756

info@nanoolympiad.org

secretariat@nanoolympiad.org