

The Tetris of the Olympic Games and the establishment of temporary infrastructure¹

How can modular logistics improve the sustainable managerial processes of the Olympic Games?²

By Maxime HANRION NICHOLLS, Baki ALTUN, Ludovic PIRES DOS SANTOS, Hamza EL MOUMNI

The Graduate School of Industrial Logistics – ESLI
(l'École supérieure de logistique industrielle - ESLI)
Paris, France

ABSTRACT

Every four years, the Olympics are hosted in a different country. As they are becoming bigger and more diverse through the years, their impact is growing deeper and greater on the economic, environmental and the political status quo of the hosting country. Therefore, one of the main challenges of these countries is to guaranty the event's performance while planning a sustainable and profitable outcome. That being said, within the context of the ongoing digitalization & robotization of business logistics, engineers have started to imagine alternatives to palliate to the non-sustainable infrastructures that are being built each year to welcome the Olympics. Thus, these massive innovations could revolutionize the organization as well as the return on investment of the Olympic Games.

Key words: Logistic demand, Modular logistic, Olympic Games, Sustainable management, Construction innovation, Olympic waste management, Decarbonization

INTRODUCTION

The Olympic Games which originated in ancient Greece, were revived in 1896 in Athens. The world's preeminent sporting competition welcomed to its first modern edition, 280 participants from 12 nations competing in 43 events. In 2024, this legendary event will take place in Paris for the 2nd time since 1900. Paris will welcome over 10 500 athletes from 206 nations competing in over 30 disciplines and almost 10 million visitors. The skyrocketing number of people involved in the games have an enormous impact on the political, economic, social and environmental scale of every country that is chosen to host the competition.

¹ How to cite this paper: Hanrion, M., Altun, B., Dos Santos Pires, L., El Mourni, H. (2022), The Tetris of the Olympic Games and its establishment of temporary infrastructure, PM World Journal, Vol. XI, Issue VII, July.

² Prepared for the course Supply Chain Tools and Project Management in the Masters' program in Secured & Intelligent Logistics - option: Defense and Private-Public ecosystems, l'École supérieure de logistique industrielle – ESLI, Paris campus. Reviewed by Mohamad-Fadl HARAKE, Affiliate Professor at ESLI Paris – Director of International Academic Affairs of GIP CEI and Academic Head of Logistics Programs – Paris Campus.

This competition has to face more challenges every four years. The risk of the faded future of the Olympic installations all over the world has become a real problem. These risks have always had a bad impact on the environment and can lead countries to severe economic situations. It is obvious that since the late 19th century, a significant progress has been made in terms of technology and its application on every field of activity such as logistics or construction. Thus a greener and more sustainable approach of the managerial processes of the Olympic Games organization must be reviewed if we don't want the hosting countries to be affected by the biggest event in the world therefore, we can raise the following question: ***How can modular logistics improve the sustainable managerial processes of the Olympic Games?***

In order to answer this question, we will first bring to the fore the Olympic Games and its challenges. We will then introduce the modular logistics sector via a literature review. Finally, we will deduct from the research the benefits and the limits that can come out of implementing this type of logistics to the event.

I. THE OLYMPIC GAMES AND ITS CHALLENGES

Impacts of Olympic Games on host cities have been classified into five types by Pitts and Liao (2009): physical and environmental, socio-economic, socio-political, urban displacement, and socio-cultural and socio-psychological impacts. In this section we will talk about the political, environmental, social and economical aspects.

A. THE POLITICAL AND ECONOMIC ASPECTS

Political aspect

Speaking at the meeting in the Qatari capital, Doha, President Bach said “ [...] *we are living in a diverse world where your neighbor may think differently and may not feel the same way and may have a different opinion. Respect your neighbor, respect all the members of the Olympic family and don't take political sides. Concentrate on the unity of sport, concentrate on what unites us, and not on what divides us or those who try to divide us.*” (Bach, 2019). For the president of the IOC, political neutrality is key during the Olympics.

More than neutrality, the Games are sometimes seeking for temporary peace as in the Greek tradition of the Olympic Truce or Ekecheira, under the pretext of the unifying character of sport. For example, in 1917, the seat of the IOC was transferred to Lausanne so it was not involved in the Franco-German conflict.

The competition must be a neutral ground where athletes of all nations can compete in peace. According to Pascal Boniface, this apolitism is a myth because the very objective of the IOC to promote peace is political.



Fig. 1 Olympic Host cities

The map above shows the inequality in the choice of the organizing cities. These are either North American, European, or East Asian (Korea, Japan). No games have been held in Africa, for example. Cities in developing countries have very little chance of obtaining the organization of the games because of the phenomenal cost of sports facilities and infrastructure needed to accommodate athletes and tourists during the event.

“The Olympic idea in the modern era is symbolic of a world war, one that does not openly reveal its military ambitions, but which provides—to those who know how to read sports statistics—a good appreciation of the hierarchy of nations.” (Arnaud, 1999) This quote, shows that Olympism was rapidly involved in the international political relations.

In 1931, the IOC decided to choose Berlin as the future hosting city for the 1936 Games. In 1933, Hitler became Chancellor of the Reich. He then created the Reich Ministry of People's Education and Propaganda, with Joseph Goebbels as minister which exercised absolute control over the media and culture.

Hitler and Goebbels took advantage of this opportunity to make propaganda film completely dedicated to the event – entitled *“Olympia”*. The Nazis saw in these games – the occasion to raise the German popular masses depressed by WWI, but also to reveal to the world the Nazi ideology.

Pierre de Coubertin Baron's (the man who recreated the modern Olympic Games) first intention was to completely separate the political and the sport scenes. In the XXIst century, unstable international relations do persist and we can still see that now as the Games are not likely to become entirely independent from geopolitical affairs.

Economical aspect

According to the IOC, their objectives consist in creating sustainable advantages for the country accepting the challenge to welcome the games.

Hosting the Games becomes a "technological showcase" for cities, an opportunity to rapidly acquire important infrastructures. The State is therefore a privileged partner in the preparations. However, these gigantic works do not only present advantages for the economical situation of the country.

Indeed, the Olympics can have negative aspects: they require the construction of many giant infrastructures that make the organization of the games very expensive for the hosting state. Moreover, these infrastructures do not always meet the permanent need of the local-impacted populations as they are then abandoned.

After the 2006 Olympics hosted by Turin (Italy), the Olympic village that costed millions of euros was totally abandoned after the 16 days competition. However, the country had to welcome thousands of Libyan refugees that were fleeing the civil war (the activist Nicoló Vasil decided to fight for these refugees). Indeed, it was decided to transform this said Olympic village into a hosting town where shops started to appear.

Another example is the Olympic village of Sarajevo that built for the 1984 Olympics which has been totally abandoned. "*[...] The wars of Yugoslavia, which started in 1991, did not spare it. Some facilities, such as the luge and ski jumping tracks were used as rocket launching pads, others were transformed into bunkers.*" (DEYRIEUX, 2021).

This shows the risks and the complexity of creating profitable and sustainable infrastructures for the event in an instable politic and economic context.

On the other side, the Olympic Games can be used to revitalize a territory that is losing momentum, such as the Stratford district during the 2012 London Olympics. This district is a former industrial area whose conversion was facilitated by the Olympic Games, which allowed the construction of new means of transport (high-speed train line, subway, stations) and housing (notably the former Olympic village).

This new dynamism was then followed by the creation of new parks, offices, and shops that have revitalized a large part of this former industrial district.

As we have stated above, the economical and the political aspect of the Olympics is a subject that will continually be discussed because of its significance on the international scene.

B. THE IMPACT OF SOCIAL-ENVIRONMENTAL ELEMENTS

SOCIAL LONDON 2012

The Olympic legacy is generally broken down into five categories: sporting, social, environmental, urban and economic.

In this section we will introduce the social and environmental impacts of the discussed topic.

Environmental aspect

The Olympic Games (OG) are one of the most important sporting events in the world. Whether in terms of number of participants, infrastructure or broadcasting, few sports & competitive events can compete with the said Games.

Unfortunately, there are also few competitions that can boast a worse carbon footprint than the Olympic Games. Since the early 1970s, many voices have been raised to denounce the environmental impact of the Olympics, but it is only in the last few years that the International Olympic Committee (IOC) has decided to take action with the goal of having a negative carbon footprint by 2030.

However, the environmental protection objectives set before each Olympiad are rarely met. To better understand this, let's look back at some of the last editions. Per instance, if we want to check the Rio Games 2016 – which was an insane carbon footprint in the games' history. As in the previous editions, the IOC wanted to review the Games of Rio (Brazil) and make them eco-friendly. In this optic, the organization had taken strong measures as the depollution of the bay of Guanabara or a program of reforestation (24 million plants of tree foreseen).

At the time of drawing up the environmental balance sheet of the Games, the reality caught up with the organizers. The Rio Olympic Games in 2016 had a negative environmental impact:

- 8 million cubic meters of water were used;
- 17,000 tons of waste were generated;
- 3.6 million tons of CO₂ were emitted into the atmosphere.

the environmental problem goes beyond these figures and continues to this day. Because of corruption and a global lack of means, many infrastructures built for the Games are abandoned. It is in particular the case of the golf course, built on a protected natural zone, completely abandoned but whose construction had irreversible effects on the fauna and the local flora.

Pyeongchang 2018: The degradation of a primary forest

After more than mixed carbon footprints of the Vancouver and Sochi Olympic Games, the organizers had set themselves the goal of achieving carbon neutrality at the Pyeongchang (South Korea) Olympic Games.

The positive point is that the organizers have learned the lessons of the previous editions and have decided to rely on public transport and renewable energies in order to save the emission of about 6,500 tons of CO₂.

However, its efforts did not achieve carbon neutrality and the greenhouse gas emissions were even 1.6 million tons. Even worse, in order to build ski slopes, a large part of one of Korea's primary forests had to be cut down. It was cut down by a little less than 80 hectares which represents about 60 000 trees.

Social aspect

“The modern Olympic Games have grown into a social and cultural spectacle without parallel in kind or scope” (SEPPANEN, 1984). Indeed, scientists have first studied the economic impact and the urban changes of the games. Social impact was studied later-on but it became one of the most important objectives of the IOC. The social aspect includes many subject such as the population commitment in the event, the happiness experienced or the image of the hosting city. During each opening ceremony, the country and its people show proudly their history, their experiences, their culture and so on. These ceremonies show how proud the country and its population are to host hundreds of nations on its territory.

The effect of the Paris Olympic and Paralympic Games is also at the heart of the contribution of R. Richard, A. Marcellini, A. Sakis Pappous, H. Joncheray and S. Ferez, who focus their reflection on people with disabilities. The authors focus on the conditions for building an intangible legacy for Paris 2024. This reflection is particularly important at a time when host cities are emphasizing the availability of sports infrastructures. The intangible heritage is at the heart of the concerns. But it is both difficult to conceive and to evaluate. Developing an efficient public action is therefore extremely problematic. The authors endeavor to defend the mechanisms, based in particular on the experience of the London 2012 Olympic Games, to consider the positive impact of the 2024 Games on the inclusion of people with disabilities. In particular, they defend the importance of the media coverage of Paralympic athletes as a lever to develop more widely the popular practice.

II. LOGISTICS AND OLYMPIC GAMES

The moment Eisenhower achieved in 1944 to debark 3 million soldiers on France's west coast and coordinate 1.5 million soldiers at the back scene of the operation is the moment that logistics became a key factor in the research of performance.

Because of the greatness of the games, the logistics demand is extremely high during the event. Thus it is important to overlook the logistic evolution through the history of the Olympic Games to understand where the International Olympics Committee is standing today in this process.

A. EVOLUTION THROUGH HISTORY

Before diving directly into the logistic of the games it is essential that we understand what impacts the growing challenges during the event.

The notoriety and the sky rocketing mediatization of the competition are one of the aspects that influence deeply the problematics of the logistics through the years. Goebbels considered the radio as "[...] *the most modern and most important instrument to influence the population*" (Reichel, 1993, p.149). In 1936, it was the first time that the games were broadcasted and shared publicly to the world. This strong media instrument allowed the games to be followed by thousands of fans. In Tokyo 2020, the total amount of viewers worldwide reached more than 3 billion people; indeed, "*this represents an evolution of 139% compared to Rio 2016*"³. We can easily understand how this enormous mediatization and coverage around the world is affecting the logistic part of the games.

Indeed, this actually increases the popularity of the event and brings more visitors to the hosting countries which constrict them to adapt all of their capacity for welcoming the spectators. The population stream brings many sub-issues to the logistics' flow. The countries have to face the transportation obstacles which could be really complex for some cities. In 2016, Rio de Janeiro's transportation plan for the spectators was one of the most critical point of their project. With his 1300km², "*[...] Rio is ten times more extended than Paris.[...] with four different sites, 30 kms away from one another in a town known worldwide for its traffic jam[...], the worst was expected*" (Godon, 2016). In total, between the center of Rio and the Olympic Park, spectators had to stay in the transport for more than one hour and thirty minutes.

On the contrary, Sydney's officials' was recognized for their success in the way they managed the public transport through the event in 2000. "*Friday 22 September was the busiest day. By*

³ IOC, 2021

5pm, 307,139 people had been transported to the stadium - 217,953 by train and 89,186 by bus.” (Hensher, 2012)

Depending on the host country, its transportation processes already in place and its demography the development of a performant transport system during the games can be a really big challenge and pricy development.

Greater the event was getting, greater the number of athletes and nations was participating to the event as well as the number of disciplines. These two factors lift other challenges. In London 1948, 4 104 athletes were competing as in Tokyo 2020, they were more than 11 000.

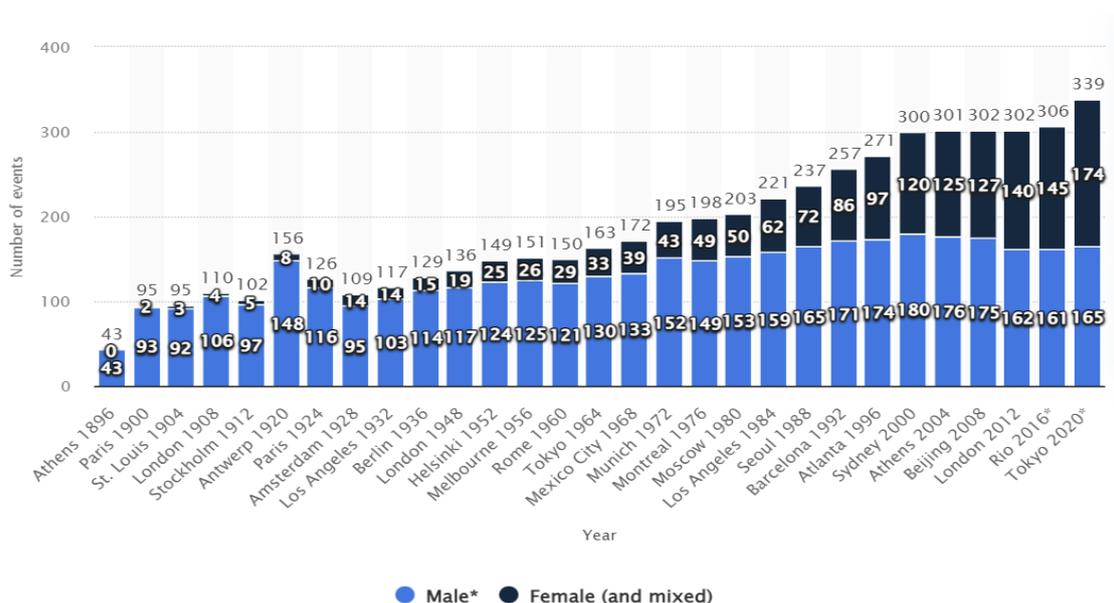


Fig. 2, Number of disciplines through the years (Statista, 2022)

As the number of athletes increases, the housing capacity had to be adapted to the demand. Here comes the “construction logistic”. As in London 2012, the capacity of housing had to reach 17000 spaces. We can also cite the three villages that Turin had to build. (CIO) These villages are built for the competitors but we also have to take into consideration the media staff that needs to be accommodated. In fact, we could think of welcoming all the reporters in hotel but the capacity could easily be reached as in Tokyo 2020, 41 177 hotel rooms were booked for the event which represents ½ of all hotel rooms in the city.

The “construction logistic” requires a really large expertise for an event this big. The leaders have to think and organize their actions and plans years before the launching. Indeed, the villages must respect many criteria as described in the Olympic project management bible. They have to be within 50 kilometers or 60 minutes’ drive of all venues, if not respected then countries have to build other villages as they did in Turin. “ [...] the construction logistic is concerned with the reliability of services and the optimization of deadlines. Logistics management is becoming a “value-added” service for all partners. In short, the search for a

"convergence of interests" between players is at the heart of the new logistics issue."
(GUFFOND & LECONTE, 2001).

The challenge can be different and more complex depending on the geographical situation of the hosting city. Here, we can compare two situations, Tokyo and Paris. Tokyo has a big advantage to respond to the problematic of supply on all the different construction site. The city is right on the coast of Japan which allow them to construct their streams of raw material entering directly from the Pacific Ocean with maritime transportation. But in Paris, which is cluttered in the middle of France, the challenge stands in urban logistic technics as inland waterway transport followed by road transport.

The management of the worksites waste is a logistic component that is also really important during this type of major transformation of a country's urbanism. In Paris area, 5.2 million tons out of 16 million tons of goods transported by inland waterway, concerns public construction wastes which is more than 30% of the flow. The Paris 2024 dockyard represents 210 000 m² of infrastructure demolition and 300 000 tons of wastes to evacuate (DEBLOCK, 2021). The IOC and the French organizers of the coming event assured that they had the capacity to respond effectively to the growing demand of worksites waste, thanks to the 4 multimodal port platforms in the city.

As we mentioned before, the number of disciplines has also incredibly increased since the first games in 1896 with 43 sports compared to 339 different disciplines in 2020. With all these different sports in the competition comes all the materials and equipment needed from each team all around the world. All the different nation participating to the games must be able to bring their own material to the hosting country depending on the discipline. In Tokyo 2021, the French delegation of canoe kayak had to send by sea the 17 boats to Japan to be part of the competition. That means they had to book for full container load from Le Havre to Tokyo, which is a big logistic organization and a big financial cost. We can understand the growing complexity in the logistic management processes as the number of athletes and disciplines are increasing.

In this section, we clearly pointed out the fact that the expanding globalization of the Olympics had a real impact on the way countries have to deal with the Supply chains.

The question that actually arises here is the following: *as we are already living the fifth industrial revolution, how can we find new solutions to this growing complexity?*

B. MODULAR LOGISTICS

In this part we are going to focus on the modular construction and the logistic sector.

Modular logistics is a tailor-made construction for different infrastructures. It is pre-installed in the manufacturing plant.

The modular building is a steel structure to which panels are added and inserted. The assembly is then transferred to its installation site. With one or more modules, this solution allows to elaborate projects with beautiful volumes. Installation is as simple as disassembly for expansion or moving purposes, for example.

Over the years, modular logistics has evolved a lot. It was called prefabricated building and was sometimes poorly seen upon in the eyes of the public. It is booming in various fields, thanks to flexibility, such as construction, event industry and sports.

Over the years, it has evolved a lot. It was called prefabricated building and was sometimes poorly seen upon in the eyes of the public because of the uncertainty of the infrastructures.

In fact, there are many benefits in modular logistics. We will show you this with the following specific and detailed examples:

- **Environmental scale:** we all know that today environmental impact has been a hot topic for several years. The environmental benefits of modular construction are enormous. For the construction of a modular building it does not require a foundation. As a result, it eliminates several constraints, more or less different, such as those of soil degradation, carbon emissions, work sites wastes etc.
- **Time-saving:** Modular buildings are faster to build because they take less time to build. They are prefabricated in factories and sent directly to the customer's site. Moreover, their construction does not require any foundation unlike traditional constructions. It saves time on the number of physical deliveries that will have to take place for the construction of the building. Indeed, thanks to this building, a decrease in material delivery will be noticed compared to the need for material during a traditional construction. It is 100% modular: the juxtaposed modular elements can be assembled and disassembled at will, and this in a period of time.
- **Financial gain:** Modular logistics has a positive impact on the economy in several aspects during the construction process. First, the cost of the raw material needed for manufacturing is more economical because it is cheaper because its composition is recycled. It avoids multiple transport of heavy machinery, trucks...which may be unnecessary. Finally, it reduces the payroll, thanks to the reduced needed time to set a modular building.
- **An eco-responsible solution:** With this technology of construction, it is possible to develop an urban project or build a house that meets the objectives and is in harmony with the environment. As construction materials are mostly recycled, they can be

used for other purposes. This avoids waste generation or landfills that cause damage to the soil.

- **A tailor-made project less harmful to the community:** One of the major advantages is that it is fully modular. Indeed, the elements can be assembled and disassembled at will. Modular constructions adapt perfectly to the wishes and requirements of the customer. They also respect the conditions related to the living environment such as soil quality or climatic conditions. It should be noted that traditional constructions take longer, thus causing noise and permanent discomfort to environmental dwellings.
- **Flexible solution:** One of the main advantages of modular solutions is their flexibility. In case of increased activity or stocks, you have the possibility to expand the premises with new buildings. In case of a decline, you can demodulate buildings. This system allows companies to remain reactive

Modular logistics is compatible with all fields such as construction industry and logistics warehouses, which represents a double advantage. Indeed, the density of their activities has an energy cost. The modular construction due to its thermal insulation capacity is a solution to reduce energy consumption and of course for events and sports one can use the modular construction to build the changing rooms, the media village or villages for fan clubs. Modular buildings can also be used to build prefabricated reception rooms. Qatar at a 100% modular stadium for the 2022 World Cup, this is where we see that it is suitable for any kind of large infrastructure small and medium.

In the next part we will talk about implementing a modular solution to the management processes of the Olympics logistics.

III. CRISSCROSSING MODULAR LOGISTICS AND THE OLYMPIC GAMES

We can deduce from our previous research that the main challenges the IOC and the hosting countries face during the Olympic project are clustered in two main steps of the project life : The project set up and the project closing. In this section we will enumerate the different benefits and the limits of what could modular logistics bring to the management processes of the implementation of the games.

A. BENEFITS

Improve its image

We can take the example of the Olympic Games which are criticized on the post-event. However, with this solution, the Olympics can show that they can be an eco-responsible organization, which would improve their image and prove that they are in a CSR approach. This helps the social vision of the event.

Quick installation of every infrastructure

One of the main advantages of modular construction is the speed with which the project is carried out. The customer benefits from a great time saving thanks to the manufacturing process designed to be very responsive, while respecting standards and deadlines. That means we could take into account the economical issues of the population and the country hosting the games. With the actual context of the pandemic it can also allow the countries to adapt their needs depending on the international situation.

Evolutionary project

Another major advantage of modular construction is its 100% modular character. Each element can be enlarged, disassembled, modified and moved in record time. A simple crane is enough to stack the building elements, which can also occupy a small space. A project that does not damage the ground and does not require a foundation. By keeping this technology in sight, the IOC sends out an image of an environmentally friendly organization.

Optimized budget

Opting for a modular construction allows to optimize its budget compared to a traditional construction project. The modular construction allows a budget flexibility to best match the needs of the customers, who also have the choice between purchase and rental. The key is up to 30% savings. Moreover, it allows the company to reduce considerably their transportation costs thus their carbon footprint. This could bring more countries into the participation of hosting the games.

Respect for the environment

In addition to meeting the standards of thermal regulation, modular buildings generate no waste on construction sites, and adapt perfectly to the environment. In addition, the modules are 99% recyclable.

A tailor-made project

The modular construction project fully adapts to the wishes of the customer. Depending on the expectations and the housing context, the choice of equipment is completely flexible (facade dressing, heating, ventilation, access, air conditioning, sanitary facilities or layout).

By applying this technology to their managerial processes, the IOC could improve their impact economically, politically and socially at the same time.

The modular construction logistics exists since the middle of the 20th century... so why didn't the IOC implement these technologies before?

B. LIMITS

Social

The modular logistics in the construction sector could impact the employability of all the expert in the industry. Indeed, this technology is still new for most of all the companies around the world therefore there could be some difficulties to implement this type of change in their processes.

Politic

Through the history of the games we saw that the hosting countries don't only go through all this work and expenses for the passion of sport. They also do it to prove to the entire world their ability to make this event possible on their soil so they can be internationally recognized as a powerful country. Standardizing the processes and the structures could deeply affect their ambition to become the next hosting nation.

Geography

Modular infrastructures mean that the assembled building must be placed on free lands. As the purpose of modular construction is to be able to remove the building after the event, it means that the land will then be empty and not used. In Tokyo free land is rare. That is why they opted for an alternative: using existing, build new buildings and also use temporary infrastructures:

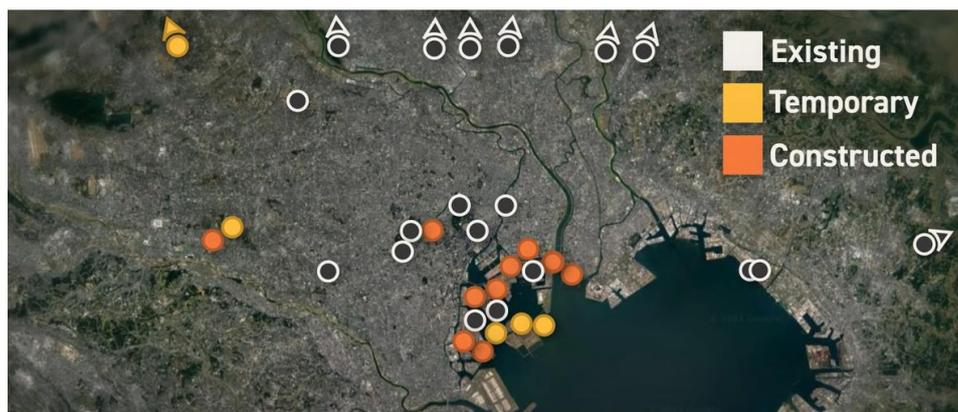


Fig. 3 Tokyo 2020 infrastructures status

On this map above, we can see that the initiative of bringing in the modular technology was taken but not 100% of their infrastructures are modular because of the lack of space and their existing sport buildings as well.

CONCLUSION

Through this study, we were able to assess the dimension of the Olympic Games and its impact on many aspects around the world. With many crisis that happen around the globe: sanitary, war, humanitarian and also environmental, the IOC's main challenge is to certify that all of these issues are taken into account while organizing and selecting the hosting countries.

Therefore using modular logistics and modular construction could bring answers and solutions to the crisis that the IOC are facing. Indeed, this technology has already been put in place in certain sport events as in Qatar for the next World football cup or even in Tokyo 2020. Nevertheless, The IOC has not yet introduced fully this new way of using modular technologies during the games.

To this end, we wanted to prove and demonstrate that this innovation in construction methods is one of the many ways of reducing the negative impact on the population and hosting countries the event. But, this change in the managerial processes of the Games could take decades for the politics and the different actors concerned, to fully put in place a sustainable solution that is modular logistics.

REFERENCES

1. <https://www.franceinter.fr/sports/decrepis-ou-abandonnes-quand-les-temple-des-jeux-olympiques-galerent-a-se-reconvertir>
2. <https://www.paris2024.org/fr/histoire-jeux-olympiques/>
3. <https://olympics.com/cio/news/solidarite-et-neutralite-politique-indispensables-a-l-universalite-des-jeux-olympiques-insiste-le-president-thomas-bach-devant-l-assemblee-generale-de-l-acno>
4. https://www.afri-ct.org/wp-content/uploads/2010/07/Article_Arboit_JO.pdf
5. <https://major-prepa.com/geopolitique/la-geopolitique-des-jeux-olympiques/>
6. Arnaud P., 1999, Introduction P-1. <https://www.cairn-int.info/journal-Annales-de-geographie-2011-4-page-425.htm#no1>
7. <https://www.franceinter.fr/histoire/les-jeux-olympiques-de-berlin-en-1936-sport-et-propagande-politique>
8. <https://olympics.com/cio/candidature-a-l-organisation-des-jo-au-dela-de-2028>
9. <https://parismatch.be/actualites/societe/111660/italie-village-olympique-abandonne-abrite-refugies>
10. Deyrieux C., 2021; <https://www.ouest-france.fr/leditiondusoir/2021-07-21/decouvrez-ces-sites-des-jeux-olympiques-abandonnes-apres-la-fin-des-competitions-2fbf8cea-788f-4337-917d-70654378b2d2#:~:text=Des%20stades%20pouvant%20accueillir%20des,l'abandon%20le%20plus%20total.&text=En%201936%2C%20le%20d%C3%A9veloppement%20durable,pr%C3%A9occupations%20des%20organisateur%20des%20JO>

11. <https://logisticsmgepsupv.wordpress.com/2020/04/04/how-complicated-is-olympic-logistics/>
 12. <https://logisticsmgepsupv.wordpress.com/2019/06/09/logistics-of-olympic-games/>
 13. <https://www.icsspe.org/system/files/CIO%20-%20Heritage%20olympique.pdf>
 14. https://www.liberation.fr/sports/2017/07/10/londres-un-succes-durable-mais-pas-social_1582943/
 15. <https://grandparisdurable.org/2020/04/29/objectif-neutralite-carbone-paris-2024-lance-la-chasse-au-co2/>
 16. Godon P., 2016 https://www.francetvinfo.fr/monde/bresil/jo-2016-a-rio-la-galere-des-transportes-en-commun-pour-les-supporters_1576897.html
 17. <https://www.cairn.info/revue-movement-and-sport-sciences-2020-1-page-1.htm>
 18. <https://journals.sagepub.com/doi/10.1177/101269028401900202>
 19. Hensher, D. 2012. <https://theconversation.com/olympics-transport-how-did-sydney-handle-it-8249>
 20. <https://www.statista.com/statistics/1090581/olympics-number-athletes-by-gender-since-1896/>
 21. GUFFOND, LECONTE, 2001 https://www.chantier.net/journal/0299_3.html
 22. DEBLOCK, F., 2021. <https://grandparisdurable.org/2021/05/17/jo-de-paris-pres-de-300-kilo-tonnes-de-dechets-a-gerer-et-recycler/>
 23. https://www.apur.org/sites/default/files/documents/publication/documents-associes/jo_paris_2024_innovations_durables_logistique_urbaine.pdf?token=iIH5nTMO P-18
 24. <https://france3-regions.francetvinfo.fr/bourgogne-franche-comte/yonne/sens/pourquoi-le-materiel-de-l-equipe-de-france-de-canoe-kayak-part-pour-les-jeux-olympiques-depuis-l-yonne-2111341.html>
 25. <https://www.youtube.com/watch?v=B3FKtBNEBRc>
 26. <https://olympics.com/cio/heritage/turin-2006/villages-olympiques>
 27. <https://fr.furniturehomewares.com/2017-12-07-qatar-2022-fifa-world-cup-shipping-container-stadium-football-fenwick-iribarren-architects-doha>
 28. <https://www.sciencedirect.com/science/article/pii/S0926580517308580>
-

ABOUT THE AUTHORS



Maxime HANRION NICHOLLS

Paris, France



Maxime Hanrion Nicholls is a student at ESLI Paris, MSc Industrial Logistics and Purchasing Management (MLAI). After a bachelor's degree in Logistics management where he learned every logistic problem in warehouse management, supply chain strategy, accounting and transport, he decided to continue his studies path by applying at ESLI Paris. Now he focuses more on industrial logistics. He also had the opportunity to develop his professional experiences through 5 years in the French army and also 2 years in the agri-food industry as sales administration manager. He can be contacted at mhanrionnicholls@etu.campus-redon-industries.com



Mohammed Hamza EL MOUMNI

Paris, France



Mohammed Hamza Elmounni is a student at ESLI Paris in Master 2 MLAI (Manager of Logistics and Industrial Purchasing) in the field of intelligent secure logistics. He has an engineering background in industrial mechanical engineering and through this training has come to know the importance of logistics in the industrial field. He can be contacted at melmounni@etu.campus-redon-industries.com



Baki ALTUN

Paris, France



Baki Altun is a student at ESLI Paris, MSc Industrial Logistics and Purchasing Management (MLAI). He has a bachelor's degree specialized in the field of logistics; he also got a high diploma in transport . Today he is an ATC engineer at Siemens mobility for the “Grand Paris Express” project. He can be contacted at baltun@etu.campus-redon-industries.com



Ludovic PIRES DOS SANTOS

Paris, France



Ludovic Pires Dos Santos is a student at ESLI Paris, MSc Industrial Logistics and Purchasing Management (MLAI) in France. After a bachelor's degree in Logistics management at AFTRAL – ISTEELI, he decided to continue to study in this field of activity. He is a project manager at Castorama – FRANCE. He can be contacted at lpiresdossantos@etu.campus-redon-industries.com