Industrial revolution 4.0 on the example of flagship brand in women's tennis

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Abstract

The fourth industrial revolution is characterized by a combination of technologies blurring the boundaries between the physical, digital and biological spheres. It disrupts almost every industry and changes our lives at a rapid pace, combining all collected data with knowledge. Sport is no exception. The Fourth Industrial Revolution changed the way sport is viewed and practiced. The desire to use technology in sport results from a competitive spirit. There are also psychological themes, such as emotional attachment to sport, that affect the pace of technological innovation. The fourth industrial revolution permeates all disciplines widely practiced around the world, including women's tennis.

Key words: Industrial revolution 4.0, Internet of Things, innovations in sports technology, Women's tennis, Agnieszka Radwańska.

Introduction

The fourth industrial revolution is defined by the WEF (World Economic Forum) as digital revolution, which took place from the end of the last revolution (in electronics and IT technologies). It is characterised by combination of technologies that blur borders between physical, digital, and biological spheres" [1]. The first industrial revolution was based more on mechanisation, the second - on mass production, and the third- on electronics and IT technologies. The fourth industrial revolution disrupts almost all industry and changes our life at a sudden pace while combining all collected data with knowledge. Sport is not an exception in this matter. The nature of sport is human desire. The meeting of between the essence of sport and technology (the fourth sport industrial revolution) constitutes as a perfect combination. Technologies contribute to the human desire to achieve better and better results and the desire for true victory. It is hard to find a motivation stronger than this one in other industries.

The purpose of the fourth industrial revolution in sport is the creation of environment and culture, in which people train more, as well as watch and play more sports. The purpose of this article is to focus on the role of sports technology and method of managing the innovation process in sports. The technology is developed and integrated in the context of sports. We observe a quick technological

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[1] Globalization 4.0. 2019 Available at:

https://www.weforum.org/agenda/2018/11/globalization-4-what-does-it-mean-how-it-will-benefit-everyone/

progress in played sport disciplines. Interest in product, process, and service innovations in sports is related to the need of competition based on technological progress.

It is assumed that the Internet of Things will be most widely used in sports tennis. The use of technological innovations is very important for sport because it increases the chances of success in sports competition.

1. Industrial revolution 4.0

 The fourth industrial revolution covers the most integrated and complex technologies, such as:

- Internet of Things (IoT)

  This term was used for the first time by British entrepreneur Kevin Ashton in 1999. It defines a network of thinks, which can communicate between each other and with human thanks to the possession of various types of sensors and ability to be connected to the Internet.[2]

- Cloud

It is a certain type of space provided to us by the Internet provider via the Internet. The cloud can be defined in two ways. First way is and the other is public cloud, or drives in cloud.[3]

- Big Data

  This term refers to big, variable, and different data sets, which are hard to process and analyse, but at the same time they are valuable because they can lead to the acquisition of new knowledge. According to Gartner, big data are collections of information with great volume, great variability, and great variety, which require new forms of processing in order to support making decisions, discover new phenomena, and optimise processes.[4]

- Artificial Intelligence (AI)

  Usually understood as a wide term covering any attempts to imitate human intelligence: from simple systems based on few rules (e.g. for Tic Tac Toe games) defined by a programmer up to complex models that can recognise objects in photos or interpret statements in natural language. At this point it is worth to distinguish Strong AI, at which we merely aim and which would not

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[2] Czym jest Internet rzeczy (What is the Internet of Things).2019. Available at:

https: // www.wieciecownecie.pl/ czym-internet-rzeczy-internet-of-things/

[3] Czym jest popularna chmura (What is the popular cloud). 2019. Available at:

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[4] Big Data. 2019 Available at:

https://en.wikipedia.org/wiki/Big_data

yield to human intelligence in any matter, and Weak or Narrow AI that nowadays can solve specific, predetermined problems in a way similar to approach that a man would take.[5]

- Robotics

    It is an interdisciplinary field of knowledge operating at the meeting point of mechanics, automatics, electronics, sensor technology, cybernetics, and IT technology. The domain of robotics are also considerations on the subject of artificial intelligence - in certain environments, robotics is straight equated with artificial intelligence. [6]

- Virtual Reality (VR)

    It is a three-dimensional image that was generated by a computer. VR can present various things, objects, and even whole events. Depending on the conception, virtual reality is based on elements of both real and completely fictional world. Thus, the simplest way to say it is that this term simply means a virtual imitation of reality. [7]

- Augmented Reality (AR)

    It is a system that allows to combine real and virtual worlds. Most often this is simply done by overlapping virtual elements on what we observe in front of us. Most often in the creation of augmented reality is used a feed from video camera, on which are overlapped elements generated in real time.[8]

- Mixed Reality (MR)

    It is a technology that consists of combining virtual and augmented realities together. Therefore, it allows to introduce a user into space generated by a computer, as well as overlap virtual objects on the reality that surrounds this user. [9]

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[5] Czym jest dziś sztuczna inteligencja (What is today's artificial intelligence). (2019) Downloaded from the Harvard Business Review. Polska application:

https://www.hbrp.pl/b/droga-do-ai-czym-jest-dzis-i-czym-moze-stac-sie-sztuczna-inteligencja/PJzlpXnpV

[6] Robotyka (Robotics). 2019 Available at: https://en.wikipedia.org/wiki/Robotics

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https://antyweb.pl/co-to-jest-rozszerzona-rzeczywistosc/

[9] Mieszana rzeczywistość (Mixed reality). 2019. Available at:

http://www.benchmark.pl/aktualnosci/mieszana-rzeczywistosc-wedlug-microsoftu-i-acera.html

2. Fourth industrial revolution in sports

The fourth industrial revolution has changed the way that sports are watched and played. Technological innovations are a necessity in sports. In order to initiate a technological innovation in sports, one must show a creativity in the scope of its use. Innovations in sports technology must transfer research over sport to a technological context, in which new technologies play a significantly bigger part. Technological innovations improve results achieved by athletic teams and athletes. Thanks to experiences of sport organisations and athletes, it is possible to acquire more information on the subject of role played by technology in sport rivalry. Technological innovations create a new path for sport organisations through interactive applications and new media. Sport organisations must invest significant amounts of money into technological innovations in order to remain competitive at the sports market. The absorption of complex technological innovations by sport organisations allows them to better prepare for future challenges. Computerisation and digitisation implement deep changes in sports and majority of people sees technology changes as an opportunity to develop sports and sport services. Many breakthrough innovations in sports occurred as a result of changes in media, which were possible thanks to wireless communication. Live transmission of sport events has increased the geographic range or reception and provided a more interactive experiences to sports fans. These breakthrough innovations have turned sports into physical and mental activity, which is a form of entertainment. The complex technological innovations are the base of sports because they contribute to its further development. In order to survive in a global business environment, the sports industry must implement innovations in its system. More and more sport organisations use this knowledge as a resource that can improve their competitiveness. This has led to a situation, in which traditional resources, such as physical assets, are not so important anymore. Because of the fourth industrial revolution, technological competences became a part of stored knowledge of sport organisations and transformed their business activity. However, sport is distinguished by unique traits, namely the uncertainty of results. Yet at the same time sports and technology share the same philosophy in the scope of constant crossing borders of what is possible. Majority of sports markets is related to competition, in which there is a winner and a loser. This means that on sports markets there is a competition to keep fans and win in sports events.

Sports has changed significantly within the last decade. The appearance of Internet followed by revolution in mobile technologies have forever changed the way we watch and interact with sports. Many athletes and athletic teams have personal social accounts that enable fans to engage in real time, which in turn make contact with sports more personal. More and more often innovations appear in Internet social media, which share information and knowledge on the subject of sports technology. Social media are defined as a group of Internet applications based on the ideology and technological bases of Web 2.0 that allow to create and exchange contents generated by users. [10] In addition, the real

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[10] A.Kaplan ,M.Haenlein, 2010.Users of the world, unite! The challenges and opportunities of Social Media. "Business Horizons", 53(1) p.61.

time technology means that it is possible to watch sport events without unnecessary delay. Technological innovations have an essential meaning for the ability of a sport organisation to acquire an advantage in sport rivalry. Sport organisations are aware of the possibilities that technological innovations provide to the global environment, but sometimes they are not so sure what way is the best to use the said technologies[11]. The cause of such uncertainty is the method of combining technology with sports. Sport organisations face various worries, problems, and hazards related to technological innovations and think whether these innovations are a change or threat to sports.

Radical innovations in sports have covered, among other things, the application of new materials in sports equipment and sportswear. In the past, majority of sportswear was made from cotton, but this change with the introduction of a sweat-removing and quick-drying materials. Earlier sports equipment, such as tennis rackets, was made from wood, but this changed along with the introduction of new metals used in the production process. Isotonic beverages and energy bars appeared in sports and allowed athletes to quickly fill fluids and minerals, as well as regenerate strength. New technology in sport venue transportation system, such as network of light rail, was implemented in cities as a way to reduce congestion. In addition, certain sports stadiums were rebuilt in order to be more balanced and use resources in a more optimal way. Much energy was consumed during sports events and technological innovations allow to use them in a better way. Physical infrastructure on sports events, such as illumination and heating, was changed in order to use solar energy and other natural resources. Sports technology is increasingly more often used to register results of matches and provide statistical information. Computers used for this purpose quite often are more accurate than people and provide more reliable information. This can be seen in the goal line technology used in such sports as tennis, where it allows to make replays in order to see whether the ball actually landed inside or outside of the field. Fifty years ago, there were few examples of using computers and similar IT technologies in sports. This quickly changed when sports analytics became an important aspect of the sports industry.[12] Nowadays we are witnessing numerous technologies used in sports, including special technologies created for specific sport disciplines.

Stress on innovations in sports is put mainly due to the various methods of their application and management. Consumers often seek technologies to watch sports, and players are interested in how it influences their results. Managers and trainers use technologies to evaluate athletes.[13] Each innovation in sports technology is different and cannot be appropriate for all sport disciplines. Innovations in sports

[11] P.Chelladurai, 2009 . Managing organizations for sport and physical activity: A systems perspective. Scottsdale: Holcomb-Hathaway. p.39.

[12] M.Yuksei, M. McDonald,& S. Joo, 2018,Cause-related sport marketing: An organizing framework and knowledge development opportunities. "European Sport Management Quarterly", 16(1), p..58–85.

[13] A.Campos-Izquierdo, M.Gonzalez-Rivera, & M.Taks, 2016. Multi-functionality and occupations of sport and physical activity professionals in Spain. "European Sport Management Quarterly", 16(1), p.107.

technologies are a new type of innovation that aims at a change in the context of sports. [14] Various sports require different forms of technology depending on whether they are played in water, on land, or in air. Therefore, the characteristics of a technology will depend from the type of sport and needs of players. However, not all sport disciplines can use technological innovations. The recipient is the majority of sport disciplines played commonly on a global scale. The implementation of technological innovations in sports differ depending on the size of an organisation. For example, leading football clubs of the Champions League have big amounts of money to spend on research and development. In addition, the structure of the League means that there exists a collective pool of money, which can be spent on technology. On the other hand, smaller athletic teams have less resources, but can use government and municipal donations.

3. Industrial revolution 4.0 on the example of Agnieszka Radwańska's sport career in tennis

The phase preceding the implementation of a brand on sports market usually requires the most sacrifices. The first contact of a few-years old Agnieszka Radwańska with tennis took place in Gronau, Gemany. The costs of learning how to play tennis were high. For the Radwańscy family, these few years they had to endure without the support of sponsors meant an expense of several hundred thousand of zlotys. The beginning of Agnieszka Radwańska's life on the professional sports market is the introduction phase covering years 2005 to 2008. Agnieszka acquired the state of a professional on 23rd April 2005 as the age of 16. She broke to the lead of tennis players participating in the WTA plays in the growth stage, which covered years 2008 to 2011. In 2011, Agnieszka Radwańska had the best season. She ended it as the eighth racket of the world, on the way she gained three important titles, and at the end she appeared in the WTA Finals. At the maturity stage in years 2011-2017, Agnieszka Radwańska started to participate in tournaments in the company of a young trainer, Tomasz Wiktorowski. The father now trained her daughter only in Kraków. It was a period full of important events of the fourth industrial revolution in tennis.

In 2012, an average-sized French company Babolat invented intelligent rackets, which brought tennis in the technological age. This company has announced that it has in its offer a racked with the IoT Play & Connect technology. The abilities of the Internet of Things have caused intelligent tennis rackets to become a reality. These rackets precisely measured the strength of a hit and rotation and position of the ball when it hits the racket and send the date toa smartphone app, which analysed the tennis player's efficiency.[15] At the same time, in 2012, Agnieszka Radwańska wins the tournaments in Beijing with

[14] Ratten, V., & Babiak, K. 2010.The role of social responsibility, philanthropy and entrepreneurship in the sports industry. "Journal of Management & Organization", 16(4), p.482–487.

[15] Sports and the Fourth Industrial Revolution. 2019. Available at:

775.5 thousand USD bonus and in Miami with 712 thousand USD bonus. In 2014, Agnieszka Radwańska wont the Indiana Wells Tournament with 500 thousand USD bonus and has achieved 14th tournament victory in Montreal with 441 thousand USD bonus. In the Finals in Singapore ending the 2015 season, Agnieszka Radwańska has defeated her opponents. First, she defeated the tournament number one, Simona Halep. In semi-finals, she won with Garbiñe Muguruza. In the final, she defeated Petra Kvitová (6:2, 4:6, and 6:3) and have achieved the greatest success in her career. In 2016, a German company SAP and the Women's Tennis Association (WTA) have introduceda breakthrough technological innovation, thanks to which trainers could bring on the court mobile devices approved by the WTA and use the data generated in real time to analyse the game of their players. This application was already used after matches in 2015 in order to prepare for the next games.

Agnieszka was regarded as the most intelligent tennis player in the world. She ridiculed her opponents with lobs and drop shots and she played volleys and swerved balls with an incredible feel. She saw much and played smart. She has shown that in women's tennis, quick legs and cool head are more important than muscles. However, due to a contusion, her career was coming to an end and in years 2017 and 2018 it has reached the downtown phase. In the first one hundred of players only 20 were older than her. Few of them played more matches than our tennis player (863). In her career she participated in 47 Grand Slams (she did not win any of them). She did not want to extend her sport career by force. Agnieszka Radwańska announced the final decision about ending her career on 14th November 2018. Since then tennis was an extreme example of numeric advantage of referees over players: one main referee and six additional referees for two sportswomen participating in a match. Unlike refereeing in tennis matches up to this point, in which participated 7 referees, the progress of tournament will be evaluated by one referee and six Hawk-Eyes based on a camera.

Summary

Many things that we know about sports will have to be describe anew in order to reflect the upcoming technological changes. There are serious causes to believe that innovations in sports technology differ from innovations in other industries. This results from the use of technology in a way specific for sports. The will to use technology in sports stems from the spirit of competition. There are also psychological motives, such as emotional attachment to sports, which have an influence on the pace of technological innovations. The global sports industry is undergoing an unprecedented change in relation to technological innovations. These changes have a broad range and concern various types of technology. Sport organisations use technology as a basic strategic tool and way to influence results. The common

https://ioncomm.blogspot.com/2018/02/sports-and-fourth-industrial-revolution.html

trait of majority of sports technology forms is the use of information and communication in the context of sports. The real evaluation of sport organisations show that they must be restructured in order to use technological innovations. The use of technologies is extremely important for sport organisation in order for them to be able to compete and success on the sports market. Sports consumers, who buy and later use these technologies, provide a mechanism that allows them to interact or make contact with sports. This interaction is related to the fourth industrial revolution, in which robots and automation become increasingly more popular.[16] The Internet of Things has found it use in tennis. Its basic goal is to create intelligent spaces. Thanks to the IoT, it is possible to drastically improve the way we exercise and play tennis.Using intelligent equipment and application allows users to track efficiency, monitor progress, and in the end improve the skills of tennis players. The SAP technology implemented in 2016 played a significant part in the modernisation of tennis by offering fans more information without simultaneous violation of game's clarity. Tennis is a sport powered by data and information is power. Currently many products and services in the sports industry can be easily related to new technologies and furthermore, institutions and sport rivalry inspire and contribute to the development of new technologies. However, the key to the fourth industrial revolution is not IT. This key rather consists of data and knowledge collected by each industry, including the sports industry.

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