

Summary of Innovation Projects for the Tokyo 2020 Games

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We planned and implemented measures from three perspectives to realize “the most innovative Games ever in history, bringing positive change to the world”. With the cooperation of partners, we introduced the latest technologies (VR technology, robots, and 5G) and incorporated concepts unique to the Olympic and Paralympic Games Tokyo 2020. Due to the one-year postponement of the Tokyo 2020 Olympic and Paralympic Games caused by the coronavirus disease 2019, some of the events were scaled back or partially cancelled. However, we hope that these first-ever initiatives will be carried on as a legacy not only for the future Olympic and Paralympic Games, but also for the development of sports.

Keywords : Innovation, VR, Robot, 5G, SNS

1. Introduction

The Innovation promotion office was established in April 2017 to realize the vision of “the most innovative Games ever in history, bringing positive change to the world” at the Tokyo 2020 Olympic and Paralympic Games (hereinafter referred to as “Tokyo 2020 Games”). The goal was not only to pursue the latest technologies, but also to make proposals that would lead to social change and leave a legacy as the “most innovative Games ever in history”. The innovative measures for the Tokyo 2020 include not only the original initiatives led by the Innovation Promotion Office, but also those implemented

by other departments of the Organising Committee and partner companies. This article focuses on the projects implemented by the Innovation Promotion Office.

2. Approach and Design Concept

The Innovation Promotion Preparation Office was established in January 2017 before the Innovation Promotion Office was established in April of the same year. The following basic policies were set forth based on discussions by the project members.

- To ensure directionality and consistency of measures with the vision and brand image of the Tokyo 2020 Games
- To collaborate not only with the Organising committee but also with the Japanese Government, the Tokyo Metropolitan Government, partners and external organizations
- To aim that the measures drafted and promoted will lead to social transformation after the Tokyo 2020 Games
- To establish collaboration among multiple business departments to make the measures more

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innovative

We gathered volunteers from Organising Committee staff, and carried out an ideathon to propose measures that satisfy these principles. As a result, we selected and fine-tuned 28 ideas that had emerged through the ideathon while gaining insights from external experts (Ministry of Economy, Trade and Industry, Ministry of Internal Affairs and Communications, Ministry of Education, Culture, Sports, Science and Technology, Cabinet Office, Cabinet Secretariat, Tokyo Metropolitan Government, Technology Advisory Committee^(Note 1), Economy and Technology Committee^(Note 2), and Dentsu Inc.). For technology-related measures perspective, we referred to the recommendations^(Note 3) by the Technology Advisory Committee. Finally, we consolidated the ideas into three perspectives and six projects.

- ① “Innovation in sports”, which proposes new ways of watching and enjoying sports
- ② “Innovation in participation”, which proposes new ways to participate in and enjoy sports games
- ③ “Innovation to change the future of society” as an effort to build a barrier-free society and to develop a safe and secure society.

3. Achievements at the Games

3.1 Innovation in Sports

In “Innovation in Sports,” new ways of watching and enjoying sports are being pursued through the use of innovative technology. The Olympic and Paralympic Games could be watched only by spectators with tickets inside the venue. This innovation will enable spectators to enjoy watching the competitions from outside the venue, in the same way they would enjoy watching inside the venue. The following is an overview of the measures implemented and their key points.

Firstly, this project is for fans who cannot go to the

competition venue, such as those residing at remote places or those with disabilities, to give them an immersive experience and a sense of togetherness, as if they are watching the games from the spectator seats at the competition venue. The aim of the project was to distribute live sports dome visuals captured by all-sky (360-degree) cameras installed at competition venues by transmitting the visuals to planetariums across Japan over a network. The viewers at the screening sites can enjoy a bird’s-eye view of the entire competition venue, rather than a flat screen cut out as in TV broadcasts. They also can experience powerful visuals and sounds as if they were at the competition venue. As a result, the live broadcast at a dome theater was successfully completed for the first time in the Olympics, although it was limited to eight venues (four for general screenings and four for limited screenings for stakeholders) and the number of spectators was approximately 1,000 due to the coronavirus disease (hereafter COVID-19). Details are described in “4-2 Future-oriented Sport Viewing Project”⁽¹⁾.

Secondly, this project offers a new spectator experience of watching the games by utilizing the 5th Generation Mobile Communication System “5G”. The purpose of this project is to symbolically showcase Japan as a technological powerhouse by introducing the latest communications technology ahead of the rest of the world. While services utilizing 5G were showcased during the Pyeongchang 2018 Games, 5G commercial services were used for the first time at the Tokyo 2020 Games. High speed and large capacity of 5G were utilized to the maximum extent for sailing and golf and low latency was put to maximum use for swimming, showing the possibility of practical use of 5G technology in the future. Details are described in “4-3 Innovation Projects utilizing 5G Technology”⁽²⁾.

Thirdly, children who are unable to watch the games at the venue due to illness or other reasons were given the opportunity to enjoy the games in a realistic manner by utilizing technologies such as sports dome visuals, 5G network and technology as described above, as well as robots (described below). In collaboration with the Tokyo Metropolitan Government, we offered a unique experience of the games to children and students from special needs schools across Japan (296 participants, from 13 schools) by combining three measures, namely, VR theatre (Figure 1), game watching tour with the mascot robots (Figure 2), and TOKYO 2020 hands-on event (Figure 3), with five facilities in Tokyo as the

(Note 1) A third-party advisory body with 6 experts for technology-related measures to be constituted in the future by the Organising Committee.

(Note 2) An expert committee for examining actions related to “Economy and Technology Commission” from the “Tokyo 2020 Action and Legacy Plan” created by the Organising Committee in collaboration with the concerned organizations (Tokyo Metropolitan Government, Government, Japan Olympic Committee, Japan Paralympic Committee and business community).

(Note 3) Recommendations by the Technology Advisory Committee (Published on June 28, 2018).

<https://www.tokyo2020.jp/image/upload/production/kuvuiehqolfvvdqgjn.mj.pdf>



Figure 1 Children in Wheelchairs and on Stretchers Experience Realistic Visuals through the Use of a Dome-shaped 360-degree Projection Screen (©International Olympic Committee-All Rights Reserved)

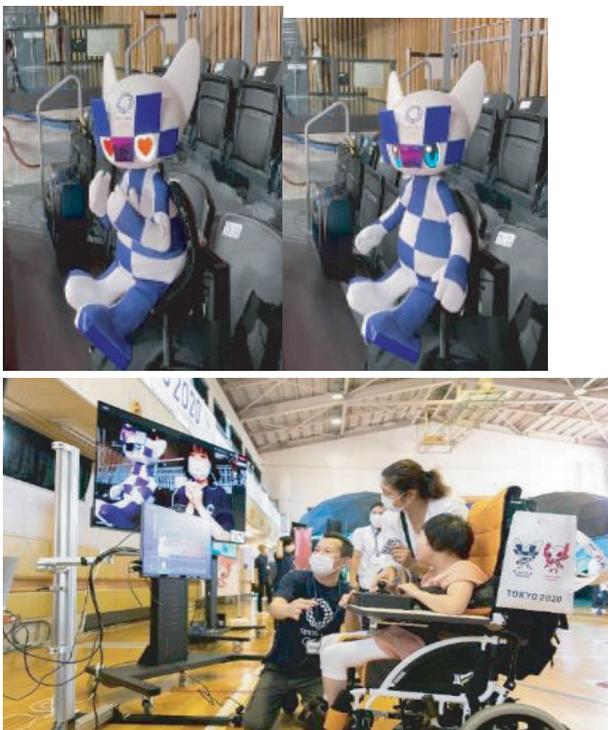


Figure 2 Remote Control of the Mascot Robot at the Competition Venue Allows Visitors to Experience the Atmosphere of the Competition Venue in Real Time (©International Olympic Committee-All Rights Reserved)



Figure 3 Experiencing the Unique Atmosphere of the Games by Directly Touching Mascots, Olympic Torches, and Other Items Associated with the Olympic Games (©International Olympic Committee-All Rights Reserved)

interactive venues.

All three projects implemented in “Innovation in Sports” were the first-ever attempts for the Olympic and Paralympic Games. Hence, many issues had to be solved in terms of technology, operation, and various rights. The realization of these projects was made possible by the significant technical support of Tokyo 2020 marketing partners for the robots, AR, and communications categories, as well as the cooperation of external organizations such as the Olympic Broadcast Service (OBS) and the Japan Consortium (JC). The ability of various stakeholders to work together in a joint initiative has led to the provision of new ways to watch and enjoy sports using cutting-edge technology.

3.2 Innovation in Participation

The “Innovation in Participation” program is an initiative to promote the participation of young individuals by offering a new way of participation in the Tokyo 2020 Games, which has never been done before, with an eye toward the future. Representative examples include selecting the mascot through voting by elementary school students, producing medals using recycled metal recovered from small home appliances, and creating and distributing Tokyo 2020 math drills^(Note 4) for elementary school sixth-grade students.

(Note 4) The drills that incorporated 33 sports in the Olympics and 22 sports in the Paralympics were distributed to all public elementary schools (approximately 100,000 students) within Tokyo. This initiative was aimed at increasing interest in the Olympics and Paralympics through the study of mathematics. In addition, in order to enhance the students’ understanding of the drills, practical learning sessions were held in which athletes were invited to the elementary schools to demonstrate the content learned in the drills.

On the other hand, from the perspective of the use of technology, we introduce a project in which people from all over the world participated by making full use of social media. In this project, cheering videos posted on SNS with the hashtag (#2020beat) are edited and combined into a single cheering movie that is shown on giant screens at the competition venues. Since the Tokyo 2020 Games were held without spectators, this contributed to “delivering cheers to the athletes” for encouraging the players from outside the venue and for medalists to communicate with families and friends in their home countries through the screens at the venue. By the end of the Games, there were 1,369 posts (of which 529 were video posts). Eight videos were screened at the competition venues and three videos were screened in the Olympic and Paralympic village. Collecting videos from social media and displaying them on giant screens at the competition venues were the first-ever attempts during the Olympic and Paralympic Games.

3.3 Innovations That Will Change the Future of Society

A variety of robots appeared at the Tokyo 2020 Games. The objectives were to “show how robots can be useful to people in various situations” and to “promote social implementation of robots through the Games”.

At the Tokyo 2020 Game, not only did we showcase the robots, the we also utilized robots in a variety of situations, with 12 types made up of 73 robots working together with staff to provide hospitality. In particular, the use of robots under the COVID-19 showed that they can contribute to safe, secure, and sustainable Games operations from the viewpoints of avoiding physical contact and saving labor. The details are described in “4-4 Utilization of Robotics Technology in the Tokyo 2020 Games”⁽³⁾ and “4-5 Supporting the Tokyo 2020 Games with People-friendly Robots”⁽⁴⁾.

4. Realized Technologies

4.1 Technologies Utilized in the Six Projects

Various technologies have been utilized in the projects implemented by the Innovation Promotion Office. All sorts of technologies are being used to realize the most innovative Games ever in history, and the details of which are given in the following articles.

The 360-degree video technology and NTT’s ultra-realistic communication technology, Kirari!, were used to enhance the immersive experience for “Innovation in

sports”. We combined the 5G and latest technologies to offer a new style of watching sports that fully demonstrated the high speed and large-capacity transmission capabilities of 5G.

SNS, which is familiar to the general public is utilized for the “Innovation in Participation”. Videos and messages posted by users are used to automatically generate cheering videos through the use of AI.

In the “Innovations to Change the Future of Society,” various robots were provided by the partners to support the Games operations staff, including the correspondence to COVID-19.

4.2 Other Technologies Used in the Tokyo 2020 Games

In addition to the technologies introduced in 4.1, many other innovative initiatives were implemented using technologies from other departments and partners.

These included Drones (Ceremony), Hydrogen-powered Vehicles (Transportation), Hydrogen-powered Torches (Torch Relay), Automatic-driving Buses (Olympic and Paralympic Village), Face Recognition System (Security), and Next-generation Commercial Wireless Systems (Technology). This article presents an overview of the two technologies from NTT.

4.2.1 Marathon x Ultra-low-latency Communication Technology

This technology provides real-time video transmission between the marathon course in Sapporo and the cheering venue in Tokyo. This technology delivers spectators’ cheering from remote location to the athletes. Since they do not need to gather in on place, it provides a safety. Furthermore, it provides a sense of presence as if we are cheering along the roadside. We could feel a sense of unity between athletes and spectators. In conventional general video transmission, various delays occur. These include optical propagation, transmission, video data compression, and media processing delays. The total delay time can be several seconds round-trip. Due to these delays, delivering the cheering to the players was impossible. NTT’s “Ultra-low Latency Communication Technology”⁽⁵⁾ has minimized the delay time for the transmission process to approximately 100 ms each way. Due to this technology, the cheering to the athletes was delivered reliably.

A 50 m wide display at the Tokyo venue provided an immersive experience. The spectators felt that the athletes were running right in front and could show their



(a) Spectators cheering from Tokyo for the women's marathon in Sapporo



(b) Cheering from Tokyo reaching the runners during the women's marathon

Figure 4 Ultra-low Latency Communication Technology (©2021-International Olympic Committee-All Rights Reserved)

support by clapping and waving flags. On the other hand, on the marathon course in Sapporo, the ultra-low-latency communication technology allowed spectators to deliver their cheers before the athlete passed by. Spectators were able to feel a sense of oneness with the athletes at the Tokyo venue as well. (Figure 4(a) (b)).

4.2.2 Venue Operation Staff x CUzo

The “CUzo Card⁽⁶⁾” (Figure 5), a handheld device with a transparent display, was provided to the venue management staff. This device provided a communication style that allowed visitors to be guided while watching their facial expressions of visitors. The CUzo card is provided with applications to support “face-to-face translation” and “facility guidance”.

The “face-to-face translation” application in the CUzo card displays the conversation content like subtitles, allowing two people to have a conversation while simultaneously watching the facial expressions and



Figure 5 Appearance of CUzo Card (©NTT)

gestures of the other person. The “facility guidance” application guides the visitors by adding visual annotations to the users’ surroundings. Approximately 250 venue-management staff members used the CUzo card to support attendees, including event officials and players at three venues in the Kanto region, for a total of 28 days.

5. Review, Reflection and Future Legacy

5.1 Review and Reflection

The impact of the COVID-19 outbreak in early 2020 forced us to review the innovation measures. We also had to revise the vision of “the most innovative ever Games in history, bringing positive change to the world”. As a result, measures were mapped out to realize the new vision of safety and security, cost reduction and simplification without significantly changing the implementation content of the games.

The first measure was “Innovation in participation”, which was planned to boost excitement at the venue from many more people worldwide, with the slogan “contribute to providing an environment where athletes can concentrate on the game with peace of mind”. This was a safe and secure measure using SNS to boost the mood at the venue, eliminating opportunities for physical contact between event officials and spectators.

The next measure was “Innovation in sports”, which was positioned to “provide spectators with a greater emotional experience through watching sports, which is

the basic requirement of competitions”. This measure shared the excitement from watching competitions with many people, even when the games were held without spectators.

The last measure was “Innovations that will change the future of society”, which was aimed at “management using advanced technologies as a precursor to coexist with the COVID-19”. In addition to the use of robots for reducing physical contact and remote services to avoid crowding, 5G, which was the core technology for these services, was introduced.

As a result, the projects were implemented almost as initially planned, but we regret that some services were canceled or scaled back due to lack of spectators and that the expected results could not be obtained. Many of these initiatives at the Tokyo 2020 Games are the first in Olympic and Paralympic Games history, and we believe that in the future, these initiatives will contribute to the development of the sports industry, not only in the Olympics and Paralympics.

5.2 Legacy of the Innovation Promotion Office

We believe that each project in collaboration with the Japanese government, the Tokyo Metropolitan Government, partners and external organizations should be passed on to bring social change in the future. In particular, the new experience of watching sports using advanced technologies such as 5G and robots is the first-ever practical technology to be introduced in the Olympic and Paralympic Games. We hope to work with our partners and the Tokyo Metropolitan Government to realize a legacy.

The Innovation Promotion Office is an organization that was established for the first time at the Tokyo 2020 Games. Having faced various challenges under the situation of the absence of IOC counter organization, we operated the office and implemented measures through trial and error. In the end, with the support of the IOC and with the cooperation of partners and external organizations, we were able to contribute to making the Games more attractive. Innovative initiatives have the potential to be required at future Games, and we hope that the experience and know-how gained from the Tokyo 2020 Games will be passed on as a legacy.

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