

APPLYING TECHNOLOGIES OF THE FOURTH INDUSTRIAL REVOLUTION - THE FUTURE OF ECOTOURISM AND TOURISM OF PROTECTED AREAS

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Abstract

In this paper we analyze and evaluate the impact of the new technologies of the Fourth Industrial Revolution (4IR) on tourism of protected areas and the future of ecotourism and tourism of protected areas. The transformational role of the 4IR technologies has huge potential effect on managing protected areas. Using new technologies in ecotourism and tourism in protected areas will greatly improve management of protected areas. In this paper we analyzed dominant technological trends and key concepts in tourism industry. We also presented case study of the applying new technologies in SNR Zasavica in Serbia. In future, the new concepts and the Smart Tourism paradigm will transform the ecotourism and tourism of protected areas in the way of creating fully automated technological ecosystem intended for managing sustainability of the protected areas environment. There are several emerging concepts that have a capacity to completely and radically change the way of the business as we know it and will surely have great impact on tourism and ecotourism in the future.

Key Words: *fourth industrial revolution, Future, 4IRtechnologies, tourism of protected areas, ecotourism, smart tourism*

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Introduction

According to Klaus Schwab (2016), the actual Fourth Industrial Revolution(4IR) is fundamentally different from the previous industrial revolutions. Schwab specified that the 4IR is “characterized by a range of new technologies that are fusing the physical, digital and biological worlds, impacting all disciplines, economies and industries, and even challenging ideas about what it means to be human” (World Economic Forum, The Fourth Industrial Revolution, 2022).

At the heart of the Fourth Industrial Revolution there is a set of new technologies capable of transforming the economy and society in new ways, which will enable a new, unprecedented momentum of the economy and radically change social and interpersonal relationships. According to the World Economic Forum’s Global Risk Report 2017 (World Economic Forum, 2017), there are 12 core technologies that make the technological infrastructure of the 4IR: a) 3D printing; b) Advanced materials and nanomaterials; c) AI and robotics; d) Biotechnologies; e) Energy capture, storage and transmission; f) Blockchain and distributed ledger; g) Geoengineering; h) Internet of Things; i) Neurotechnology; j) New computing technologies; k) Space technologies and l) Virtual and augmented Realities.

Actually, there have been numerous significant reports and studies publications that predated the Schwab’s concept of the 4IR based on new technologies. Among them, the more important ones were the following: Rocco & Bainbridge (2002), Nordmann (2004), European Parliament (2006), Andler et al. (2008), Van Est et al. (2010), Van Est et al. (2012) and Van Est et al. (2014). In these reports and studies the new technologies are recognized either as converging technologies (CT) or as NBIC, which refers to four crucial technologies: nanotechnology, biology, information technology, and cognitive sciences. (Van Est et al., 2014, p. 12).

Leonhard (2016, p. 6) mentions three key characteristics of the 4IR emerging technologies, explaining that they are exponential, combinatorial and recursive. As Radun (2018) states, “the Fourth industrial revolution enables the connection and permeation of a wide range of new technologies and is a fusion or synthesis of many new scientific and technological fields. In this way, it synergically magnifies and multiplies the interplay of many disciplines, branches and fields, integrating science, technology and economics into new great syntheses, causing enormous and incomprehensible tectonic changes in the worldview, the relationship between human and the world, the possibilities

of knowledge and re-examining possibilities, role, boundaries and meaning of human in general.” (p. 110).

The 4IR can be considered as a comprehensive and rapidly transformational technological wave which impact is overwhelming. The area of travelling and tourism and, especially, eco-tourism, is very attractive for the new technologies and pretty receptive for the implementation of the new technological solutions and applications.

The importance, position, market and terms of development of ecotourism and tourism in protected areas

According to The International Ecotourism Society (TIES, 2015), the ecotourism is defined as “responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education”. It can be concluded that the ecotourism is based on four key concepts: conservation, local community, responsibility, sustainable development and education.

Bartula & Radun (2020) point out “the main characteristics of ecotourism in a way that it: a) is applied in natural and cultural areas; b) has a minor impact on the environment; c) is based on principles of conservation and preservation; d) may even contribute to the improvement of the environment and its resources; e) protects local communities and may be beneficial to the local communities’ wellbeing; f) involves responsible and planned use and engagement of tourists who intentionally take care of the environment and local communities; g) implies highly informed, planned and strategic approach, which involves the use of technology and the knowledge management methodology” (pp. 80-81).

Since ecotourism is firmly linked to sustainable development, it is a responsible and environment-conscious tourism as it involves respect and care for natural and local cultural environment. Therefore, its importance, in the age of severe environmental crisis, will surely continue to rise over time. Tourism in protected areas, as a special branch within ecotourism, is growing rapidly and its popularity is constantly increasing, precisely because of the properties it has. The preserved and clean natural environment as well as the distinctiveness of the native culture of local communities within the protected areas are highly valued by tourists. As Nikolić (2006) states, “it is precisely landscapes and natural objects of such features and importance that are valued and proposed for protection as

natural resources. There are no significant differences between the ecological and tourist features of a protected and ecologically preserved nature.” (p. 110). The aim of the tourism in protected areas is to sustain the natural resources, to preserve the biodiversity as well as care and contribute to the welfare of the local people, while meeting the needs of the tourists and visitors, making them enjoy the distinctiveness of the well-preserved nature and the native culture.

The travelling and tourism industry, as a whole, during 2020 and 2021 passed through a serious crisis due to the COVID-19 pandemic, which severely hit the entire world economy. The tourism industry was definitely one of the most harshly struck areas of economy caused by a pandemic.

Figure 1: *Tourism industry market size worldwide 2011-2021*



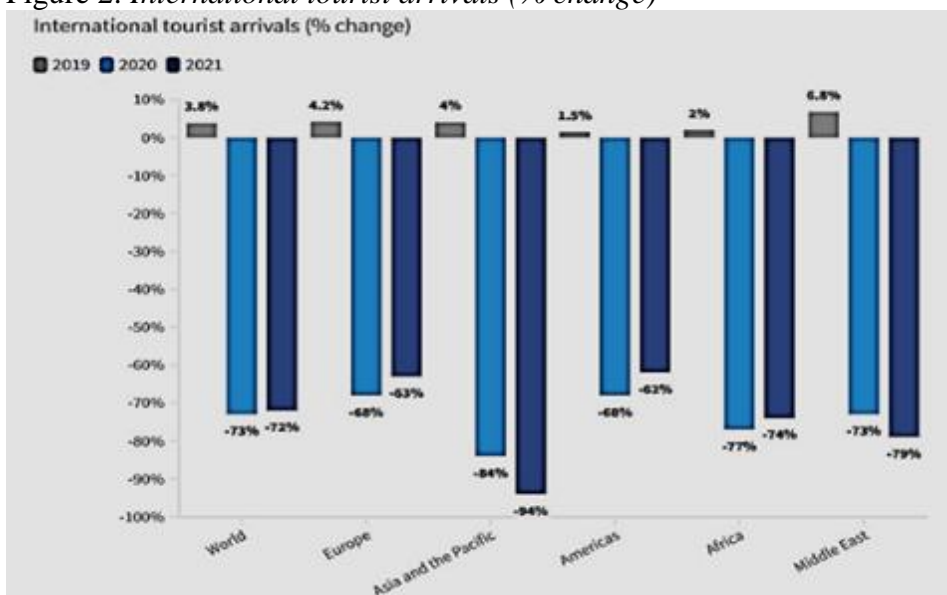
Source: *Statista, 2021a*

The market size of the global tourism industry (Figure 1) had steady growth from 2011 to 2019, with a minor decline recorded in 2015 and 2016, then returned on the rising track in 2017 and kept on increasing until 2019, when it reached USD 1.87 trillion. Then, due to COVID-19 pandemic, the market size of the global tourism sector in 2020 shrank dramatically to USD 1.09 trillion. In 2021 it slightly recovered as it is estimated that the global tourism market reached USD 1.3 trillion. The direct gross domestic product value of tourism dropped fiercely in the years 2020 and 2021 compared to pre-pandemic 2019, due to the pandemic – from USD 3.5 trillion in 2019 to only USD 1.6 trillion in 2020 and USD 1.9 trillion in 2021, which is a small improvement over 2020. The export revenues from international

tourism also sharply dropped in these two pandemic years: estimated USD 638 billion in 2020 and a bit above USD 700 billion in 2021, compared to pre-pandemic USD 1.7 trillion in 2019. (UNWTO, 2022a).

There were only about 400 million international tourist arrivals in 2020 globally, compared to 1.5 billion in 2019, and 415 million in 2021, which is insignificant increase (4%), only 15 million more than in 2020. That is still 72% below 2019 levels, in contrast to the 73% drop in 2020.

Figure 2: *International tourist arrivals (% change)*



Source: UNWTO, 2022b

According to data presented in the UNWTO World Tourism Barometer (UNWTO, 2022b), the year 2020 was the worst year on record for tourism, while in 2021, the tourism sector was marked by slowly recovering from the crisis, although it was still insignificant progress (Figure 2). The prospects for 2022 seem mildly optimistic, as according to the latest UNWTO Panel of Experts a majority of tourism professionals (61%) see better results. Nevertheless, most experts (64%) anticipate the return of international arrivals to pre-pandemic levels only in 2024 or later. (UNWTO, 2022a).

The global ecotourism market size was estimated at USD 181.1 billion in 2019 (Statista, 2021b). It is forecasted that the value of the market size of ecotourism will reach USD 333.8 billion in 2027, with a CAGR of 14.3 percent.

Ecotourism, as a form of tourism, has also suffered the devastating effects of a pandemic. However, its characteristics, such as adherence to the principles of sustainability, responsibility for the environment and society, commitment to conservation and care for the environment, as well as involvement in local cultures and communities and cooperation with indigenous peoples in protected areas, ensure its sustainable growth and development in the forthcoming years. New possibilities and opportunities are emerging from wider application of 4IR technologies, in a way that should further strengthen the critical issues of environmental-conscious, holistic ecotourism.

In their article on statistics and trends in sustainable tourism, Avantio (2022) mention the environmental and ethical revolution and relate of them as of “change in mindset”. They emphasize that “sustainability is no longer a choice, but an imperative that will impact our society and the vacation rental industry in the years to come.” (Avantio, 2022). According to the Statista’s overview of statistics on sustainable tourism (Lock, 2021), there is a trend of growing awareness for social and environmental responsibility among travelers. The global survey in 2020 exposed that 48 percent of global travelers, especially amongst the younger generations, believe that choosing the environmentally friendly way is vital.

To resume, the pandemic crisis did almost halt the tourism activities, but it also made a critical break, paving the way for a critical analysis and redefining the tourism industry. It was a turning point for travel companies, from which only two outputs emerged: either to restructure and reorientate towards more sustainable and efficient way or to remain in a dead end and eventually disappear from the market.

Trends, challenges and opportunities for the future of tourism in protected areas in terms of using 4IR technologies

There are numerous challenges and opportunities that the future posts to ecotourism and tourism in protected areas. Actually, the COVID-19 pandemic made major disruptions in the travelling and tourism industry, which may be perceived as great opportunities for a critical shift to a new development model in terms of radical transformation of the industry. It seems that the actual pandemic served pretty much as the turning point of the shift to a new technological paradigm of the 4IR, which urged a need to install and implement new technological solutions and applications in various industries and areas of the economy and society as a whole. The

Fourth industrial revolution sets new standards for business and requires technological adaptation through the implementation of new technological solutions and taking advantage of a series of technological breakthroughs that provide a radical technological transformation of the branch. It will have huge repercussions on the offer of tourist facilities, the way of using tourist services and the attitude towards users. In addition, the experience of enjoying the facilities and activities offered by travel companies will be dramatically different.

One of the key issues is which technologies are to be used for the purpose of innovative technological transformation of the organizations in ecotourism and tourism in protected areas. In view of choosing and organizing portfolio of 4IR technologies that should be applied for the purpose of optimal company management in the field of ecotourism, one should keep in mind the “trade-offs between sustainably managed tourism and nature conservation.” (Eddyono et al., 2021).

We should look in more detail at some of the dominant trends in tourism and ecotourism in order to get a bigger picture and perceive the directions and tendencies of the future technological transformation of tourism. Revfine (2021a) finds 11 key technology trends emerging in the travel & tourism industry: 1) Voice Search and Voice Control; 2) Robots; 3) Contactless Payments; 4) VR; 5) AI Chatbots; 6) CyberSecurity Measures; 7) Internet of Things (IoT); 8) Recognition Technology; 9) AR; 10) AI and 11) Big Data. Though, according to Vidal (2019), there are seven most important technological solutions for the tourism industry, and they are: 1) mobile technology; 2) Augmented Reality; 3) Internet of Things; 4) Virtual Assistants; 5) Big Data; 6) Blockchain and 7) 5G.

The most important core travel technologies that can have a significant disruptive impact on tourism and ecotourism industry are the following: a) Artificial Intelligence – AI; b) Big Data; c) Robots; d) Virtual reality (VR) and Augmented Reality (AR) and e) Internet of Things (IoT).

AI is a vital set of technologies, which increasingly becomes an essential technology in various industries. According to Radun et. al. (2021), “The impact of AI on economy is disruptive in a way that it is revolutionizing every aspect of life and work. Implementation of AI in industry leads to radical transformation of the production process in all sectors of economy, especially in manufacturing, travel industry and transportation as well as agriculture.” (p. 871).

Big Data technology is of the utmost interest for tourism industry. The main goal of using Big Data is to improve personalization, meaning collecting a great deal of information on customers, which is used by travel agencies for the purpose of making specific offers, tailored to the customer's personal profile.

Using robots is also pretty extensive, so that there are huge possibilities to include robots in the service operations. There is a trend of massive use of various specialized robots designed to perform a wide range of different specific tasks and duties. An excellent example of using robots in tourism is the Henn-na hotel in Nagasaki, Japan, recognized as the first robot-staffed hotel in the world (Revfine, 2021c). In this hotel, the entire staff consists of robots and specialized robots performed all needed services: providing information, carrying luggage, security, reception, escorting, concierge etc.

Virtual reality (VR) and Augmented Reality (AR) have especially significant role within the tourism industry. Their popularity and value is on rise and will be still more appreciated in the future. VR especially offers a great variety of new experiences for the customers and has huge benefits for companies. The impact of the VR and AR in tourism industry is so huge that a new concept was developed – Virtual Tourism. As Ehinger (2020) claims: “Virtual tourism offers the ability to take a virtual tour of an attraction from home. The combination of videos and still images with multimedia, such as narration, music, and sound effects offers an immersive experience for the user”.

Although VR and AR technologies usually go together, there is a significant difference between them. Revfine explains VR in this way: “Virtual reality technology typically involves the use of a VR headset, which helps to immerse a user in a digital environment. Through the use of images, sounds and other physical sensations, the user is essentially placed within a virtual world, which they can move around and, in some cases, interact with in other ways.” (Revfine, 2021d). AR is defined by Revfine as “a digital technology, which makes changes to a person's perception of their physical surroundings, when viewed through a particular device. The technology has similarities with virtual reality, but AR does not replace the real-world environment, but augments it by overlaying digital components.” (Revfine, 2021e).

Internet of Things (IoT) is a platform that enables complete interconnectedness, meaning that all things, computers, mobile phones, wearables, devices, objects, machines will be connected to each other. Investopedia (2021) defines IoT as “a name for the aggregate collection of network-enabled devices, excluding traditional computers like laptops and servers. Types of network connections can include Wi-Fi connections, Bluetooth connections, and near-field communication (NFC). The IoT includes devices such as ‘smart’ appliances, like refrigerators and thermostats; home security systems; computer peripherals, like webcams and printers; wearable technology, such as Apple Watches and Fitbits; routers; and smart speaker devices, like Amazon Echo and Google Home.” The IoT Analytics (2021), according to its latest report for 2021 “expects the global number of connected IoT devices to grow 9%, to 12.3 billion active endpoints. By 2025, there will likely be more than 27 billion IoT connections.”

The mentioned core travel technologies (Big Data, AI, IoT, VR, AR and robots) have great capacity to improve the competitiveness of the tourist organization while aligning to the ecotourism standards of business and supporting sustainability, conservation and preservation principles

The protected areas are appropriate and highly sensitive for the application of 4IR technologies as they are legally regulated and protected within strictly defined boundaries in accordance with national laws. Considering the terms and prospects of applying 4IR technologies in the protected areas, Radun & Bartula (2021) state that “the set of 4IR implemented in the protected areas should provide wide range of methodologies and effects in terms of tracking, measurement, analyzing and control, such as automation of management of natural resources, monitor and control biodiversity, monitor and track movement of wildlife or tourists within the protected areas, protect the key points of the areas, etc.” (p. 28).

Recently, the terms “Tourism 4.0” and “Smart Tourism” have come into use, in order to emphasize the distinction between the approach to tourism in which novel 4IR technologies are extensively used and the traditional type of tourism. The term Tourism 4.0 is referred to as a new paradigm in tourism, a transfer of the concept Industry 4.0 (4IR) to tourism, and a technological evolution of tourism in relation with technological changes of 4IR adapted to tourism (Korže, 2019).

Smart Tourism encompasses digitalization of the tourist service and activities in addition to an extensive use of various so-called smart tourist

technologies (STT), mainly ICT, which is treated as a key factor, as well as a whole range of other technologies and applications, smart devices, “social platforms, cloud computing, big data, IoT, artificial intelligence (AI), virtual reality (VR), augmented reality (AR), mixed reality, NFC, and radio-frequency identification (RFID), which are related to tourism activities” (Pai et al., 2020). Smart tourism is becoming a main trend in tourism, and an approach that drastically changes service, relations to a customer, the whole business setting, management and marketing.

There are several emerging concepts that have a capacity to completely and radically change the way of the business as we know and will surely have great impact on tourism and ecotourism in the future. These concepts that should be carefully considered are: a) Experience economy; b) Bionic organization; c) Internet of senses and d) Metaverse.

The concept of Experience Economy means that emotions and experience are increasingly becoming profitability point, the ‘goods’ that can be traded. In the future, customers will more and more value unique and strong experience, happiness, excitement, ecstasy, even a kind of trance, not just commodities or usefulness of the goods or services. As G. Ascolese and J. Llantada in *The Next Great Tourism Revolution Report* (We Are Marketing, 2019), “We have to work systematically to cultivate emotions in peoples’ minds. We have to move from being a commodity to the emotional world. Today’s tourism industry can create a sensory world in its customers’ minds using colors, images, words, scents, videos, and more through a perceived story and lived experience. This process of bringing these together is key to successful competitive positioning...”

Bionic company is a concept of the company of the future, which integrates 4IR technologies in its structure and functioning through all its operations and activities. Boston Consulting Group (BCG) issued a series of articles and essays on bionic company. According to BCG, the company of the future is bionic. The bionic company is defined as a company that “blends new technologies with human capabilities to power innovation, advantage, growth, efficiency, and resilience.” (BCG).

Metaverse is a mode of radical virtual experience. Concept of metaverse offers to a customer completely new dimension of travel experience and, what is still more exciting, an ability to create and totally immerse into a new interactive virtual world and redesign it on his own, up to his own preferences until he be satisfied. As Ravenscraft (2021) explains,

Metaverse “doesn’t really refer to any one specific type of technology, but rather a broad shift in how we interact with technology”. According to Revfine (2021b), “the idea of interactive virtual worlds could help to alter the way customers engage with other locations and may replace some instances of physical travel, without hurting the industry”.

Metaverse will expand to its full potential with the development of a new 6G network. In the Ericsson White Paper on 6G (Ericsson, 2022), calling 6G a future network platform, it is stated: “6G makes it possible to move in a cyber-physical continuum, between the connected physical world of senses, actions, and experiences and its programmable digital representation. The network provides intelligence, limitless connectivity, and full synchronization of the physical and digital worlds.” It seems that the Metaverse, powered by 6G network and the IoT, together with other 4IR technologies, will push us all into an era of technological convergence and fusion of the physical, digital and biological worlds.

Case study: Applying emerging technologies for wildlife watching in SRP Zasavica

The Special Nature Reserve of Zasavica (hereinafter referred to as SNR Zasavica) is situated in the Republic of Serbia, on the territory of South Voivodina and North Mačva, east of the Drina River and south of the Sava River. Zasavica is protected area of the national importance (category I) that spans over the surface of 1128.55 ha, with additional buffer zones of 3,462.65 ha. It has 3 regimes of protection:

- Protection regime of the first degree covers 59.85 ha (5.30%),
- Protection regime of the second degree covers 686.26 ha (60.81%),
- Protection regime of the third degree covers 382.44 ha (33.89%).

As a unique mosaic of aquatic and wetland ecosystems with fragments of flooded forests, Zasavica is home for 218 species of fungi, 655 species of plants, 19 species of fish, 13 species of amphibians, 182 bird species and about 65 species of mammals among which are numerous protected and strictly protected species. It is the area of international importance. It is a Ramsar Site, Important Plant Area, Important Bird Area, and Prime Butterfly Area. According to the IUCN management categories, it is a Habitat and Species Management Area, category IV (Bartula et al., 2011). With its exceptional landscape and biodiversity, traditional grazing and cattle breeding, particularly of autochthonous races such as podolian cattle,

mangalista pig and Balkan donkey, SNR Zasavica has high potential for ecotourism and tourism in protected areas.

Ecotourism has been developing in SNR Zasavica from the very beginning of its inauguration as protected area. Since then, the number of visitors in the Reserve shows a growing trend. In comparison to the year 1997, when number of visitors was only 500, in 2019 the total number of visitors increased 80 times reaching the number of almost 40 000 visitors per year. Most of the visitors to the Reserve were schoolchildren, making 70% of all visits. During the 2020, when travelling was restricted drastically due to the pandemic, the number of visitors to the Reserve did not significantly change in comparison to the 2019. However, instead of schoolchildren, majority of tourists were adults, especially parents with children, coming with the aim to spend whole day in the nature which makes higher pressure to the natural values although the number of visitors remained the same. That was the reason for introduction of critical change in visitor management practice.

In order to decrease direct pressures on natural resources and at the same time to keep the current number of visitors, new technologies were set up in the Zasavica. Therefore, five photo hides were constructed in the Reserve and equipped with web cameras connected to internet. Thanks to live streaming, visitors to the reserve have opportunity to watch wildlife from the 5 five distant points of the reserve from visitor center (Figure 3).

Figure 3: *Live streaming from the bird feeding station*



Source: *Internal data archive of the Faculty "Futura"*

What is more, mobile application gDMSSPlus with QR code enables watching the wildlife in Zasavica from any part of the world. This is an innovative way that provides the opportunity to viewers to get an interactive look into wild habitats of Zasavica Reserve. By taking the watch, anyone can become a virtual ranger and help protect the endangered wildlife. Species that are especially attractive for online watching are: *Aythya nyroca*, *Circus aeruginosus*, *Falco tinnunculus*, *Alcedo atthis*, and *Castor fiber*.

This technology help visitors to have virtual tour through the reserve at any time of the year without disturbance of the wildlife. It helps scientists study animal behavior any time during the day in their natural habitats, and it helps managers perform efficient monitoring of the site with less human and financial resources. Having in mind the fact that the total protected area in Serbia is currently 677,950 ha, which is 7.67% of the territory of Serbia (Bartula & Radun, 2020), it implies significant potential ecotourism development. Large number of species and natural ecosystems in Serbia indicate rich biodiversity which is unfortunately under anthropogenic pressure, urge for harmonization between nature protection and tourism planning sector of (Amidžić et al., 2014). Application of new technologies for online wildlife watching can bridge the gap between nature protection and tourism planning sector and enable increasing the number of visitors to the protected and preserving the natural resources at the same time.

There is still a lot of work to be done on the way to more substantial and extensive use of 4IR technologies in the Zasavica protected area. Nevertheless, the management of the Reserve has determined to initiate a new break-through to a Smart Tourism paradigm, which means more organized, systemic and technologically supported approach for the purpose of more sustainable and efficient tourism in protected areas.

Conclusion

We may say with assurance that the future of ecotourism development, especially tourism in protected areas, will be determined by the capabilities of new 4IR technologies, on the one hand, and on the other hand, the readiness of tourism management to accept a smart tourism approach, as well as openness to adapt solutions and applications that offer different 4IR technologies.

Given that 4IR technologies are still at an early stage of development, it is very certain that the pace and conditions of 4IR, which is in full swing, will still place huge demands and challenges on business and the economy, and thus keep being the main driver of economic and social development in the near future. Tourism in protected areas should be opened for rapid technological improvements and radical technological transformation of tourism, in accordance with Smart Tourism paradigm.

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