

Summary of Information System and Digital Media for the Tokyo 2020 Games

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This article reviews the overall management of information systems and digital media for the Olympic and Paralympic Games Tokyo 2020. In particular, the article shares the successes and reflections of the project, focusing on the management and governance considerations, architecture, and development system that are necessary when building information systems for large-scale events.

Keywords : Information system, IT governance, Enterprise architecture, In-house development, DX promotion

1. Introduction

The Olympic and Paralympic Games Tokyo 2020 (hereinafter referred to as “Tokyo 2020 Games”) for the first time in 57 years, which were postponed by one year due to the impact of the COVID-19 that spread worldwide from the beginning of 2020, were held without spectators, but ended successfully without any major operational disruptions. As a member of the Information Systems Department of the Bureau of Technology Services, I gained valuable experience in all phases of the Games, from conception and planning, to development, construction, testing, operation, maintenance, and support. This article reviews information systems and digital media among the various technology services provided in preparation for and during the conference.

2. Overview and Governance of Information Systems

2.1 Overview of Information Systems Supporting Games Preparation and Operation

Information systems can be broadly classified into the following three categories as shown in Figure 1: Olympic Diffusion System (ODS), which distributes competition results and measurement results; Olympic Management System (OMS), which supports business operations common to each event with relatively few requirements unique to the host city, which supports the management and operation of the Games; Functional Area Applications (FA apps), which need to be built from scratch by the host city to meet the unique requirements of the 52 functional organizations that will manage the Games or the functional areas of the organising committees that will be in charge of these organizations.

Digital media for spectators included the official website, mobile applications, dedicated websites for ticket sales and official goods sales, and e-mail magazines. Tokyo 2020 Games ID and Customer Relationship Management (CRM) were introduced and operated as the user management platform to support these services for spectators.

Excluding the ODS/OMS mentioned above, the total

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The Journal of The Institute of Electronics, Information and Communication Engineers, Vol.105, No.8, Supplement, pp.116-123, August 2022
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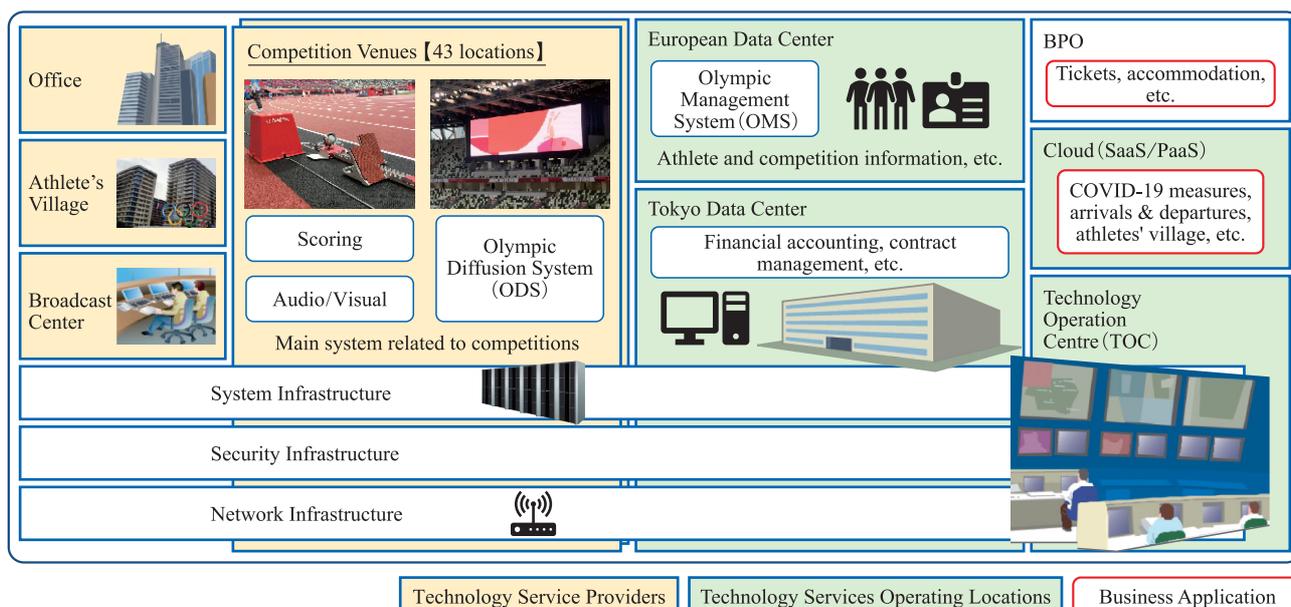


Figure 1 Overall Bird's-eye View of Information Systems (©2021-International Olympic Committee-All Rights Reserved)

Table 1 Breakdown of Business Applications

No	Classification	Number	Remarks
1	BPO destination system	9	Ticket management, warehouse management, etc. Systems used in outsourced operations.
2	Individual IT service contracts	8	Access control, transportation service for related parties, electronic medical record system, etc. Individual IT service contracts.
3	Use of SaaS	7	HR (human resources, travel expense reimbursement, attendance management), education portal, etc.
4	Extranet development	4	Information sharing sites with the Olympic and Paralympic committees of each country, news media, etc. There were about 120 small-scale Web sites developed by non-code development.
5	System development using PaaS	23	Systems developed by low-code development, such as immigration control, torch relay management, lost property management, and the COVID-19 countermeasures.
6	Outsourced system development	15	Financial accounting, contract management, official web/smartphone apps for games, etc.
	Total	66	

number of business applications deployed at the Tokyo 2020 Games was 66, as shown in Table 1. The total number of business applications in the past Games was approximately 60 for the London 2012 Games, 80 for the Rio de Janeiro 2016 Games, and 50 for the Pyeongchang 2018 Winter Games, which were held on a relatively small scale. Since the organizational design and business services for the operation of the Games do not differ greatly from one Games to another, the lineup of applications is almost the same. Although the number is smaller than that of Rio de Janeiro 2016 Games, the extranet development shown in the fourth row of Table 1 utilizes a non-programming development platform,

and the total number of systems is 120. Therefore, the total number of systems can be considered one of the largest ever.

As for individual topics, as reported by the International Testing Agency (ITA), an independent international anti-doping testing organization⁽¹⁾, a paperless doping test record management system using tablet terminals was introduced for the first time at the Olympic Games. As expectations for business innovation through DX increase, there is still ample potential for the application of IT in new areas and for its use in future Games.

2.2 Role and Governance of the Technology Services Bureau

2.2.1 Establishment of System Procurement Guidelines

The Technology Services Bureau was literally involved in the provision of all IT-related services for the Tokyo 2020 Games. Its responsibilities include the development of venue networks, delivery of IT equipment, implementation of cyber security measures, and implementation of information systems. As a matter of fact, there were various implementation patterns in addition to the services supplied by the Technology Services Bureau as the lead agency. As shown in Table 1, there are cases where a system of a reasonable scale is used in a Business Process Outsourcing (BPO) contract, in which the business department outsources the business itself to an external party, and there are also cases where a direct contract is made with an external IT service vendor. In light of this situation, a scheme was introduced at the end of 2017 to conduct reviews by specialists from each department of the Technology Services Bureau from the procurement phase. This is mainly an evaluation from the perspectives of cyber security, system quality and project management. The reviews were conducted at three points in the system lifecycle: when requirements were finalized, when the system design was completed, and before the system was released. Excluding the pre-review, about 200 reviews were conducted for the final decision before the system release.

The human resources of the organising committee are limited, and there is no department appointed to perform quality control and quality assurance. Therefore, the best-effort approach was taken by specialists from each department of the Technology Services Bureau. Fortunately, there have been no incidents that have had a significant impact on operations due to inadequate IT services or cybersecurity issues from 2018 to the Games time of 2021. In particular, for procurement by business FAs who do not have specialized IT skills, we believe that we made a significant contribution to governance, including pointing out items that should be included in the procurement specifications and evaluating the appropriateness of the prices. On the other hand, in the case of the system used at the BPO site, there were issues such as insufficient disclosure of specifications from the vendor and gaps in interpretation of requirements because the system itself was not procured.

One more point should be added in terms of quality

control. In particular, in IT service procurement from overseas service providers, although Service Level Agreements (SLAs) were defined, there were some difficulties regarding the availability and promptness of user acceptance testing before release and failure response after release due to differences in the way of thinking about system quality. Even if a Japanese vendor can cover a case as an implicit expectation even if it is not specified in the procurement specifications, it is not possible to expect the same from an overseas vendor. This is not simply an argument of which is better or worse. It should be noted again that the high-quality awareness in Japan, which is sometimes derided as excessive quality, should not be expected globally as it is, and policies and rules should be firmly discussed before the contract is signed and at the project planning stage.

2.2.2 Establishment of IT Solution Selection Criteria

Except for ODS/OMS, business applications are not supplied by the IOC's worldwide partners and must be developed independently by the host city for each Games. For the Tokyo 2020 Games, full-scale consideration of system planning began after the 2016 Games in Rio de Janeiro. Based on a list of all the applications actually developed for the past Games, we discussed the necessity of each system operation of FA, and optimized the budget while weighting the system scales. The Olympic and Paralympic Games are transient events, and systems are often used for only two months before and after the Games. Therefore, the challenge is how to select the most cost-effective and optimal solution. The criteria shown in Figure 2 were developed to promote rational system selection. The concept is to use existing systems as much as possible without creating new ones because of the transient nature of the event.

3. Introduction of Information System

3.1 Implementation Schedule

The Organising Committee, which was created in 2014 as a corporate entity with a limited term, is scheduled to be dissolved in the middle of 2022 after a lifespan of about eight years. Although it started with a small staff of a few dozen people, the number of staff members reached 8,000 during the Games time, and the staff size increased at an accelerated rate each year. In April 2015, the number of staff members exceeded 300, and the introduction of IT services to improve operation-

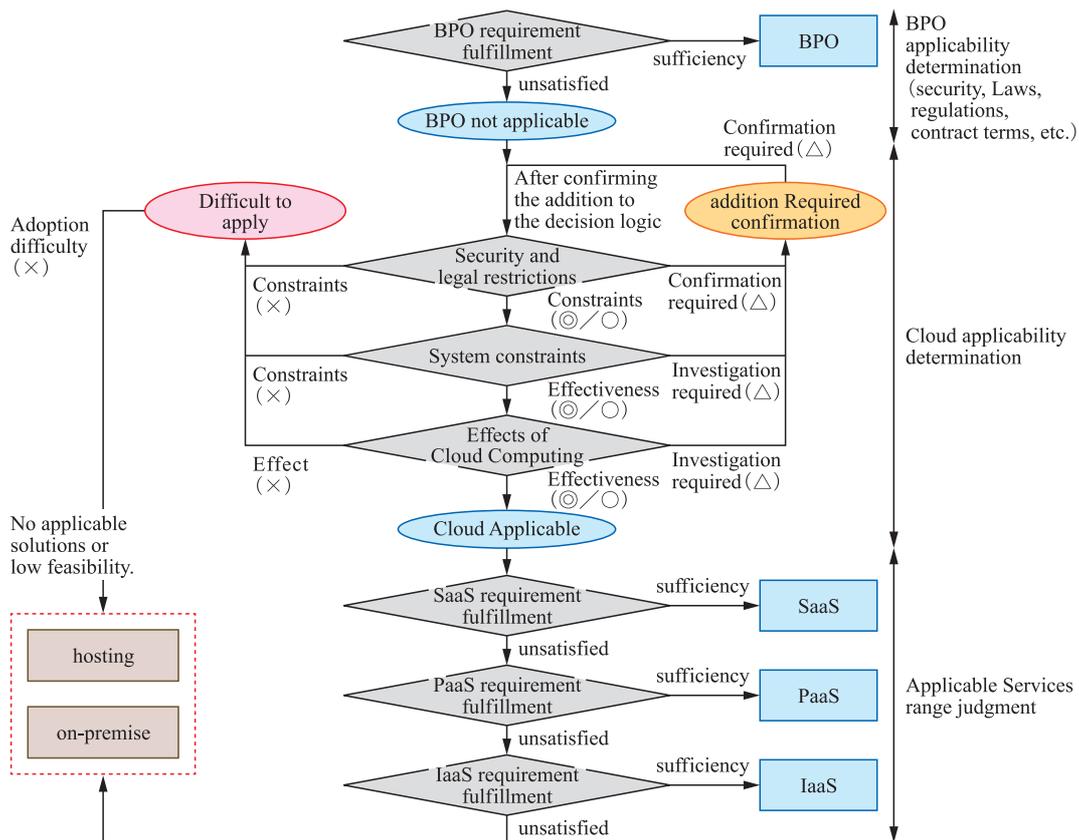


Figure 2 IT Solution Selection Criteria

al efficiency became inevitable. In early 2016, each operational department was drastically increased as shown in Figure 3, the introduction of systems for human resource management, financial accounting, contract management, etc. became necessary first and foremost. At the time, cloud computing was beginning to emerge in the so-called mission-critical systems, but there were few options. The system was built on-premise at a data center contracted by the organising committee because the system was used for a long period of time, until the dissolution of the organization, and because the system architecture for the convention required the implementation of individual measures, especially in terms of security.

From the latter half of 2018 onward, the main task was the implementation of business applications. Some of the business applications, such as torch relay management and rate card management (catalog sales of goods and IT services to convention officials for a fee), were used before the actual convention, but most of them were basically limited to use for a few months during the convention. For this reason, system development was concentrated one year before the conference.

3.2 Examination and Implementation of System and Business Architecture

3.2.1 Introduction of Common System Infrastructure Services

Although the Information System Division built various systems from scratch, it was essential to strategically study the architecture that would serve as the foundation of the system to avoid future bankrupts before implementing and mass-producing the system. First, a cloud-based e-mail service was provided as a comprehensive IT service for the staff, as well as a file server for managing various electronic data. Then, we proceeded with the introduction of the infrastructure functions that support the various IT services. As a common infrastructure for these systems, user authentication and data linkage functions between systems were introduced.

As shown in Figure 4, the services for Games stakeholders were provided in a hybrid architecture that combines on-premise virtual servers and public cloud computing. (For details, please refer to 3-2 of this special issue.)

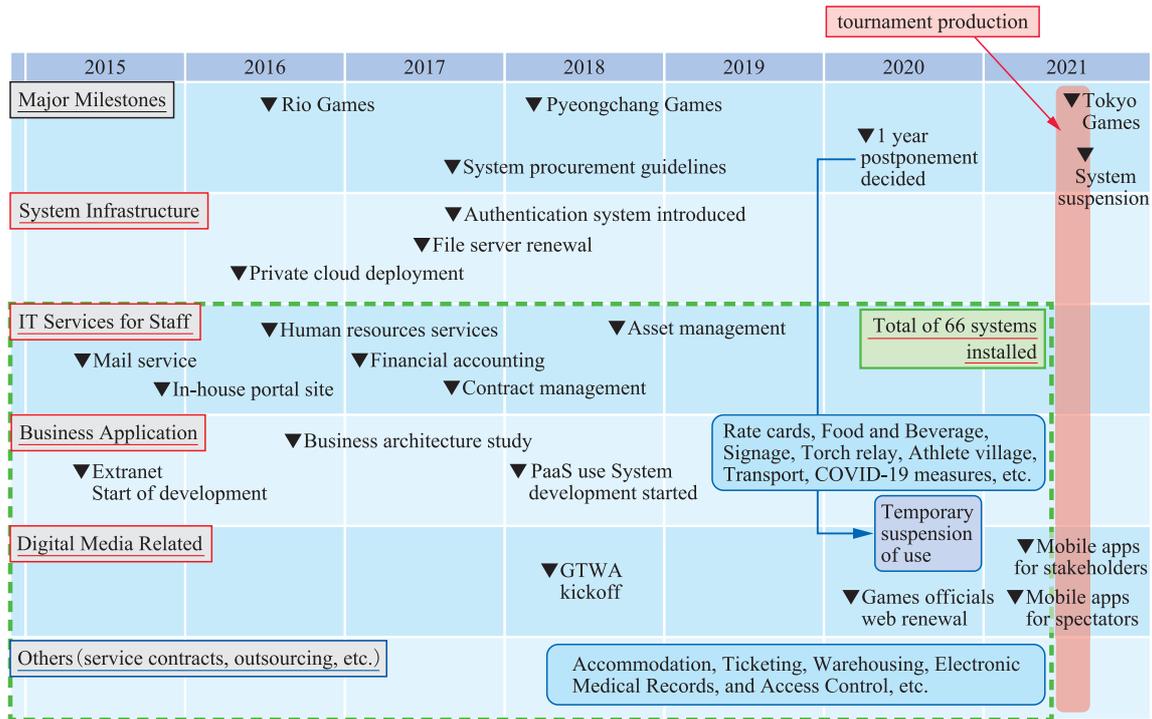


Figure 3 Outline Schedule for System Implementation

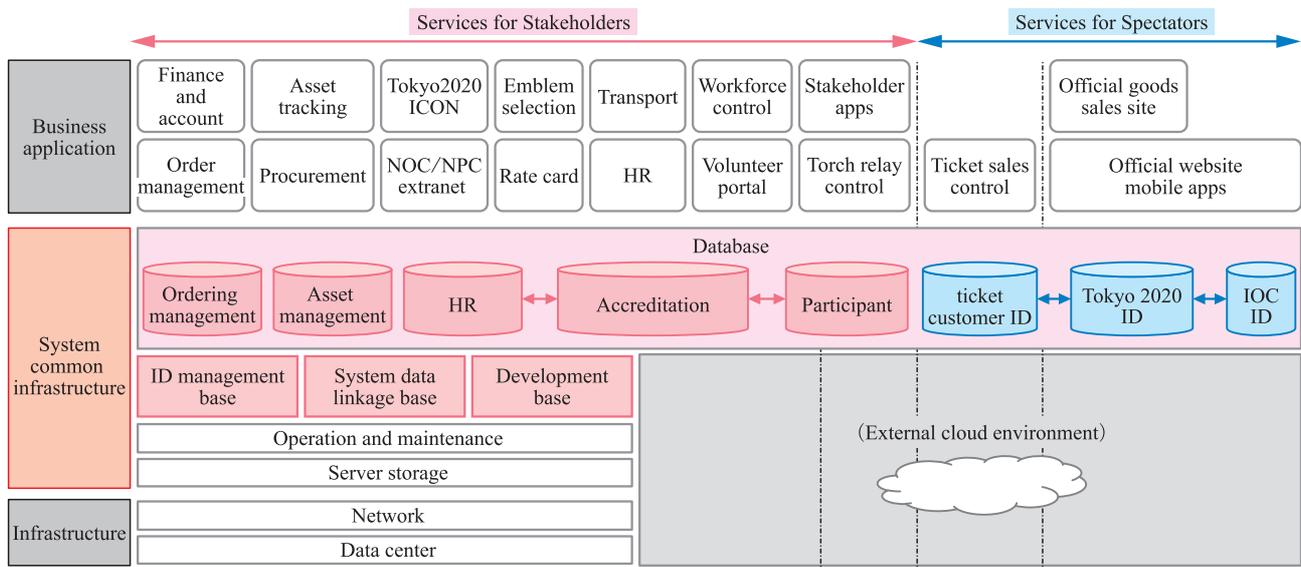


Figure 4 Overview Diagram Centered on the System Common Infrastructure

3.2.2 Business Architecture Design

The core systems, led by the financial accounting system, did not have strong requirements specific to the Olympic and Paralympic Games and could be covered by existing IT solutions, such as the application of packaged software (COTS).

On the other hand, in 2016, we needed to analyze the

business requirements from scratch for managing the FA operations that provide services to the people involved in the Games (humans), such as arrivals & departures, transportation, accommodation, and the athletes' village. Also, we were in a state of complete exploration regarding the operational requirements for managing the many items (goods) required before and during the Games, including the technology equipment

as well as the large amount of sports equipment (from tennis balls to beach volleyball sand) used for competition. The management of “goods” for the Olympic and Paralympic Games was called “event logistics” and had special requirements. All FAs have an operations manual that defines their responsibilities, along with the knowledge inherited from the past Games, but although it describes what to do (what), there is no follow-up on how to do it (how). Furthermore, there is no document that describes the comprehensive business flow across multiple FAs and the boundaries of responsibilities among them. Therefore, in September 2016, immediately after the Rio de Janeiro 2016, we launched a project to study Enterprise Architecture (EA) and analyzed mainly business architecture (BA: Business Architecture). (For details, see this special issue 3-3.)

The departmental design of the Organising Committee consists of 52 FAs in a so-called functional organization. Although each organization started up quickly, there were many scenes in which cross-organizational discussions stalled. This BA study project is one of the roles expected of the Information System Division, which has relationships with all business divisions, although it is a temporary matrix organization. The cooperation of the various FAs helped to realize the motto of the Organising Committee, “One Team”, and this project increased the momentum of the field toward the success of the convention.

3.2.3 Development System for Introduction of Business Applications

The core system described above was developed using the waterfall method. On the other hand, the other business applications, although small in scale, required the simultaneous development of many systems. Because it is inefficient to procure each system individually, in the past Games, a system platform was selected in advance and systems were mass-produced on that basis. The London 2012 Games were based on a website development package, and the Rio de Janeiro 2016 Games used scratch development based on a certain development framework, both of which were on-premise environments. For Tokyo 2020 Games, a PaaS platform that enables low-code development was selected for small- and medium-scale business applications. The platform was called “Software Factory”, and application development was carried out while maintaining a system that included IT engineers under quasi-contractual agreements. (For details, see 3-4 of this

special issue.)

3.3 Introduction of Olympic Diffusion System (ODS), Olympic Management System (OMS), and Face Recognition Technology

3.3.1 Olympic Diffusion System (ODS)

The ODS is continuously provided by the IOC's worldwide partners across multiple Olympic Games and operates closest to competition operations among the many information systems. The Business Impact Analysis (BIA) of the Technology Services Bureau evaluates system failures that could disrupt competitions during the Games as having the greatest impact. Of all the systems, ODS is the one with the highest criticality. In fact, the day-to-day operation of the ODS was rigorously conducted by deploying a system to check the accuracy of the competition results information distributed in real time from 140 servers deployed at each competition site. (For details, please refer to 3-6 and 3-7 of this special issue.)

3.3.2 Olympic Management System (OMS)

The OMS provides distribution of competition results, management of volunteers, management of athletes including competition schedules, and accreditation services. Accreditation is a photo identification card issued to Games stakeholders and centrally manages the authority for all services, including detailed control of the areas where athletes can enter and exit each venue, the availability of food and beverage services in the athletes' village dining rooms, and the service grades of bus and fleet transportation services. OMS is also a system provided by the IOC's worldwide partners across multiple Games, and is a set of systems that implement the specific business requirements of the Games. For the Tokyo 2020 Games, OMS has also been enhanced for web accessibility. (For details, see 3-6 and 3-7 in this special issue.)

3.3.3 Face Recognition Technology and Congestion Detection System

The Tokyo 2020 Games introduced an access control system based on face recognition at all competition venues, including the athletes' village and the International Broadcasting Centre. This control system, which utilizes an IC chip embedded in the accreditation card, has contributed greatly to the efficiency of entrance checks at each venue and the strictness of identity authentication. In addition, a congestion detection

system installed in the main dining hall of the Athletes' Village showed the congestion status to the athletes, encouraging them to avoid the three-density areas and contributing to the thorough prevention of infection. (For details, see 3-7 and 3-8 of this special issue.)

4. Digital Media

4.1 Official Website and Mobile Apps

The Tokyo 2020 Games official website and mobile application (hereinafter referred to as GTWA: Games Time Website and Mobile application), which distributed various information on the Olympic and Paralympic Games to the entire world, successfully completed its services without any system problems caused by cyberattacks. While people around the world were forced to live with severe restrictions due to the COVID-19 pandemic, the distribution of information on the Games through digital media attracted a great deal of attention and recorded the largest number of unique users in the history of the Games. According to a report from a content delivery network operator (2), the streaming playback time via the Internet was more than double that of the Rio de Janeiro 2016 Games. In the past Games, GTWA was established and operated for each game, but from the Tokyo 2020 Games, the scheme was changed to one in which IT services are provided across multiple Games, similar to the ODS/OMS scheme. Digital media will be positioned as an important medium for future Games, and advanced services will be provided in line with the progress of IT technology in the world. (For details, please refer to 3-9 of this special issue.)

GTWA was built through agile development using Scrum. Although it was a difficult project to manage involving several overseas service providers, no major problems in progress or quality occurred and stable services were provided thanks to the teamwork fostered across organizations and companies.

4.2 Tokyo 2020 Games ID, CRM, and Service Linkage

The purpose of CRM is to maintain relationships with people around the world who have expressed interest in the Tokyo 2020 Games. The Tokyo Games were operated in a grand scope, integrating CRM services that had been operated by the IOC for some time. As a result, 8.2 million users registered, almost twice as many as at the London 2012 Games, the largest ever,

contributing significantly to ticket sales and information distribution during the Games. (For details, please refer to 3-10 of this special issue.)

5. Difficulty in Transferring Knowledge to the Next Convention

ODS/OMS are used continuously at multiple Games, and are provided to the next convention after repeated improvements. On the other hand, how to efficiently transfer the knowledge of business applications developed for each event to future events has become an important issue in terms of reducing the cost burden on the next host city. In fact, we were handed over with the documentations from the Rio de Janeiro 2016 Games, but unfortunately this did not lead to significant cost savings because the deliverables were too fragmented to rebuild the system. As a result, the most effective way was to transfer the knowledge of the former staff members brought in from Rio de Janeiro through human resource transfer. Knowledge transfer to the next Games in Paris 2024 was done through the provision of documents via extranet, QA, and meetings. However, from the viewpoint of cost efficiency in Tokyo, the development documents were kept to a minimum and written in Japanese, which, in my personal evaluation, was not an efficient knowledge transfer. Knowledge transfer across countries from the past Games was also at the same level, and the requirement to build and operate something that works only during the period of the organising committee's activities at minimal cost was a factor in the first place.

In general, a large volume of deliverables delivered under a traditional lump-sum contract enables vendor replacement at the time of system renewal or transition. However, due to the recent changes in system development methods, knowledge about systems is becoming more and more proprietary. In fact, in the quality evaluation results of a service provider involved in a convention that promoted agile development, there was an example in which Talent Retention Plan was cited as an issue.

In such a changing environment, the IOC, in an attempt to transfer and pass on knowledge, has left behind video images of key persons involved in the Games who answer questions in an interview format, and opened them to the Organising Committee for future Games. In the COVID-19 pandemic, we, the staff of the organising committee, had to work at home as well as

the companies, but the recording of online meetings and the provision of user manuals in the form of video images worked very efficiently. Furthermore, with the rise of non-code and low-code platforms, the need for knowledge of manufacturing processes is shrinking. In the future, it is expected that a new standard for knowledge transfer will be formed in sync with the evolution of ICT and system platforms and the promotion of DX.

6. Conclusion

In the Japanese IT industry, the pros and cons of the “vendor-dependency” structure are often discussed. The business application development project described above was promoted under a scheme similar to in-house development, in which external resources secured under a quasi-contract on a long-term basis collaborated with in-house IT staff. This scheme, called “software factory”, has been used in the past Games to mass-produce relatively small-scale systems (average man-months per system : about 6 man-months). This scheme was born out of necessity, as the development of the system had to be started at a stage when the business requirements were not yet clear, and a lump-sum contract was not suitable. In fact, all the members who participated in the project worked in the same environment and with the same ambitions as our staff members. I would like to express my great appreciation to them once again.

Here is an example. In a normal competition, personnel are shifted to the competition site as the event approaches, and the system operation and maintenance system is re-established. This is to concentrate on training for the operation and maintenance of the services that have been established so far, and to prepare for the actual operation of the competition. The development of a system to support the operations of the Tokyo Games, however, was an urgent task, as the coronavirus disease 2019 (COVID-19) countermeasures were to be added to the normal Games operations. The Games Delivery Office, which serves as the business division, led the cycle of formulating business rules and organizing them into systemization requirements on a weekly basis. As a result, the delivery of the system was completed without major delays toward the entry schedule of the parties involved. We believe that we were able to achieve this because of the maturity of the Software Factory scheme that was launched at the beginning of 2018. If the design and development phases

had proceeded only after the business requirements were completely determined, delivery would not have been possible even in time for the closing ceremony of the Paralympic Games. (For details, please refer to 3-5 of this special issue.)

Based on this experience, we believe that a scheme of in-house production by in-house engineers on a low-code platform called “PaaS” is fully feasible. The presence of engineers who are less restricted in their scope of activities by contract, and who can discuss and co-create new value with business departments on an equal footing, is necessary to accelerate DX by each company itself. Furthermore, whether they are in-house engineers or external resources under a quasi-contractual agreement, IT departments need to continue to produce results in order to maintain them over the long term. In the Tokyo 2020 Games, the Technology Services Bureau, which has a so-called Information Systems Department, continued to emphasize the importance of IT within the organization and may have contributed in no small way to overcoming the final challenge of the spread of the COVID-19.

Finally, I personally hope that the importance of IT will be increasingly recognized as companies promote DX, and that the treatment of IT personnel in Japan will improve and that the mobility of human resources will also increase.

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(Received Feb. 9, 2022 ; Revised Feb. 28, 2022)



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