

Introduction History and Operational Performance of the Infection Control Business Support System “Tokyo 2020 ICON”

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The Olympic and Paralympic Games Tokyo 2020 were held amid the lingering effects of the coronavirus disease 2019. This article reviews the development project and operational performance of the Infection Control Business Support System (Tokyo 2020 ICON), which was introduced at short notice, to implement entry procedures for the international Games stakeholders in cooperation with the national government and the management of health conditions and screening test results of the stakeholders and staff. The primary users of Tokyo 2020 ICON were the managers in charge of the infection control operation in each organization. This article also analyzes the success factors and lessons learned in the project to introduce the most extensively used digital tool in the Games operations.

Keywords : Information system, Personal information management

1. Launch of the Project

It was expected that the number of participants in the Olympic and Paralympic Games Tokyo 2020 (hereinafter referred to as “Tokyo 2020 Games”) would reach several hundred thousand, including athletes and sports officials and Japanese and international broadcasting and media personnel and officials from partner companies involved in preparations and operations of the Games. Therefore, studies began in the summer of 2020, during the postponement period of the Games, in cooperation with the national government, to resolve issues such as managing the health condition of people visiting Japan

and how to prevent the outbreak of infectious disease clusters during the Games.

On the other hand, when the decision was made to postpone the Games (March 24, 2020), only four months were left before the Games, and the information system to be used in the Games’ operations was almost complete. There was a concern that implementing a completely new system design on a large scale and in such a short period, even for measures against infectious diseases, would entail significant risks to the stable operation of the entire information system and information security governance.

Therefore, in considering the requirements for infectious disease control operations in cooperation with the government, the concerned parties first agreed to use the design of the existing system infrastructure of the Tokyo 2020 Organising Committee (hereafter referred to as the “Organising Committee”) as a base. Then, we prepared a system for the agile development of an application that would meet the new operational requirements and worked on the project.

This article summarizes the project from its launch to

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the performance achieved throughout the system operation period.

2. Requirements Definition and Project Structure

2.1 Main Functional Requirements

In the summer of 2020, shortly after the coronavirus pandemic began, several event organizers and local governments had already developed and introduced some trial applications that could contribute to preventing the occurrence of infectious disease clusters. These applications can be used for officials and spectators (entering a specific venue or event) to input their health conditions information ahead of the events and manage them. Referring to such cases, the relevant sections of the Organising Committee began to consider the related requirements for the Tokyo 2020 Games.

The government was also planning to develop a smartphone application to confirm the health condition of visitors during the immigration process, not only for those involved in the Games but also for overseas

spectators coming to Japan to watch the games. The government and the Organising Committee agreed to create synergy by linking the back end of this application with a new information system to be developed by the Organising Committee for the use of personnel in charge of infection control operations in each organization. Expected synergy effects were: the government to meet its immigration control requirements for the Tokyo 2020 Games with a minimum of development effort and operation by using the information system which is developed by the Organising Committee, and the Organising Committee to meet its requirement of health condition management of people involved in the Games by saving the effort in developing a separate end-user application and utilizing the government-produced application instead.

Based on these backgrounds, the functional requirements for the new system to be developed by the Organising Committee were agreed upon as follows: (1) to manage all “Schedule of Activities in Japan (Note 1)” to be submitted by the international Games stakeholders, (2) to manage the health condition and alert

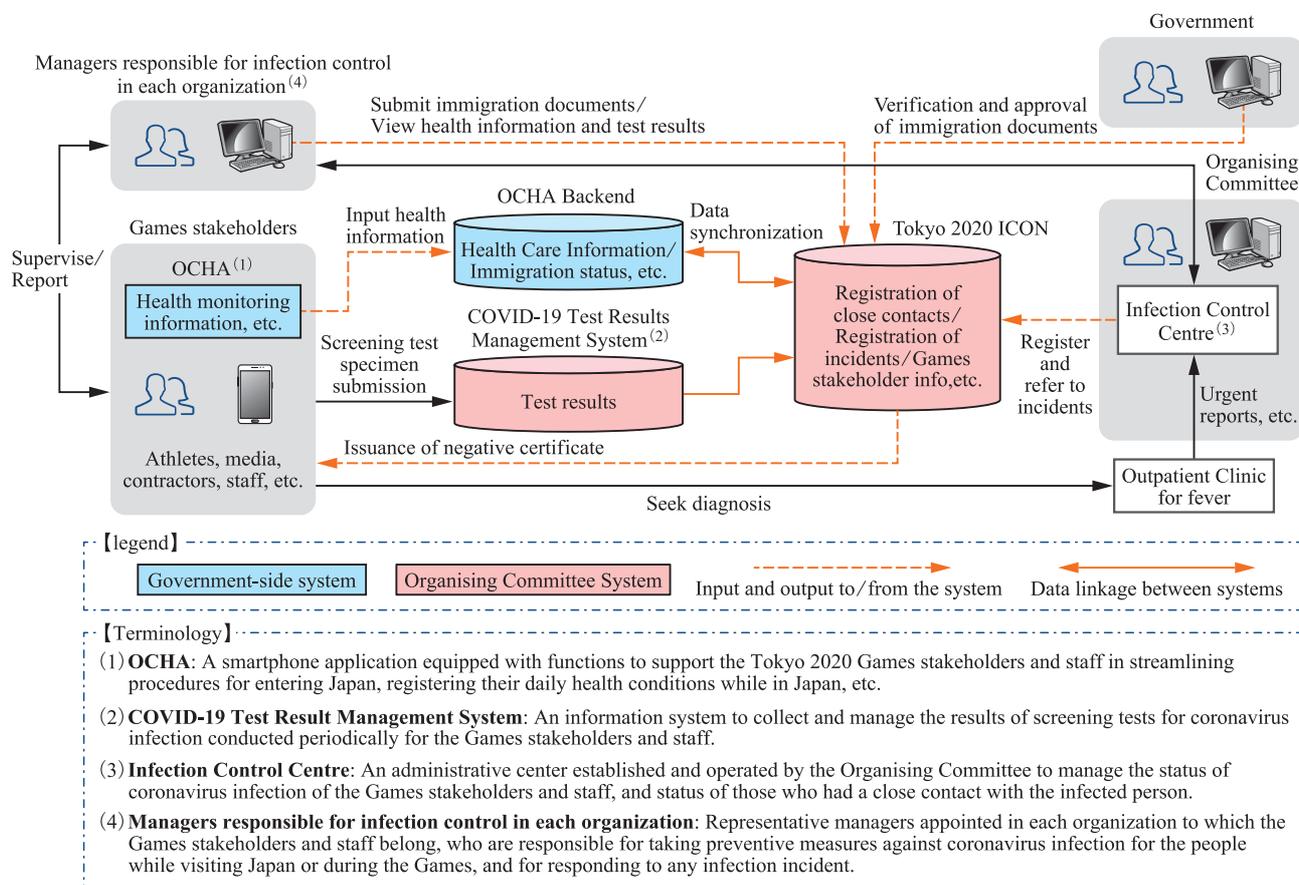


Figure 1 Infection Control Business Support System, Tokyo 2020 ICON

Table 1 Main Functions of the Infection Control Business Support System, Tokyo 2020 ICON

No.	Function name	Description
1	Management of the Schedule of Activities in Japan ^(Note 1)	The responsible manager in each organization submits the Schedule of Activities in Japan required for entry of the members, and the government notifies the approval result accordingly.
2	Management of Health Condition	Daily health condition which was entered into a government-developed smartphone application is visualized to the responsible managers in each organization and Infection Control Centre. Poor health condition and missing information are automatically detected and alerted.
3	Management of Screening Test Results	Results of screening test that the Games stakeholder and staff periodically taken are visualized to the responsible managers in each organization and Infection Control Centre.
4	Management of Incidents (Positive Test Case)	Associated information of test-positive persons (date of onset, date of test, inpatient care facility, close-contacted person, facilities visited, etc.) are recorded and shared with relevant parties.
5	Issuance of Negative Certificates	Negative test certificates which are necessary upon return to the home countries are issued based on the latest screening test results.

(Note 1) Schedule of Activities in Japan: Advance declaration of the subject's activity plan for the first 14 days after entry into Japan, including where to stay and where to go.

function in the case of health abnormalities, (3) to manage the screening test results, (4) to manage incidents (case of positive test results). These requirements were mainly from the managers responsible for the infection control operation in each organization. This system was named Tokyo 2020 ICON (Infection CONtrol) (Figure 1).

In early July, when Tokyo 2020 ICON was completely operational, a possible problem of issuing a large volume of the new coronavirus negative test certificates (hereinafter referred to as "negative certificates") at medical institutions was identified. That is, when the number of international people involved in the Games would return home simultaneously after the closing ceremony at the beginning of August, the capacity of medical institutions in the city to perform tests and issue negative certificates requested by the governments of their home countries was assessed as insufficient. Then, a fifth functional requirement to issue negative certificates by referring to the recorded latest test results was added to Tokyo 2020 ICON (see Table 1).

In addition to the personal information of Games stakeholders (passport numbers, dates of birth, and other information necessary for the issuance of accreditation cards) that has been managed by the Organising Committee since past Games, Tokyo 2020 ICON was designed to handle more sensitive personal information, such as daily health information, screening test results, and information on close contacts of the infected person. Consequently, it was required to carefully study the system design, operation, and rules for handling personal information and deliberately explain the system and associated operations to the concerned people and organizations.

Therefore, it was clear that the Organising Committee needed to have a substantial structure to ensure that these requirements would be realized, and the system would be introduced by the deadline and operated without significant incident.

2.2 User Authentication, Access Control, etc.

As a requirement for the government-provided smartphone application (OCHA), it was decided to implement it as a native smartphone application to prevent user spoofing in the immigration process. On the other hand, the government requirements which need to be met by working with the Organising Committee were first to ensure the identification of Games stakeholders and to control the use of the application so that it cannot be activated without prior approval of the "Schedule of Activities in Japan", and to enable the application to recognize specific Games stakeholders if their registration was cancelled for some reason.

Tokyo 2020 ICON requires multi-factor authentication for access due to the system's feature, which allows authorized persons in charge of infection control operations to access a large volume of personal information in managing the daily health conditions of the members of each organization. Furthermore, it was designed so that the highest authority level to access all Games stakeholders and staff information is available only over a specific VLAN (Virtual Local Area Network) to strengthen security measures further. (administrator authority granted to the Organising Committee's Infection Control Centre.) In addition, data encryption was implemented for particularly sensitive data fields (e.g., screening test results).

2.3 Project Structure

The Organising Committee originally had a framework composed of the Software Factory and the Center of Excellence (CoE) for agile development and operation of the numerous information systems required for the Games operation. Therefore, it was most reasonable to significantly strengthen the existing framework for developing Tokyo 2020 ICON at the start of this project. Also, we decided to extend and use the database of the Games stakeholders and staff (named Participant Database) for Tokyo 2020 ICON. This is because the database had already been constructed for different business applications, and all data were supposed to be registered in advance through the accreditation system.

In addition, to collect and manage additional sensitive personal information, it was necessary to identify legal requirements from the perspective of personal information protection and medical information management and to define requirements and rules from the perspective of system design and operation. In parallel with the launch of the development project, a study team was set up, consisting mainly of consultants with experience in information system audits and the legal staff of the Organising Committee (Figure 2). This team provided advice on requirement definition and privacy policy formulation and assistance for preliminary explanations and coordination of business requirements with the IOC

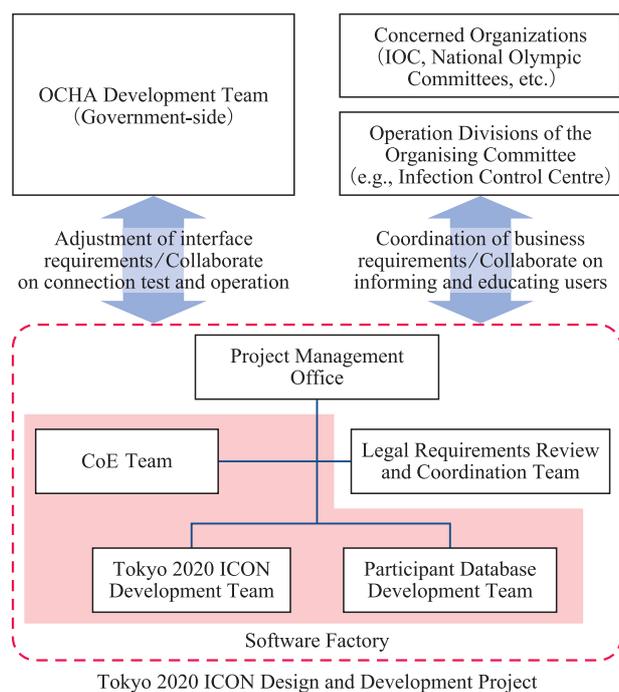


Figure 2 Tokyo 2020 ICON Design and Development Structure

and other concerned organizations. This framework and structure contributed to the successful completion of the development project without rework, even in a limited period and under strict deadlines.

3. Operational Performance

3.1 Major Results during the Operation Period

Tokyo 2020 ICON was released in three phases in response to an increasing number of Games stakeholders coming to Japan for the Games (Table 2). All Games stakeholders, both Japanese and international, were registered in Tokyo 2020 ICON for health management and incident management in the event of a positive test result. On the other hand, the primary users of the system were managers responsible for infection control

Table 2 Tokyo 2020 ICON function release schedule

Date	Events	Release/Close function
Year 2021 May 31	Primary release	Release : management functions of the Schedule of Activities in Japan
June 24	Secondary release	Release : management functions of health condition/management functions of screening test results/management functions of incidents
July 25	Additional release	Release : issuance function of negative test certificate
August 11	System mode switch from Olympic to Paralympic Games	
September 12	Part of functions close	Close : function of submitting the Schedule of Activities in Japan, etc.
September 20	Further functions close	Close : all functions for external users
September 23	Complete system close	

Table 3 Tokyo 2020 ICON usage results

Item	Result
Number of users	5,600 organizations registered, 6,900 responsible managers for infection control registered
Immigration entry handling	Approval of the Schedule of Activities in Japan for 14,000 cases or 65,000 persons
Health information management	1.79 million cases or 69,000 persons
Screening Test Results	920,000
Incidents managed	1,300
Negative certificates issued	53,000

operations in each organization and those in the Infection Control Centre of the Organising Committee, and a total of 6,900 of these managers were registered. A vast volume of information was registered and managed during the operation period, including 1.79 million health management cases, 920,000 test result management cases, and 1,300 incidents (Table 3).

The health management status of the Games stakeholders and staff in each organization and the occurrence of positive screening results were visualized in real-time using the dashboard function. This was utilized by the responsible managers in each organization and the Infection Control Centre for their work, including the status report given to the public (Figure 3).

3.2 Problems in Operation and Response to Them

Tokyo 2020 ICON was operated stably throughout the entire operation period. On the other hand, there was significant confusion due to the lack of prior explanation about related procedures to the Games stakeholders. Examples of this are the pre-registration procedures for visitors to Japan which were also required in conjunction with the introduction of this new system, and the user authentication procedure when activating the smartphone application, OCHA.

The number of visitors to Japan peaked in mid-July (Figure 4). A little earlier than this peak, in early July, the call centre began receiving many complaints that OCHA could not be activated even after the necessary

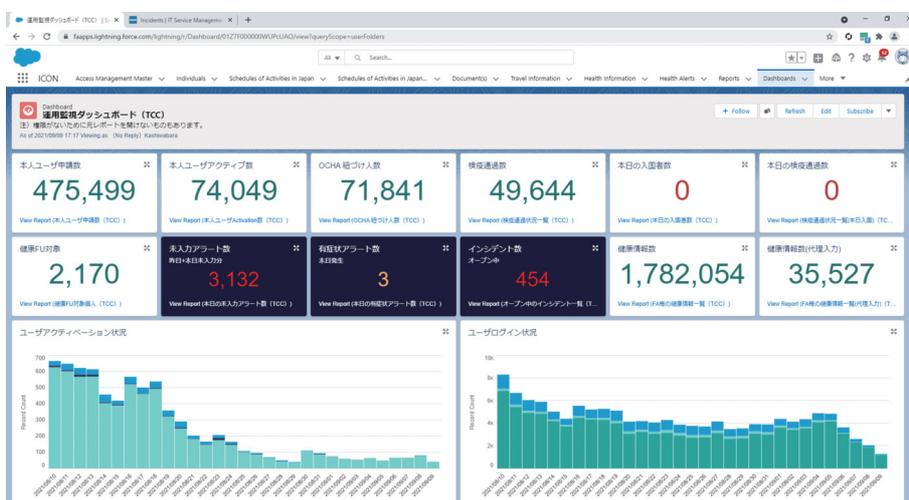


Figure 3 Tokyo 2020 ICON Dashboard Screen

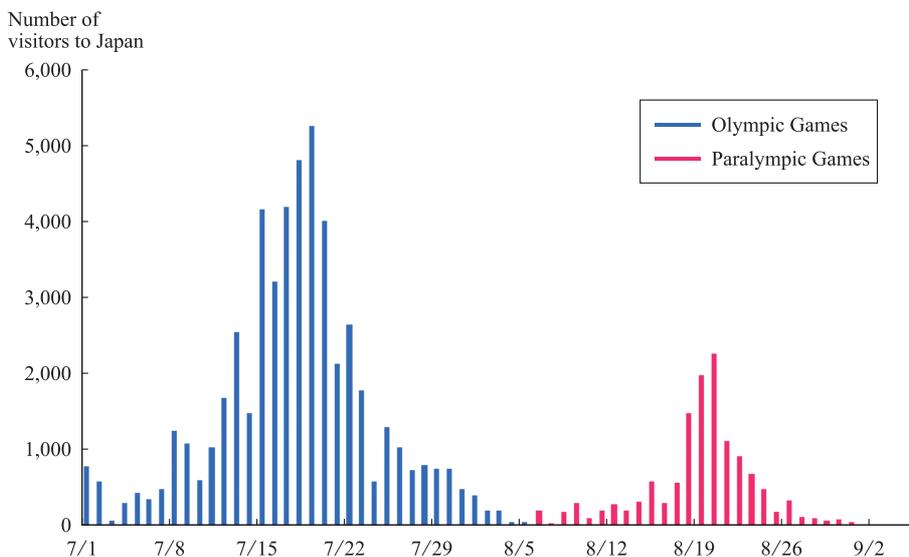


Figure 4 Trends in the Number of Entrants Based on the Schedule of Activities in Japan

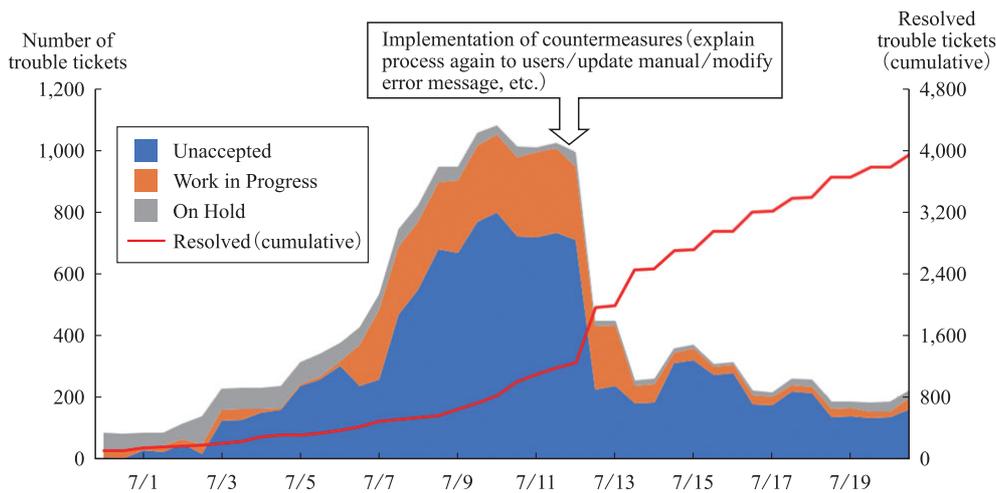


Figure 5 Trends in the Number of Cases Handled by the Dedicated Call Centre

information had been entered. At its peak, there was a backlog of nearly 1,000 problem cases that remained unresolved, but an investigation revealed that about 80% of the problems were caused due to “user registration not completed in advance”. Why this happened is described below. Tokyo 2020 ICON needs to be set up in advance so that the designated managers in charge of infection control operations in each organization are authorized to access the personal information of their members. As some organizations have several thousand members, it is necessary to have multiple managers designated on a pre-registration sheet and to clarify who can access the personal information of which members in the organization. If the registration sheet was not completed, the OCHA and Tokyo 2020 ICON could not be linked, resulting in many problems that prevented OCHA from activating correctly.

In response to this emergency, we reiterated the necessity of pre-registration to each organization and distributed an updated manual to make the registration process easier to understand. We also modify the error message, which is displayed when the pre-registration was not completed, to be a more recognizable expression. With these measures implemented, the number of backlogs at the call centre reduced significantly (Figure 5).

The final problem that required individual support was the inability to activate the application due to errors in basic personal information (e.g., incorrect passport number, middle name) that each organization had pre-registered in the accreditation system at the very beginning. In past Games, if there had been a mistake in the information registered, it was dealt with by reissuing

the accreditation card. This was handled at the accreditation service counter by verifying the identity of the person and correcting the data recorded. However, when the same registered information is used for identification in online user authentication, as in this case, the individual cannot easily correct information that is not correct on the spot. In many cases, the registration information could not be corrected in time, so the applicants needed to bring a separate article document to prove that their application for entry had already been approved.

3.3 Lessons Learned and Areas for Improvement

Operations at the Tokyo 2020 Games, which were held in the shadow of the coronavirus pandemic, were much more complicated than in past Games held under normal circumstances. This includes the specialized procedures at the airport, such as immigration inspection, screening tests, and handling of special vehicles for transportation. Despite such complexity, the immigration procedures using OCHA correctly, in conjunction with Tokyo 2020 ICON, were confirmed to be very smooth. This was the case observed especially in the latter half of the Olympic Games period and during the Paralympic Games period, as the process had matured. Although the preparation period was short, it is regrettable that the confusion at the beginning of the operational period could have been avoided if more preliminary reviews and rehearsals from the user’s perspective had been conducted and if the improvement measures mentioned above had been introduced earlier.

In addition, we noticed that the information of the people involved in the Games and registered in the

accreditation system could be a valuable database that makes sense not only for infection control measures but also for various potential information services. Considering that there are a certain number of people who continuously participate in multiple Games, such as Games and media officials, if this information can be taken over and fully utilized with the consent of each individual, it could further improve the efficiency and serviceability of Games management through the use of digital tools. For this purpose, it would be desirable to develop a Customer Relationship Management platform for future Games that guarantees the accuracy of registered information and securely transfers or updates the information from one Games to the next.

4. Conclusion

The Tokyo 2020 Games, held in the aftermath of the coronavirus pandemic, introduced and utilized more new digital tools than any past Games, including tools other than Tokyo 2020 ICON discussed in this article. Examples include (1) a function added to the Games information system (myInfo) to stream daily press meetings and athlete interviews and (2) a reservation system to avoid dense crowding and maintain social distance in interview areas.

Tokyo 2020 ICON, which is the most extensively used and largest-scale system as well as the core tool of infection control operations, has achieved secure and stable operation despite its short development time. This was mainly due to the system platform, including the database of Games stakeholders that were already in place, as well as the presence of the Software Factory and CoE that built and operated the system. Although we were unable to mention them in this article, thanks to the support from partners and suppliers involved in the project, we could promptly respond to requests for changes from Games stakeholders even after the system went into complete operation. We want to express our gratitude for the efforts of all who have created such a

flexible development system.

We would also like to take this opportunity to thank the government officials who made a tremendous effort to establish rules and procedures for a large number of Games stakeholders coming to Japan under such difficult circumstances as the coronavirus pandemic.

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