

Hosting IOI 2019 Azerbaijan: Back to the Future

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Abstract. Who would guess that the 31st International Olympiad in Informatics (IOI) in Baku, Azerbaijan will be referred to as “the last normal” one for so long? While the IOI community looks forward to the upcoming onsite events, the readers may be interested in a retrospective report on the IOI 2019 from the host organizing, scientific and technical committees. This report covers the whole process throughout bidding, preparations, event days and closeout, shares some pain points and provides a number of practical recommendations. The authors hope that by looking *back* at the IOI 2019 Azerbaijan they will also help potential hosts of *future* IOIs.

Keywords: IOI, Azerbaijan, organizing committee, scientific committee, technical committee, CMS, project management.

Introduction

Usually all IOI host countries publish reports on the organizational aspects of the Olympiads in informatics, including the international ones (Iglikov *et al.*, 2013; Abam *et al.*, 2017). The goal of this report is to highlight some critical points of organizing an IOI specifically, while focusing on three aspects from organizational, scientific and technical perspectives. This report may also be useful for the future IOI hosts as it walks through the whole process starting from bidding and ending with the event itself.

1. *The Way to IOI 2019*

Before starting any enterprise there is that ‘why?’ question, the rationale for starting this endeavor. IOI is a massive endeavor, indeed, a week-long event that apart from the scientific component of preparing world-class original and challenging programming problems, as well as technical component of running a distributed computing environment with hundreds of workstations, also includes a heavy logistical component of accommodating hundreds of majority non-adult people, who travel from virtually all around the world. Plus, practically all of it is at the host’s expense.

Unlike many other international events, such as popular sportive competitions, it would be naive to consider IOI as a means of promoting the host country as a tourist destination. In many countries IOI is virtually unknown (unfortunately) outside of the professional community of interest. However, as one of the internationally recognized science olympiads and the second largest one, initiated by UNESCO back in 1989, it is considered as “one of the most prestigious computer science competitions in the world” (Wikipedia, 2022).

1.1. *Initiation of Bidding*

A famous Chinese proverb ascribed to Laozi (Wikiquote, 2022b) says “a journey of a thousand miles begins with a single step.” As per the official Regulations (IOI, 2022) (statute S4.1), process starts with a Letter of Intent sent by an official representative of an interested IOI member Country to the IOI Secretary. Becoming an IOI member assumes, among other requirements, a demonstrated capability of selecting a National Delegation through running national level selection of Contestants, and ability to sustainably participate in the last three IOI’s after visiting as an Invited Observer for one year.

Azerbaijan joined IOI in 1994 and has been participating uninterruptedly in every IOI since then. For many countries the participation becomes possible thanks to enthusiastic professionals and volunteers, who apart from running the local selection of contestants, over the years put a lot of effort into resolving logistical issues such as securing sponsorship for the travel of delegations. In Azerbaijan, Dr. Ramin Mahmudzade (IOI, 2020) has been leading these efforts as also a Delegation Leader at 21 olympiads between 1996–2019. A decorated educator and well respected informatics professor, he was the main initiator and promoter of Azerbaijan hosting an IOI.

In Project Management terms, some differentiate the project initiator, as an individual, who promotes the project and champions its initiation, and the project sponsor(s), as one or more individuals or organizations that provide resources and support for the project and are accountable for enabling success (PMI, 2022). The Letter of Intent for hosting IOI in a specific year usually is sent to the Secretary of the IOI by the primary sponsor organization and provides reference to previous experience of hosting similar events as well as commitment to host the IOI up to the required standards. Upon receiving acknowledgement and rules from the Secretary the Country receives a Potential Host status.

The next step for the Potential Host is to present its bid to the International Committee (IC) of the IOI in the form of a report, which would include some details e.g. draft program and proposed venues, consolidated technical and human resources, draft budget and sponsorship plan, etc. Based on these reports from Potential Hosts the IC nominates a single candidate for hosting the IOI for a specific year, to be ratified by the General Assembly (GA) voting. Upon ratification, the Country receives Candidate Host

status with an official Invitation for hosting the IOI in that year. Azerbaijan presented its report for hosting IOI 2017 during the IOI 2013 in Brisbane, Australia, and later for hosting IOI 2019 during the IOI 2015 in Almaty, Kazakhstan. A positive constructive feedback received from the IC members after the first presentation helped with Azerbaijan's second successful bidding.

In Azerbaijan, the Ministry of Education was the championing government agency for both bids, while ADA University was the championing educational institution for the IOI 2019. Both organizations responded to the Invitation with an official confirmation upon which Azerbaijan became the Future Host for IOI 2019.

1.2. *IOI is the Way*

“There is no way to IOI, IOI is the way.” This quote (homage to A.J. Muste (Wikiquote, 2022a)), which comes from the IOI 2019 General Assembly (GA) closing remarks, reflects the transformational role of IOI in the countries that join it and host it, hence may serve as a reply to our initial ‘why?’ question. In Azerbaijan, years ahead of the IOI 2019, starting from 2015 when the country became Future Host, were marked by increased attention and national level support to the competition and informatics in general, which eventually resulted in medals (IOI, 2021) after almost a decade-long gap and long-awaited announcement of including informatics questions in the centralized university entrance exams.

1.3. *You Won the Bid: Now What?*

The journey just starts with an IOI Country winning the bid and receiving the Future Host status. By that time usually there is already an official local Organizing Committee, which is to consolidate resources for arranging the IOI they won the bid for.

Three representatives of the Future Host automatically become members of each of the three long-term standing IOI committees, that is IC, the International Scientific Committee (ISC) and the International Technical Committee (ITC). This regulation ensures that the Future Host develops a better understanding of the corresponding aspects of organizing another IOI. In addition, IOI Regulations make it mandatory to invite a limited number of observers representing the Future Host to each IOI, which also facilitates further knowledge transfer. For this reason also, usually, the Future Host delegation includes many additional guest members, especially the year before the IOI they will host.

The authors discuss three aspects of running an IOI from organizational, scientific and technical perspectives, as they resided in the abovementioned committees and led the local efforts in corresponding three directions within the host Organizing Committee for IOI 2019.

2. General Organizational Matters

Every IOI is a unique event with a specific technical content and international nature, which often requires state-level efforts. Hence, having government agencies as part of the Organizing Committee is not merely a matter of prestige, their direct support is crucial for many activities, such as securing visa arrangements, safety and security, public media promotion, and access to some resources.

It is critical to build effective organizational structure and internal communications, way before any event activities commence. Project sponsors form the core of the host Organizing Committee and usually senior representatives of these organizations become members of the Steering Committee, which monitors the progress of preparations and provides support in consolidating necessary resources.

In Azerbaijan, the Steering Committee members included then head of the championing government agency, Ministry of Education, Mr. Jeyhun Bayramov, acting as the official Chair of IOI 2019, as well as the Minister of Transport, Communications and High Technologies as the Co-Chair. Finally, the true champion of the project and driving force of the committee was the Honorary Co-Chair of IOI 2019, Ambassador Prof. Hafiz Pashayev, Rector of ADA University.

The first semi-formal meeting of the Steering Committee was held as early as in March 2018 with a total of two working meetings in 2018 and four meetings held in 2019 with their participation. Having high-level decision-makers on board and effective government support helps to quickly resolve many administrative or logistical issues. In Azerbaijan, ultimately an official government-level organizing committee for IOI 2019 was formed by an order signed by the Prime Minister (ICT, 2019) in May 2019.

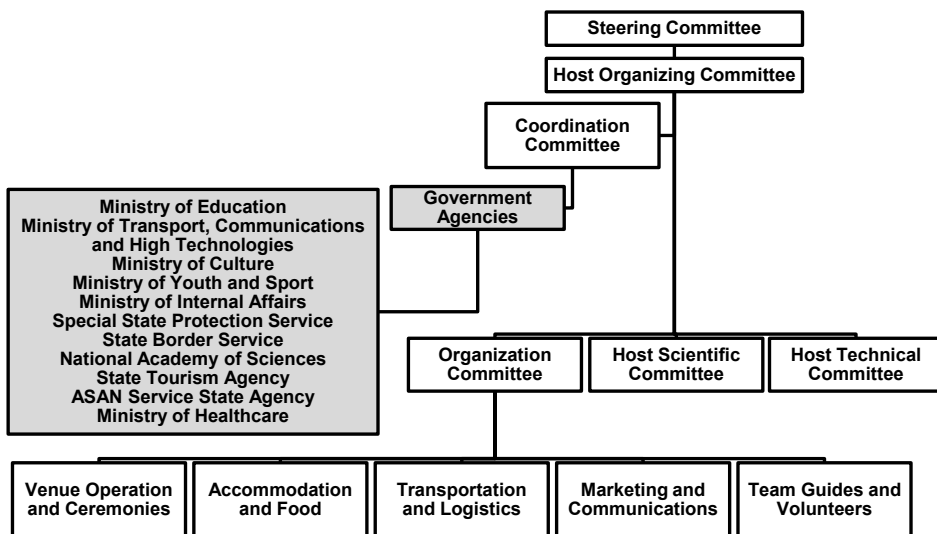


Fig. 1. Final organizational structure for IOI 2019 in May 2019.

Since the scope of an IOI includes a considerable element of event logistics, usually an effective organizational structure also includes a major event management vendor. In Azerbaijan, this role was filled by Caspian Event Organisers (CEO) company, which earned its reputation over more than two decades as an organizer of major international exhibitions or events, such as annual BakuTel Azerbaijan International Telecommunications, Innovations and High Technologies Exhibition (Bakutel, 2022) or Asian Development Bank Annual Meeting (ADB, 2015) in Azerbaijan. It is a good idea to include representatives of this vendor as part of the National Delegation to the previous IOIs.

To ensure effective internal communication and coordination, five working groups for Venue Operation and Ceremonies, Accommodation and Food, Transportation and Logistics, Marketing and Communications, Team Guides and Volunteers were established under the Organizing Committee (see Fig. 1) with relevant members both from ADA University and CEO.

It is also critical to build effective public communications months and even years ahead of the event. Involvement of the IOI committee members in local promotion helps emphasize the international importance of the event and gain further local support. We would like to thank the IC members, Mr Eljakim Schrijvers and then IOI President Prof Krassimir Manev for accepting the invitation to visit Baku in December 2016 and for participating in public discussions, interviews, as well as official meetings with government representatives. Prof. Manev's participation as one of the original organizers of the first ever IOI added a distinctive weight and energy to the local promotion.

A major milestone ahead of the IOI is a special meeting of local and international committees to be organized about six months before the olympiad by the Present Host. The primary goal of this usually three-day event, also known as Winter Meeting, is to jointly examine 'on the spot' the organization of the upcoming IOI. It is also a good opportunity for further public promotion. In Azerbaijan, the meeting dates from 18–20 February were used to organize a press conference and interviews (IOI Azerbaijan, 2019).

2.1. Going Forward with the Project

As in any project, for hosting IOI it is important to clearly define the scope, firmly secure the budget and get final agreement on the schedule. There are efforts to institutionalize the knowledge transfer within the IOI committees. For example, IOI Secretariat archives a number of 'checklist' documents that list critical activities pertaining to hosting an IOI. These would help with better understanding of the scope of the work.

We would also like to acknowledge with gratitude the IOI 2018 Japan team for producing an internal Final Report document that includes many useful details i.e. organizational structure, design and color coding of official badges, detailed programs including opening and closing ceremonies, venue maps and seating charts, schedules for daily operations and volunteer shifts, emergency procedures and more. It was used as a model, while IOI 2019 produced a similar document for internal use by Future Hosts.

In Project Management terms (PMI, 2022), Work Breakdown Structure (WBS) is “a hierarchical decomposition of the total scope of work”. It is later translated into schedules with project activities, and budgets with projected costs and assigned resources.

As per an agreed model, the major services were procured by ADA University, while the CEO company was contracted to control the total budget for procurement of numerous other, relatively smaller services (Fig. 2).

In Azerbaijan, the Ministry of Education ensured allocation of the budget for IOI 2019. Such a model with a single source of funding is very helpful if there are solid guarantees of support. In an alternative model where there are several sources of funding at different levels (e.g. diamond, gold, silver, bronze), a separate organizing committee unit would manage “relationships with co-organizers and sponsors”. For example, the final list of sponsors for IOI 2018 Japan (IOI, 2018) included around 50 organizations.

On a global level, from 2017 to 2021, IOI also had Acer as Official Sponsor (Acer, 2019), who committed to “supply notebooks for contestants and staff, and servers to run contest management systems and language translations”. This arrangement helped the organizing committees both from the budget and scope perspective. Special thanks go

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| 1. | Venue renting (ADA) |
| 1.1. | National Gymnastics Arena |
| 1.2. | Boulevard Hotel |
| 1.3. | Opening and closing venues |
| 2. | Accommodation (ADA) |
| 2.1. | Boulevard Hotel (leaders, guests, organizers, volunteers) |
| 2.2. | Athletes Village (contestants, volunteers) |
| 3. | Furniture and equipment (CEO) |
| 4. | Catering |
| 4.1. | Leaders and organizers (ADA) |
| 4.2. | Guests (ADA) |
| 4.3. | Contestants (ADA) |
| 4.4. | Volunteers (CEO) |
| 5. | Transportation (ADA) |
| 6. | Outdoor promotion (CEO) |
| 7. | Swag, souvenirs and awards (CEO) |
| 8. | Registration (CEO) |
| 9. | Printed materials (CEO) |
| 10. | Excursions (CEO) |
| 11. | Consultancy (ADA) |
| 12. | Video and photo shooting (CEO) |
| 13. | Musical program (CEO) |
| 14. | Website and social media development and maintenance (CEO) |
| 15. | Contingency costs |
| 15.1. | Contingency costs (ADA) |
| 15.2. | Contingency costs (CEO) |

Fig. 2. Top level budget elements for IOI 2019.

to Prof Greg Lee as the chair of the Acer sponsorship working group, who also served as IOI President from 2018 to 2021. In Azerbaijan, Acer also agreed to donate the notebooks used for competition as a legacy of IOI 2019 to be used for development of informatics education in the country (Acer, 2019). We would like to acknowledge the professionalism and responsiveness of Acer colleagues on local, regional and global headquarters level.

For many national level events, the schedules are also to be coordinated with government agencies to consider other important public activities. The IOI 2019 final dates of 4–11 August were agreed to fit between the 2019 Summer European Youth Olympic Festival (EYOF, 2019) and a public holiday. Knowing these dates earlier is important for National Delegations for planning ahead and coordinating, for example, with participation in other scientific olympiads.

Overall timeline can be divided to pre-IOI, IOI and post-IOI periods with the former further divided to pre-Winter Meeting and post-Winter Meeting periods. The latter is marked by increased intensity of activities that culminates with the launch of the event itself.

Table 1
Major milestones in the IOI 2019 timeline

Internal coordination	IOI operations	External communication
<ul style="list-style-type: none"> • 7 March 2018: Kick off meeting with Steering Committee • 18 October 2018: Official meeting with the Steering Committee • 20 February 2019: joint meeting of the Host Organizing Committee and International Committee • 16 April 2019: Contract signed with the approved vendor for event management 	<ul style="list-style-type: none"> • 7 September 2018: Azerbaijan received the IOI flag at IOI 2018 in Japan • 18–20 February 2019: IOI 2019 Winter Meeting • 31 March 2019: National Olympiad in Informatics running on IOI infrastructure – Semifinals • 15 April 2019: Memorandum signed with ACER as part of the 5-year global partnership • 24 April 2019: Official IOI Registration System launched for IOI2019 at www.ioiregistration.org • 30 April 2019: Soft copies of official invitation letters to IOI Country delegations sent by emails 	<ul style="list-style-type: none"> • 9 September 2018: Official Facebook page launched at https://www.fb.com/ioi2019/ • 9 September 2018: Official website with call for tasks launched at www.ioi2019.az • 17 March 2019 – Official IOI 2019 logo design approved • 26 April 2019: Official website re-launched at www.ioi2019.az • 26 April 2019: Three official contact emails @ioi2019.az and inquiry handling procedures established

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Internal coordination	IOI operations	External communication
<ul style="list-style-type: none"> • 15 May 2019: Order signed on establishing the government level Host Organizing Committee • 22 May 2019: Meeting of the Working Group of the Coordination Committee • 30 May 2019: Meeting of the Coordination Committee • 11 July 2019: Meeting of the Working Group of the Coordination Committee 	<ul style="list-style-type: none"> • 5 May 2019: National Olympiad in Informatics – Finals • 4–11 August 2019: IOI 2019 held in Baku, Azerbaijan 	<ul style="list-style-type: none"> • 5 May 2019: Official YouTube channel launched with the first video

2.2. Looking Back at IOI 2019

According to a post-event survey, IOI 2019 can be considered as another successful IOI thanks to the professionalism and dedication of many people across a number of organizations, including 148 team guides, lead guides and volunteers, who worked hard throughout the event week. There were 498 participants from 88 countries and regions, including 331 Contestants and 87 Delegation Leaders. In addition, 78 guests were hosted, including 7 juniors.

While internal communication with the event management vendor was critical, it took some ‘warm up’ time on the first day for it to settle. Establishing early on more detailed communication protocols and using Winter Meeting activities, as well as national olympiad semi-final and final rounds for testing them in practice and revising as needed could be helpful.

Another common pain point was that there were too many dependencies on a few people, for example the Organization Committee manager. Perhaps, further delegation of some roles would help in this situation.

Communication channels included also 3 official email addresses used for correspondence mainly with participants and occasionally with the general public. While the travel-related email was handled by the event management vendor, and the others by the ADA University, establishment of clear protocols and response templates was helpful during the peak times.

Every IOI is remembered by some local touch or novelty brought by the host. For example, as part of the registration, a reduced guest fee was introduced for an accompanying second guest, who agreed to share a standard room. As a result, sharing rooms among guests was not mandatory, rather encouraged in Baku.

The IOI 2019 brought all the contestants, team leaders and guests together for a Cultural Night organized along with an open-air dinner on day 6, also known as Excursion Day 2, where the teams were invited to demonstrate their talents and present their culture

Table 2
 Statistics for IOI 2019 communication channels

	Facebook page	YouTube channel	Info email	Travel email	Registration email
by 11 July 2019	Posts: 77 Likes: 903	Videos: 16 Subscribers: 120 Views: 2,606	163	102	108
by 11 August 2019	Posts: 133 / 36* Likes: 2,382	Videos: 27 Subscribers: 506 Views: 38,343	1,190 / 84*	636 / 62*	449 / 28*

*during the event

through music, dance or some other performance on the stage. This tradition should continue as it very much speaks to one of the IOI goals (IOI, 2022) (statute S1.7), which is about “foster[ing] friendly international relationships among computer scientists and informatics educators.”

A Book of Tasty Algorithms, with foreword by Prof Donald E. Knuth, a special edition of a book about Azerbaijani cuisine as a homage to the famous prologue to Knuth’s Art of Computer Programming was presented as a gift to all IOI 2019 participants. A revered computer scientist, Prof Knuth was very kind to support this project and wrote an exquisite introduction. In addition, the participants had a chance to add a personal note to a special big folded card to be sent to the professor along with copies of the book. We were overwhelmed by a positive response from Prof Knuth himself: “The books arrived today, and I’m overjoyed to see that they were very attractively printed indeed. I was also quite touched (and “flabbergasted”!) by the one-of-a-kind thank-you sheet that was inscribed by so many participants of IOI2019. Wow! My wife – who is a designer – was also appreciative of the outstanding cover design, and the IOI logo.” (IOI, 2019a)

An official postage stamp of the Republic of Azerbaijan featuring all logos of all IOIs starting from the very first IOI 1989 in Bulgaria was released on the stage during the Closing Ceremony and presented as a souvenir to all participants.

Finally, at the IOI 2019 Closing Ceremony, the official IOI flag has got a designated bag for transporting it from country to country.

3. Scientific Committee

The IOI 2019 Host Scientific Committee (HSC) was composed of members located in different countries. Team was managed and worked completely remotely, and except for the Winter Meeting and actual contest period, the team was regularly meeting online to discuss the state of preparations, to work on tasks, etc. The committee consisted of 15 members from Iran, Russia, Poland, Ukraine and Singapore.

HSC was divided into smaller groups, coordinated locally per country of residence. These groups were working independently on sets of tasks assigned. An experienced

team member was assigned as a coordinator to each group, which made the overall communication process much more manageable. Some members departed from the team after some period of inactivity, some joined the team as authors of the submitted tasks.

Establishing secure communication channels and uniform infrastructure for task preparations was challenging. It would help future IOI hosts a lot to have a standard cloud platform provided by IOI for the contest website, “call for tasks” submissions, task preparation/management, secure communication, worker/grader hosts for testing and contest simulations. It would especially help those countries, who would like to host the event, but lack any technical/scientific expertise to do so. Always relying just on community proves to be risky, hence, IOI budget could be put to a better use by providing at least some of these tools.

Overall task preparation process of the IOI 2019 can be evaluated as successful. According to the IOI survey, contestants were mostly satisfied with the difficulty and originality levels of the selected tasks and the quality of problem statements and test data.

However, the preparation process itself was not as smooth as it might seem. Due to lack of communication (it is hard to demand absolute commitment from remotely located volunteers) before the on site meetings, a lot of work had to be done on the spot. For instance, some test data for some contest tasks was under prepared, i.e., lacked deeper analysis on possible exploitation of test cases. Or another case, when some better solution for a task existed, found during the meeting, ruining initial sub task distribution. All such cases were resolved during the joint ISC-HSC meetings thanks to individual efforts and contributions of all committee members.

Initial task selection after the “call for tasks” was lacking. After short listing we were left with just several tasks, barely enough to cover the contest without any backups. Therefore, we had to rely on individual authors/committee members contributing to the set of tasks. Eventually, those authors were recruited to work in the HSC. Team had also to improvise on modifying existing task statements to maintain a balance between hard, medium and easy tasks for both contest days in the case some tasks are rejected during a GA meeting.

Call for tasks could be improved by introducing various rewards or benefits for selected task authors. Making those mandatory for host countries to compensate could be very helpful. Our decision to invite task authors, since they were also HSC/ISC members, was natural and seemed to be reasonable at the time. But initially, we had a hard time deciding on appropriate compensation for the authors who will not be able to attend the contest. Luckily everyone attended.

Last, but not least, after the last GA meeting/translation session, relocating to the contest area, preparing tasks statements for contestants, loading them into the system and proof checking everything needed a lot more time than initially anticipated. Translation session ending just a few hours before the start of the contest and having the actual contest area isolated and far away from the meeting venues had almost delayed the start time of the contest. Had it been the case, it would have negatively affected the overall contest experience. Thanks to overall team efforts we still managed to get everything done in a timely manner.

4. Technical Committee

The organization of such a wide-scale programming competition was quite a challenging task for the HTC as unlike previous hosts, Azerbaijan has never hosted regional or international programming contests before. The number of contestants in each stage of the national olympiad in informatics never exceeded 100, which would be hosted by several high school or university facilities, without extra complexity on the computational and network infrastructure.

Considering the high uncertainty of the project, HTC chose the systematic and formal management approach, which in turn delivered the results accepted by committee members. This report covers the management part of HTC. The analysis and recommendations based on contestant data analysis have been provided in a separate report published in 2021 (Hasanov *et al.*, 2021).

As mentioned in the introduction part of the paper, the number of visiting countries and contestants was not much different from the previous years. There were no significant changes on the regulations part either (one of the mentionable changes would be removal of the Pascal language from the contest, which actually simplified things a bit). Considering the similar initial conditions and requirements, using best practices from the previous years and considering the lessons learned, was the right way to keep the direction (which wouldn't probably work both for the onsite and online contests).

Project Management Institute (PMI) defines a project as “a temporary endeavor undertaken to create a unique product, service, or result” (PMI, 2018). There is no doubt that this defines IOI as a project, as the “product, service or result” part of it is a of IOI activities that are planned during the project time. This part makes IOI different from the majority of the projects – the project team's job does not finish after the delivery of the final product (service or result part will be skipped hereafter), it just transforms from one stage to another. This second, short period process is not a project at all – it's called Operation (also used in conjunction with Delivery and Maintenance), which is run and regulated differently from the projects.

Considering these two stages, the corresponding formal approaches has been used:

- 1) For Project Management – PMI's Project Management guideline and standards.
- 2) For Operation Management – best practices, standards and guidelines of ITIL's Service Operation, Lean management and ISO9001 (Service Delivery).

This report briefly describes the implementation details of the mentioned standards, categorizing the experience as positive and unexpected.

4.1. Positive Experience and Outcomes

4.1.1. Usage of Formal Project Management

Those who follow the formal project management are steps ahead of those who try to run projects based on their experience or even worse, intuition – the PMI standard defines the knowledge areas, phases, processes and documents that are required in each phase

for the given knowledge area. Below is the list of knowledge areas and their correspondence with the IOI project:

Knowledge Area	Why it was important
Integration management	Definition of the project constraints (time, budget and scope). Formal Acceptance of the Project. Change Control Process.
Scope management	Requirement analysis, collection of the facts, previous experience. Building Work Breakdown Structure that depicts the scope of the work and also helps estimate the budget based on the listed items. The scope baseline also helps understand the number of resources required for the project.
Time management	Estimating the activity durations and their execution sequence. Since the event had a strict deadline, time was the main constraint. Time management techniques allowed us to properly order the execution of tasks.
Cost management	Estimating the cost for each activity and creating the budget forecast for the technical and organizational activities. The budget shall be carefully allocated in the right directions (OPEX and CAPEX) and distributed throughout the implementation period as planned.
Quality management	Building strategies on Quality Assurance and Quality Control. The scenarios for the inspection of the software, hardware and network solutions and prevention of the real-time problems have been prepared.
Human Resource management	The HTC team contained more than 60 people of different ages, skills and expectations. Knowledge of team acquisition and management helps acquire the required talents in a short period of time and move them smoothly through all the stages of team formation and performance. Understanding motivational theories helps putting the right person to the right job, using proper reward and recognition methods and keeping team spirit always high. The responsibilities of team members was built as a RACI (responsible, accountable, consulted, informed) matrix and shared with the corresponding teams.
Communications	The communication of the HTC chair starts long before the event and keeps going even long after the closing ceremony. Preparation and delivery of presentations, writing letters, e-mails, organizing phone/video calls, writing specifications, requirement analysis, meetings with vendors, suppliers, stakeholders and external and internal IOI team members requires good knowledge of formal/informal and verbal/written communication. Project Management standards state that communication is 90% of a project manager's job, which should be considered as a serious message: if you as the next host are deciding between two options for the HTC – a geek without communications skills and non-IT guy with good communication skills, you should definitely go for the second option.
Risk management	Unexpected things (good and bad, or positive and negative risks as we call them in Project Management) will definitely happen. The uncertain nature of projects may surprise with small or dramatic surprises (don't think that in 2019 Singapore team knew about the pandemic that totally changed the format).
Procurement management	Not all deliverables are going to be done internally. The majority of them, like venues, networking, power management, printers, transport, event management, catering, security will be rented or purchased. The Project Manager shall get familiarized with the procurement procedures (wish lists, PR/PO management, single sourced orders, tender rules and so on) of the leading organization and make necessary preparations.
Stakeholder management	IOI project involves almost 30 stakeholders (if not more) of different breeds, power and interest (probably should be published in a separate paper). Having this list helps in elicitation of requirements and not forgetting anyone or anything during the decisions and changes.

4.1.2. Investigation of Previous Experience and Guidelines

The IOI events hosted in previous three years were not the same in terms of technical setup and organizational details:

- In IOI 2016 (Kazan, Russia), as a contestant environment laptops were used. The scoring system was an in-house developed software called PCMS, a Windows-based system that is widely being used in Russia. The event was held on the campus of the Kazan Federal University.
- In IOI 2017 (Tehran, Iran), they used mini PCs with external monitors and keyboards and organized the contest on two floors of the same venue, located very close to the hotels where contestants, team and committee members have been staying. As a scoring system, the version 1.4 of CMS with local modifications has been used. By the way, with their new tools and automation systems, Iranian HTC made a tremendous contribution to IOI software and processes, which is still being used by the IOI community. Ansible has been used for the development of the automation scripts.
- In IOI 2018 (Tsukuba, Japan), the contestant machines changed back to laptops (provided by Acer as a part of sponsorship). The contest management system was CMS version 1.4 but with adapted modifications and improvements. Some of the tools developed in IOI 2017 have been adapted for the new procedures. Japanese HTC was the first who decided to run services in the cloud. There was a thoroughly designed model tailored for AWS, which was reviewed and accepted by ITC. The automation tools used in IOI 2018 were developed on Ruby based scripts.

Having such a variety of options actually was good for the analysis. It would help retrospectively evaluate each option and choose the best one. The collection of the information started in 2017, during Azerbaijani delegation's visit to Tehran for IOI 2017, where the discussions with Russian and Iranian HTC started. Both HTC chairs were kind enough to provide all the documents that they had about the preparation i.e. checklists, lessons learned, preparation plans and technical details.

Key takeaways from the previous IOIs were:

- 1) Having all the contestants in the same contest hall simplifies the administrative and technical tasks. Finding a venue with a given area, number of meeting rooms (for the committees), required lighting, entrance and WC for ~400 people and flexible infrastructure for the stage design is a challenging task. After evaluation of the previous options, it was decided to use an indoor sport hall. The best match was National Gymnastics Arena (NGA) in Baku, which:
 - a) Was equipped technically (power and IT).
 - b) Had enough meeting rooms.
 - c) Had an Athlete's Village (AVL), where we decided to accommodate the contestants, on the other side of the road (there also was an underground crossing from the village to the NGA).
 - d) Was in the perfect location – on the crossroads of the city entrance, right next to the metro and bus station and in a straight, 6–7 km way to the hotel (leaders' accommodation).

- 2) Accommodation of all the visitors is another challenging task – where to place ~700 people? Hotels usually do not have that many rooms. Even if they had, it would be quite expensive. Splitting people into two hotels would add extra administration and transportation costs. Considering this, we decided to split visitors into 2 groups:
- a) Team leaders, committee members and guests in a hotel.
 - b) Contestants and their guides in AVL.

By this solution we solved several problems at once:

- Isolated contestants from the others not by the venue but by the distance too.
- Managed to accommodate contestants from the same teams in the same apartments (with 3 or 4 bedrooms).
- Accommodate contestants as close as possible to the contest hall.
- Save on accommodation and transportation costs.

The last item is very important – accommodation cost is the biggest piece in a cost distribution pie chart report.

- 3) Transportation is a bottleneck in all the processes. Arrival of the buses, their parking space, distribution of people and their gathering, driving time is always a waste that does not add a value to the process. We tried to eliminate this Muda (means “waste” in Japanese, from Lean Management) whenever possible. Our bigger achievement, again, was finding a contest hall and contestants’ venue very close to each other. The local authority’s recommendation on using transportation for the safety of contestants was successfully replaced with using a nice and even safer underground pass that connects AVL and NGA.

4.1.3. *Visiting Japan for the Observation and Participation in Technical Works*

After observing the process of IOI 2017 in Tehran and participating in the discussion as ITC members, it was decided to attend IOI 2018 before the contest and participate in the technical preparation works. IOI 2018 committee heads were very kind to accept this request and organized this process, such that our HTC chair arrived almost a week before the contest. The observation of the process was priceless. This is usually never shared with the committees that are mainly interested in the ‘what (is done or remains)’ question, rather than the ‘how (have you done this)’ question.

There were some modifications in Japanese implementation that made this process even more exciting (well, risky too):

- Using AWS infrastructure.
- The preparation of the contest hall started 3 days before the event date! Some of the previous HTCs would repeat that 2 weeks might not be enough for the contest hall works (network, furniture, setup, testing, etc.). Here we had only 3 days for it! Well, actually, they managed to finish it in 2 days, which convinced me of the power of organization and planning (“Flow” in Lean Production).

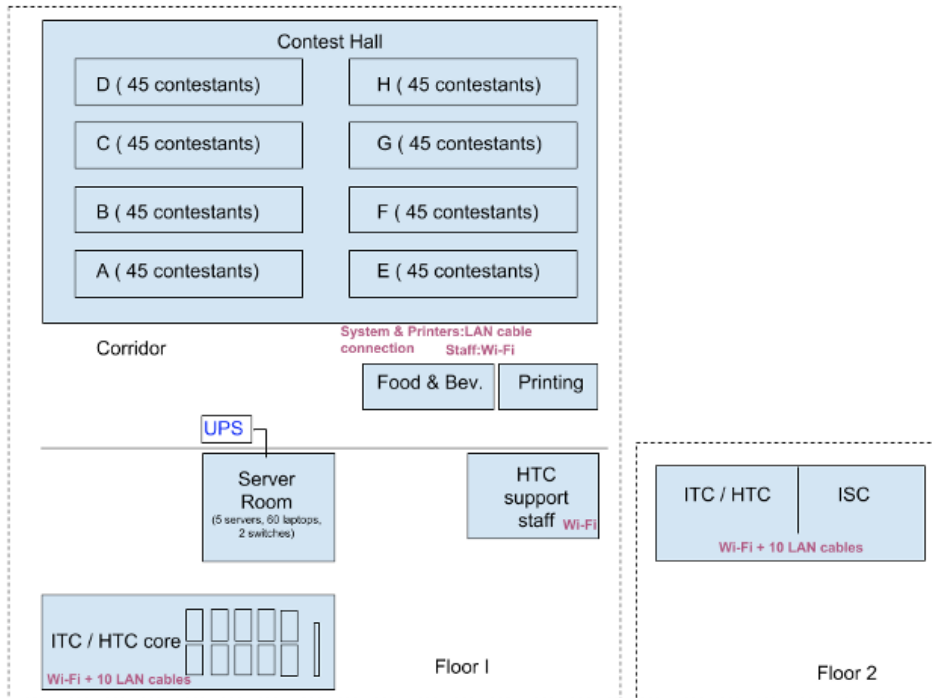


Fig. 3. The floors plan of the IOI 2019 contest hall in the National Gymnastics Arena.

These are the takeaways that we got from our observation:

1. From the floor planning, networking and troubleshooting point of view, indoor sports hall is the ideal venue for the contest. Division of the contest hall into 8 sectors (A–H) with 46 seats in each (a dedicated 48-port network switch per sector) was also adopted from the IOI 2018 design.
2. It is possible to set up a contest hall in 3 days. It requires good selection of reliable suppliers, good planning and coordination. In this case, the power engineers, network guys, furniture company and HTC team will work in an aligned way. It can be imagined as shifted signals i.e. when one line of desks are put, the network and power engineers would put cables, and HTC team guys put laptops on the desks and plug them to power cords and network cables. And meanwhile, the next row of the desks was placed next to each other.

With this strategy we managed to finalize our setup in 3 days! It wasn't to beat the Japanese record, but having the same constraint. We had another event that finished a week earlier. Dismantling their stuff took exactly 3–4 days (In Tsukuba, they had a badminton contest that finished 4 days before the event).

3. In IOI 2018 the HTC was split into two parts and each of them had a coordinator: organization and technical. This isolation is a great idea, since problems during the real contest usually appear on both sides at the same time.
4. Japanese HTC used Slack for general messaging (different channels for different purposes) and push-to-talk for the organizational team. We adopted both

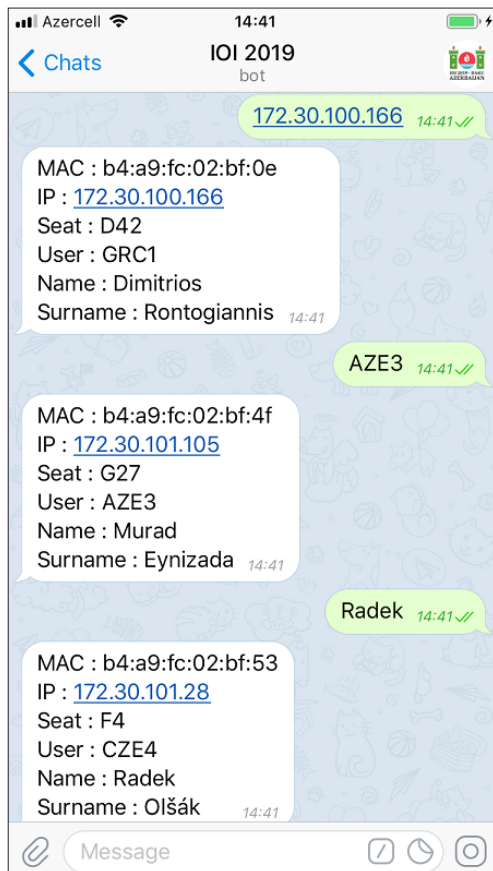


Fig. 4. The interface of the IOI 2019 Host Technical Committee telegram bot.

strategies but also added Telegram as an alternative. Telegram bot was used to locate the contestant by the IP, country, seat number or name (screenshot in Fig. 4 source code is shared in GitHub repository (IOI, 2019d)).

4.1.4. Rehearsal

Plan is a theoretical flow of the actions that considers the usual course of actions. It is always a good idea to run the action items in reality or at least simulate them. All the activities, from the hypothetical to routine works have been run in all the venues. Based on those experiments we adjusted our estimates on what is the actual time to set all the contestants at their desks, deliver a printed paper to a contestant, move from a server room to an IT meeting room, print translation copies for several countries and so on. Some of those experiments led to some changes in organizational setup. For example, it was realized that the food and beverage and the printing corners are not set optimally. Speaking of Lean principles, this is what is mentioned as “Form” (or “Kata” in Japanese).

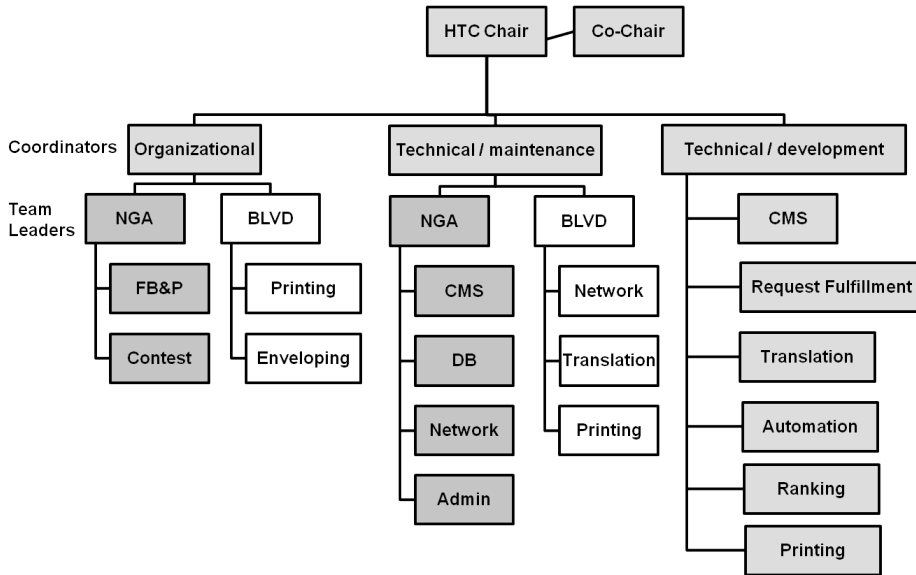


Fig. 5. Organizational structure of the IOI 2019 Host Technical Committee (NGA – National Gymnastics Arena, BLVRD – Boulevard Hotel).

4.1.5. Utilization of University Resources

The organization of an international event of such scale requires a decent workforce and other resources. When hosting organization is university, the majority of the required resources can be delivered by university, such as:

- Core HTC team. In IOI2019, the core HTC team had more than 60 people and almost all of them were from ADA University (3 faculty members, 3 people from IT department and others were undergrad students). We outsourced only the networking part. The structure of the HTC can be seen in Fig. 5.
- Procurement and Finance tasks had been done by the corresponding departments of the university.
- University’s classroom and labs have been used for the meetings and contest environments.

4.1.6. Formal Processes and Procedures

With more than five functional teams (see Fig. 5) and numerous activities under each, asking everybody to memorize all the steps and conditionals wouldn’t be the right choice. Additionally, acquiring new members and transferring members from one team to another is common throughout the process. Considering this, we decided to follow the ISO recommendations for the service quality: document what you do and do what is in the document. The majority of the technical processes are described in the “HTC Procedures” document located under the “Project docs” folder in (IOI, 2022). It helped us to speed up the onboarding process of new team members by just referring to the corresponding procedure.

4.1.7. Acer Sponsorship

Acer sponsorship is mentioned in the organization part. By having this opportunity we gained multiple benefits, putting cost savings aside:

- Had almost exactly the same contestant environment as in the previous IOI. We were familiar with user experience and common questions.
- Had a great technical support by the local Acer team. This sponsorship was not limited only to contestant laptops as all the grading machines and server equipment were from Acer, too. There was a case, when we needed to replace a network card – thanks to local Acer support we had it in NGA in less than half a day.

4.2. Things that did not go as Expected

There were some problems that affected the overall quality of the event, too. When analyzed, we can see that these are the tasks or processes that have been overlooked during the planning phase.

4.2.1. The Network Structure wasn't Built in an Optimal Way

The whole contest network has been designed as a ring i.e. from the system room switch to switch A (connecting contestant machines in section A), from switch A to switch B and so on. This creates serious problems during the mass updates and imaging. Ideally, it would be correct to run imaging for each section separately, which would be 8 times faster than we had. The main problem here was that the technical solution provided by the network supplier was not reviewed by the responsible member of the HTC team. Solution to this could be adding a checklist like “make sure the network design does not conflict with the HTC processes”.

4.2.2. Lack of Synchronization with the HSC

Unlike HTC, our colleagues from HSC did not use formal communication or project management approaches. The outcomes of their discussions were usually documented as meeting notes or discussion logs. As HTC we have been constantly asking them to share the details on the given process.

As a result of such de-synchronization, two surprises arose: one during the day 2, when it was unexpectedly announced that the contestants needed some software for the visualization and another when the translation results ended much later than expected.

4.2.3. Communication Problem with Vendors

It's impossible for HTC to do all the work using its own organizational resources, as network equipment, furniture, printers and many other things are feasible to rent rather than to buy. For that very reason you need to work with suppliers. In our case, we had a

hard time convincing them all to use the standards applied by HTC or use formal project management. Each of them had their own understanding on projects, planning and standards. It would periodically bring surprises during the preparation phase. One of the critical cases was when the event organizer, responsible for printing the team/contestant labels used the old version of the file and as a result we received complaints during the practice day.

As a preventive action (of course for the future organizers) we recommend adding one more requirement to your RFPs: the project manager from their side needs to be formally certified in Project Management. Well, it might be disputed with a counter-argument that not all the certificated Project Managers are good ones, but you as an HTC chair will know that this person is going to speak the same language with you.

4.3. New Translation Procedures

The Translation Process is the most challenging one for HTC, with the following complexity factors:

- All the other committees are involved too – the process mainly led by HSC, regulated by ISC and IC and supported by HTC.
- Is the hardest process to plan and hence to automate – the flow of the process highly depends on participants and their discussions.
- Not limited in time from the organizational point but has to finish until the next contest – very short call for HSC and HTC.

Despite the mentioned challenges, there is a space for the automation of some part of the process. In 2017, Iranian HTC has put great efforts on optimizing and automation of the possible Translation processes (IOI, 2017):

- *Task Preparation System* has a nice web interface with the functionality of preparing the contest tasks and task statements.
- Translation System is a user-friendly markdown editing environment for translating the IOI tasks, with parallel view, PDF generation, notification system, and revision history.

In IOI 2018, Japanese HTC used the same tools but made modifications based on the previous comments and new requirements.

In IOI 2019, the Iranian version of the Translation system was used as a base for many core functionalities. Additionally some new features were added, such as:

- Monitoring of live translation and printing status of each team (can be projected on a big screen).
- Automatically mapping each student's preferred language (if provided early) to the printing system, so that it prints specifically in that language.
- Optionally, being able to print all the team tasks at once (merged printing), so that teams do not have to wait in lines for every student's copy.

4.4. Summary

Using previous experience will optimize and increase the quality of processes. The project documents, processes and all the other supplementary data used and generated by HTC can be found here (IOI, 2019d). Additionally, we would like to list some problems that would be good to fix for the next onsite events:

1. Minimization of the translation time. Long discussions and late contribution to the translation delays the printing and packaging process. Azerbaijani HTC raised a question of using the resources of IC, ITC and ISC to translate the tasks before the translation session. Back then there were committee members that spoke languages used by more than one country: Spanish, French, Russian, Arabic and Persian.
2. All our negative experiences are documented in the “Lessons Learned” document located in “Project docs” in (IOI, 2019d).
3. Printing of task descriptions seems redundant – it seems the contestants do not use them much. After the contests, we saw many unopened envelopes or opened envelopes with task descriptions inside. It could be surveyed and if 70% of the contestants do not need printed task descriptions, the printing process can be removed from the translation process. This would simplify and shorten the translation process. The students who need printed papers can print them on demand during the contest.
4. Some tools are required to be developed to improve the efficiency. Based on the previous experience, we decided to develop a custom application for the registration and fulfillment of the contestant requests. It helped to categorize, filter and measure the requests related data: each request had an assigned person (in a pull mode) which helped us to estimate the average resolution time for each type of request after 40 minutes of usage. A screenshot of this application is shown in Fig. 6.

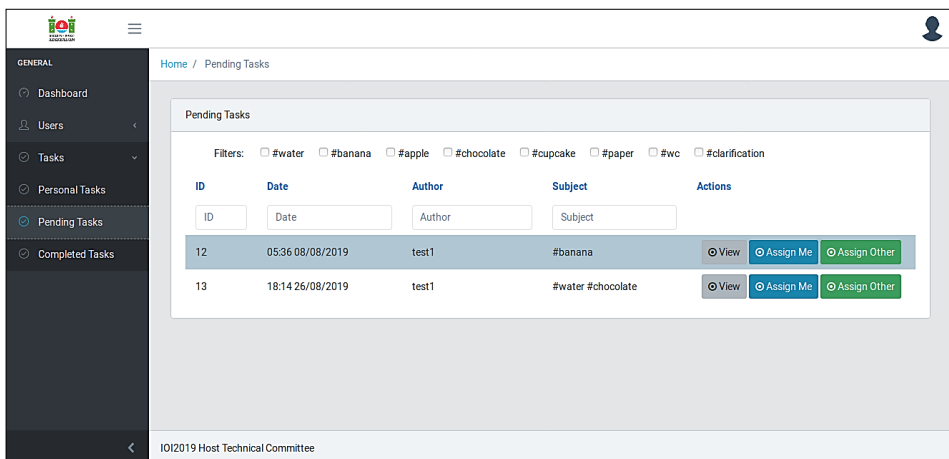


Fig. 6. The interface of the IOI 2019 request fulfillment tool.

Conclusion

The previous sections mention a number of recommendations based on the organizational, scientific and technical aspects of our IOI 2019 experience. Additional notes would be:

- Adapting the formal project management approach to organizing future IOIs with a regularly updated centralized repository of document templates will ensure both standardized knowledge transfer and increased quality.
- There is an educational component to be explored. For example, the experience of IOI 2019 was used as a case in IT Project Management (INFT 3609), as well as Systems Analysis and Design (INFT 2303) courses taught at ADA University.
- While the world is going through dramatic changes, we should be reminded that one of the IOI objectives (IOI, 2019b) is “to foster friendly international relationships among computer scientists and informatics educators.” While putting the main emphasis on the competition component of the IOI, we should not lose the focus on all objectives. IOI Conference and Cultural Night initiative will gain additional meaning and importance.
- A centralized content management system for building official IOI websites would save host team’s efforts for setting up this important communication channel, resolve the issue of archiving the historical content, and ensure a consistent look and feel.

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