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**Social perception of technological innovations at sports facilities: justification for financing “white elephants” from public sources?
The case of Euro 2012 Stadiums in Poland**

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Abstract

The main purpose of the paper is to provide a monetary valuation of social benefits in connection with the hypothetical implementation of technological innovations at four Euro 2012 stadiums in Poland. Not only the construction of the sport's arenas, but also the ongoing maintenance drain the pockets of Polish taxpayers. At the same time Euro 2012 stadiums remain underused, which familiarize the host cities with the concept of 'white elephants'. Hence, the justification for the utilization of public means based on financial terms alone is extremely problematic considering the various needs of local communities. Due to the application of the contingent valuation method (CVM), the social effects obtained by the residents of four Polish cities were linked to proposed technological innovations, which were given appropriate monetary values. The research has proved the importance of technological innovations at the Euro 2012 stadiums in Poland. From 8% to 24% of respondents indicated support for their implementation in the Euro 2012 stadiums, depending on the city and type of innovation. As a result, the residents of four Polish cities valued the social benefits related to the implementation of these innovations at PLN 70 million (USD 18 million). This amount accounts for about 80% of the total maintenance costs of all the stadiums in 2019. Therefore, this paper may have implications for policy makers who are interested in the link between the sports sector and local development.

Keywords: monetary valuation; Euro 2012; utility theory; contingent valuation method; social benefits; financing the stadiums; Total Economic Value

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Introduction

Although in recent years the number of studies referring to research on innovation in the sports industry has increased (Tjonndal, 2016; Ratten, 2018; Ratten, 2019; Corthouts et al., 2020), studies devoted to technological innovations with regard to sports facilities are still scarce (Woratschek et al., 2017; Skinner et al., 2018). In addition, even those which exist mention only to a limited extent the estimation of the social value resulting from the implementation of this type of innovation.

New technologies reportedly foster innovation (Tjoenndal, 2017; Ratten, 2019). For sports entities, it seems crucial to utilize technological innovations in order to create the right environment for competition. Initiatives in this area should be swift and should be supported by the appropriate resources, including those of a financial nature (Hoeber, Doherty, Hoeber and Wolfe, 2015; Corthouts et al., 2020), often in the form of public funds.

There is a wide range of technological innovations in sport. They encompass, but are not limited to, innovations which cover areas ranging from products to services, from processes to practice and from organization to events (Desbordes, 2001; Nordin & Svensson, 2007; Paget, Dimanche & Mounet, 2010). In this study, attention will be focused on technological innovations implemented in large sports facilities such as football stadiums. In the world of sport, mainly football games are kinds of worldwide theaters. Through hosting such games, football stadiums become symbolic arenas where different cultures, national identities and rivalry meet together; they are showrooms of players as actors transcending the geopolitical, economic and utilitarian aspects.

The starting point for further consideration is the assumption that these innovations are essential to cope with the increased usage of these facilities and the demand reported from fans (Ratten, 2018). The impact of these innovations on specific stakeholder groups, including, among others, local authorities, sports clubs, coaches, players and consumers can vary (Hoeber, Doherty, Hoeber & Wolfe, 2015). Although there have been few studies in the field of the social implications of sports innovations (Harding, Lock & Toohey, 2016; Tjoenndal, 2016; Corthouts et al., 2020), to date, no one, to the best of the authors' knowledge, has attempted to estimate the value of technological innovations implemented in sports facilities nor determine the impact on the level of this valuation of social effects which result from the way local communities perceive this type of innovation. This is the gap which prevents sports entities from fully understanding the usefulness of technological innovations



in sport, and recognizing their social impact. This may contribute to limiting the competitiveness of sports entities in the long-term and undermining the essence of the functioning of the sports industry on the market.

Therefore, the main aim of this paper is to provide a social valuation, using CVM, of the technological innovations implemented at four Euro 2012 stadiums in Poland. The idea of using these four stadiums is not only to provide more robust results on the social valuation of technological innovations at sports facilities in general, but also to link both technological and social innovations in the context of sports venues. By attributing a value to the social perception of technological innovations, an indirect objective of the study is an endeavor to compare the intangible benefits to the tangible maintenance costs incurred in the case of all four stadiums, which amounted to 88 million Polish zloties (PLN) per year. The maintenance costs are funded exclusively by public means, which is not easy to justify considering the various needs of local communities. Therefore these four stadiums lead to considerable financial burdens in the host cities' budgets, and like many other mega sporting events' facilities have been reportedly perceived as white elephants (Alm et al., 2016; Davis, 2019). In the study, the determinants which affect the willingness to pay (WTP) of the residents of four Polish cities where the Euro 2012 stadiums are located are identified. On the basis of those determinants, an econometric analysis is conducted to validate the reliability of the study.

The structure of the paper is as follows: The first section describes the current state of knowledge on sports innovations with a particular emphasis on the technological changes implemented at sports facilities, which may lead to social implications. The second section presents the Euro 2012 stadiums in Poland, including their sources of financing. The third section tackles the concept and basic features of the CVM survey and statistical methodology. In the last section, the results of the empirical analysis are presented and the aggregated



values are compared to the real maintenance costs. Finally, the main conclusions are discussed.

Theoretical background

Innovations in the field of sport are characterized by a peculiarity, far from the assumptions of Schumpeter, considered to be the precursor of incorporating innovation into the field of scholars. They are perceived more as an improvement and/or implementation of new ideas (Tjønndal, 2016), rather than the introduction of “new” products, methods or technologies (Schumpeter, 1993; Moore & Hartley, 2008). The application of innovative "ideas" referring to products, services as well as production and organization methods focuses on either qualitative or quantitative change in the field of sport (Tjønndal, 2017) and aims to improve both competitiveness and value creation in the sports industry. Accordingly, sports innovation can be defined as an idea influencing the development of a process, product or service that enhances competitiveness in a sports context and satisfies customer needs by creating value (Ratten, 2017; Paunder, 2019).

This definition shows that in the field of sports innovation, special emphasis is placed on competitiveness. Although the sources behind participation in sports competitions can be varied, an inherent element in the nature of modern sports is to enhance performance in order to compete (Guttmann, 2004; Russell, 2017; Tjønndal, 2017). Striving for victory, breaking records or being the best can be sufficient enough drivers for innovation (Balmer, Pleasence & Nevill, 2012). Notwithstanding that the impact of innovation on competitiveness is the most profoundly studied subject in terms of companies (Schumpeter, 1942, Trequattrini et al., 2016), it may be utilized in a sports context as well. Similarly to traditional business, innovation in the sports industry may be regarded as a significant source of competitive advantage and a remarkable factor determining the success of an organization (Egbu, 2004;

Del Giudice & Maggioni, 2014; Gerke, 2016). In other words, in the continuously changing sports industry, organizations that attempt to deal with innovations are more likely to succeed (Ratten, 2018).

Regardless of the numerous different categories of innovation that exist in sport (Boutroy, Vignal & Soule, 2015; Tjonndal, 2017; Corthouts et al., 2020), special significance should be assigned to technological innovation. Connections between technological development and improvements in sport performance have been elaborated (Lüthje, Herstatt & von Hippel, 2005; Abeza et al., 2015; Potts & Ratten, 2016). Some authors state explicitly that in the sports industry, technological innovation supports the fostering of competitiveness and viability (Hoerber, Doherty, Hoerber and Wolfe, 2015). Ratten (2019) confirms the close relationship between technological innovation and competitiveness, recognizing that "the desire to use technology in sport comes from a spirit of competitiveness".

The second objective featured in the definition of sports innovations is value creation. This may refer either to economic or social value (Hipp & Grupp, 2005). Whereas economic value has almost always been considered tangible, social value is almost always perceived as intangible (Guo et al., 2012; Wicker et al., 2012). The objective of most technological innovation in sport is to increase the value of sports products, services and processes by providing better performance (Ratten, 2019). The practical implications stemming from the research reveal that technological innovation applied by sports entities may produce a competitive advantage, which, in the long term, leads to the enhancement of economic value (Shah, 2000; Collins et al., 2006; Trequattrini et al., 2016). Hence, these entities may later benefit from enduring competitive economic advantage. This may encompass the purely financial nature of economic value: the revenues, expenditures, assets and liabilities of the sports organization (Hillairet, Richard & Bouchet, 2009). According to some authors, this is a controversial approach, because estimating impact solely on the basis of financial calculations



does not allow the much broader spectrum of economic value to be taken into account resulting from the existence of sports infrastructure or the organization of sporting events: impact on GDP, changes on the labor market, tourist attitude towards the host city, etc. (Kesenne, 1999; Gouget, 2002; Matheson, 2006; Zawadzki, 2017).

Although research has generated academic interest on the economic impact of sport, less is known about how innovation in sport contributes to the development of society. Tjonndal (2017) pays attention to “social innovation” connecting this to qualitative innovation in the public sector. In the context of the issue undertaken in this study, social value contributes to society through sport as proposed by Corthouts et al. (2020). This varies as it may be connected to social justice and equality (Rossi & Rynne, 2014; Hayhurst, 2014; Duret & Angue, 2015), but also may provide social unity and community interactions, promote a healthy style of life as well as leading to an enhancement of the quality of life and the so-called feel-good factor (Burbank et al., 2001; Misener & Mason, 2006; Kavetsos & Szymanski, 2009; Zhuang & Girginov, 2012; Dowling et al., 2013; Meir & Fletcher, 2017). This review already shows that these are intangible values, not easy to quantify (Mihci, 2020).

There are several methods that open up the possibility of assigning monetary values to such social effects. These methods are divided into revealed preference methods and stated preference methods (Pearce, Barbier, 2000; Orłowski & Wicker, 2019). The first group of methods consists of observing the actual behavior and decisions of consumers who make a purchase or otherwise are the users of a given good (Willis, 2014). The second group of methods relies on attempting to simulate the market in order to show hypothetical behavior and consumer reactions to the proposed scenario related to the use of a given good (Kroes, Sheldon, 1998).

The most commonly used revealed preference methods include: the travel cost method and the hedonic pricing method. In the broadly understood context of sport, these methods



refer to smaller sporting events (Layman et al., 1996; Barget, Gouguet, 2008) or possibly the valuation resulting from the location of sports facilities (Carlino, Coulson, 2004; Tu, 2005; Nicholls, Crompton, 2007; Kiel et al., 2010). On the other hand, among stated preference methods, the most widely used in the field of research related to the subject of sport has been the contingent valuation method (CVM). The use of CVM in sport has developed quite clearly in recent years, covering several areas. Most often, the contingent valuation method is used to: justify the construction of sports facilities from public funds, value the intangible benefits in connection with the organization of sporting events, or in order to determine the value of sports clubs. (Groothuis et al., 2004; Heyne et al., 2007; Atkinson et al., 2008; Walton et al., 2008; Preuss, Werkmann, 2011; Wicker et al., 2015; Zawadzki, 2016). In the neoclassical economy, the basis for CVM is the subjective theory of value based on the utility of the good presented to the consumer. The Willingness to Pay (WTP) and Willingness to Accept (WTA) categories are the link between the subjective utility and the market price, expressed in monetary units. WTP/WTA provide subjective money measures of the value of a good, including a public sector good. They thus prove the validity of using market prices to estimate the intangible social value deriving from sport.

Technological innovations may be utilized in society in different ways. Ratten (2019) underlines the importance of the affordability, availability and autonomy of technology in society, because these factors determine whether people and organizations use technology and within what time frame. For sports users, technology provides a mechanism with which they can interact with sport. This interaction has nowadays been associated with the fourth industrial revolution. Indeed, one of the crucial factors affecting the extent of technological innovation in sport has been connected with the Internet of Things, and advanced digital transformations (Kraus et al., 2019). Technological innovation in sport encompasses new social communication platforms such as Twitter (English, 2016) or Facebook (Encel,



Mesagno & Brown, 2017). The utilization of the Internet has created a new avenue of sports participation (Ratten & Ferreira, 2016). Yoshida, James & Cronin Jr. (2013) conclude that sports product development should be constantly ongoing in order to deliver greater value for sports consumers. According to Ratten (2019), the effectiveness of sports technology depends on its incorporation through the process of socialization.

Sports innovation is an enormous and broad area. It extends the actual delivery of sport itself. Innovation may take place anywhere along the sports business value chain, from building or reconstructing a sports facility to the marketing employed to sustain current and attract new sports consumers (Skinner et al., 2018). The extent to which sports innovations are adopted may differ as well. Some of them may be moderate, only making changes to existing goods, others may take the form of radical transformations using, for example, new technology that has never been available before. (Darsø, 2011; Tjonndal, 2017). The resources available, including primarily financial opportunities, remain an important aspect of the readiness to implement innovation. In this respect, entities with better economic health can afford more, at every stage of the innovation process (Damanpour & Schneider, 2006). In terms of public sector participation in the sports industry, it means that a larger city or municipality is more open to innovation, compared to smaller ones (Bernier, Hafsi and Deschamps, 2015). The motivation for this is that not only does a larger community have more resources, but also a larger population, which communicates demand for a wider range of innovations.

Many types of innovation, including technological innovations, occur simultaneously, even regarding the narrow scope of innovation concerning large sports facilities, such as football stadiums. The construction or reconstruction of stadiums, considering the implementation of technological innovations, is usually aimed at attracting more supporters and fans, and creating larger streams of revenue, but in addition to the financial determinants, there are often social reasons – as a form of social interaction through creating community



networks or increasing the sense of security. Taks (2013) distinguishes urban regeneration amongst the social components, which is understood as the upgrading or construction of sports facilities in order to meet the needs of local residents. The sports industry needs to be innovative to deal with the increased utilization of sports facilities and demand from consumers (Ratten, 2018). In terms of sports venues, their utilization is very closely linked to being competitive (Iversen & Cuskelly, 2015). From a public good perspective, it is rational that those facilities being financed mainly from public sources should be utilized as much as possible by the local community.

In the above scope, the most visible example is the development of technological innovations in the field of digital technology, the Internet and wireless communication in a given stadium, which may enhance the feel-good factor of the local community attending sporting events. What happens in the sports industry is most often taken from other sectors of the economy, hence, among others, the increased usage of online social media platforms and electronic payment systems (Gard & Dionigi 2016). Sports facilities are intent on the development of their wireless capabilities. Fans can access applications for more convenience with regard to parking, finding their seats, communicating with fan forums, sharing social media commentaries, accessing player and game statistics, watching replays and player comments, and making purchases without leaving their seats, when at the stadium (Skinner et al., 2018). The employment of smart devices may not end at solely using ‘apps’. They may be utilized in order to improve the ticketing system, giving spectators a paperless ticket option, which is a simpler and more effective method of entering a venue than the traditional way.

Another example is increasing security in the stadium area by means of drones. Although these flying devices were firstly used by broadcasters in order to deliver unique camera perspectives, they were later employed for security reasons. For example, during the 2014 FIFA World Cup in Rio, Brazil, drones were utilized to patrol the sky and provide crowd



surveillance above the soccer stadiums during the competition due to threats of terrorism (Ayranci, 2017). The idea to utilize drones during Euro 2016 in France was to protect the event from undesirable airborne trespassers (Skinner et al., 2018). This applies in particular to the growing number of private drones worldwide, encroaching the airspace of sports facilities, which in the event of falling from a great height, could pose a significant threat, such as the fall of a television drone during the FIS Alpine Ski World Cup in Madonna di Campiglio in December 2015.

One example of technological innovation at a sports stadium which may trigger positive social outcomes, such as enhancing social unity and social interactions, is public viewing (PV). PV is the collective watching of sports events on huge screens, and represents a combination of the stadium and television experience. This kind of innovation means that a stadium may be utilized as a non-host during a sporting event. For example, at the time of the 2010 World Cup, FIFA organized official PV in 6 different cities around the world. Participating in PV opens new possibilities for sports fans. Woratschek et al. (2017) indicate two of these. The first is more freedom, as spectators are free to move around the stadium during the event. They are not assigned to one place, so they can interact and have contact with other fan groups, either national or international. Furthermore, it reduces crowding costs as spectators do not need to wait in queues at the entrances and this saves time for ‘socialization’.

The manifestation of social responsibility is caring for the natural environment, hence the local environmental initiatives implemented by stadium authorities, such as recycling and the utilization of reusable materials (Ratten, 2018). With respect to eco-awareness, some sports stadiums have been rebuilt to be more environmentally friendly and make better use of resources. Sports facilities usually have a high energy demand. Accordingly, sources of energy have been changing in order to become more efficient in terms of the lighting and



heating of big venues. Technological innovation in this case is based on the use of various renewable energy sources, such as solar and wind power installed in the vicinity of the sports facility (Ratten, 2019).

It is worth noting that, in most cases, researchers consider the positive aspects of innovation, including technological innovations, ignoring in this regard any failures associated with the implementation of innovative solutions (Boutroy, Vignal & Soule, 2015). Still, the worldwide literature provides few examples of technological innovations in the sports industry which lead to significant social problems, such as diminishing the integrity, fairness, safety or culture of a sport (Harding, Daniel Lock & Kristine Toohey; 2016).

In this study, attention is focused on the positive perception of technological innovation by the local community, although it should be borne in mind that the introduction of certain novelties to stadiums may be counterproductive or there may occur a resistance to technological innovation (Trabal, 2008). Well-known examples are the PSV Eindhoven arena, where Dutch fans explicitly stated their opposition to the stadium's wi-fi installation, and Old Trafford in Manchester, where bringing in iPads was banned (Harding, Lock & Toohey, 2016). In both cases, the main reason was that innovative technologies distract fans, who, instead of actively supporting their teams, were looking at their electronic devices.

Key characteristics of the Euro 2012 stadiums and the sources of their financing

All of the four stadiums Poland prepared for Euro 2012 were financed from public funds. Amongst the facilities to host the 2012 European Championship, only the stadium in Poznan was actually in existence in 2007 when the official announcement was issued that Poland had been selected to co-host the tournament finals. The respective proportions between centrally-provided funds guaranteed directly from the state budget, and funds from the municipal budgets of individual cities are presented in Table 1. It reveals that, except for the National Stadium which was entirely financed from the central budget, the preparation of



all the other venues was based mainly on funds from the host city budgets. This means that the cities are the owners of the facilities and as such, they have been burdened with the responsibility for the maintenance of the stadiums following Euro 2012.

The true test of time for the host cities came after the tournament finals ended. The management of huge facilities, overscaled and not adjusted to the needs of local communities, generating high maintenance costs is not an easy task, a fact already learnt by the hosts of earlier events of the type, which contributed to the creation of white elephants. Take Portugal, the host of Euro 2004, for example. The cities which had financed the construction of stadiums from public funds experienced grave problems with retaining their profitability after the Championships. The problem grew to such a scale that the government of Portugal put forward the idea of demolishing some of the stadiums, those which generated the highest costs, so as to reduce the budget expenditure (Zawadzki, 2010, p. 176). The symptomatic fact regarding the Polish cities is that they decided not to cooperate with private investors, giving preference to municipal companies. This is contrary to the trends observed in the United States or Western Europe, where sports facilities of that scale end up almost exclusively in private hands, typically, specialized companies or sports clubs. Indeed the sport's venues financed and owned by the public sector have usually lower level of utilisation than those belonging to private sector due to less cost discipline and highly distribution of the financial responsibility (Alm et al., 2016).

For the time being, all stadiums, apart from the National Stadium in Warsaw, have generated a deficit. Yet the representatives of their operators emphasize that the effectiveness of managing venues of that size should be assessed in the long-term perspective, although 8 years has passed since Euro 2012. For example, in 2018, the operational loss of the stadium in Wroclaw amounted to PLN 9 million, while in Gdansk it was PLN 2.6 mln. This means that not only the construction, but also the ongoing maintenance costs of the stadiums prepared for



the occasion of Euro 2012 drain the pockets of Polish taxpayers. The justification for the utilization of public means based on financial terms alone is extremely problematic. As a consequence, an attempt was made to determine the intangible effects, based on CVM. Only their consideration may legitimize the scale and structure of financing the Euro 2012 sports venues.

CVM study on the social benefits from technological innovations at the Euro 2012 stadiums in Poland

The contingent valuation method is based on the Pareto concept, whereby only a given entity may determine in what direction their welfare is modified, and consequently, the direction of modifications to their complete utility. The sum of the levels of welfare (utility) of all entities encompassed in society can be considered as the overall social welfare. Therefore, to assess changes in the overall level of utility, data are needed regarding positive or negative increments in utility, and its monetary values assigned to every citizen, which in turn, requires data regarding individual utility functions. Considering the subject of this paper, technological innovations implemented at a sports facility may instigate such a change, and due to attendance at a given location, an increase in welfare should appear. Residents may be affected in a different way by attending a technologically developed sports facility, for example, due to the feel-good factor or experiencing social opportunities, including spending time with family and friends (Kaplanidou, 2012; Lundberg et al., 2017). Accordingly, the entity will probably be willing to pay for the existence of such a change through their attendance at a technologically innovated football stadium, which may cause an enhancement in their welfare.

The study was conducted in four Polish cities where sports venues for EURO 2012 were located, namely: Gdansk, Poznan, Warsaw and Wroclaw. For each city, 300 adult residents (18+ years old) were surveyed between July and September 2019. The research was based on



internet interviews conducted by a specialized public opinion research company using their database of emails of residents of the four cities. At the same time, the sampling method was non-probabilistic quota sampling. In order to ensure the representativeness of the research sample, each time, the basic socio-economic parameters were agreed on, with their features, including age and gender, distributed among the population of the cities of Gdansk, Poznan, Warsaw and Wroclaw. Altogether, 1,200 people participated in the survey. After data cleaning, in which respondents providing blank or incomplete answers were removed, the sample contained 1,059 responses.

Each respondent in the study was read a description intended to increase their awareness of the issues treated in the study, and serving as an introduction. The description read as follows and was identical for all the respondents from each city:

“The preparation of Polish stadiums for the occasion of Euro 2012, was financed entirely from public funds. Similarly, their ongoing maintenance determines the involvement of public funds only, which stems from the budgets of individual cities or the central budget. In 2021, necessary modernization and investment works are expected, with particular emphasis on technological innovations that go beyond the financial capabilities of public entities. Their implementation is necessary to maintain the comfort and safety of participants of various events organized at the stadium. Failure to take action in this area will result in at least the temporary closure of the facility. Proposed investments and modernization works in the field of technological innovations include:

- the utilization of drones to ensure the safety of airspace in the vicinity of the stadium;
- the construction of solar panels to reduce electricity consumption (the consequences of this innovation are both financial - reducing operational costs, and environmental - taking care of the state of the natural environment);
- equipping the stadium with devices enabling the organization of public viewing events (in particular, the purchase of new large monitors enabling joint viewing of the event from anywhere within the stadium);
- the installation of fast wireless internet within the stadium and in the stadium's close surroundings;
- the implementation of mobile applications for better time management and for improving the quality of life of event participants (smoother parking, locating seats at the stadium, watching replays, and making merchandise or food and beverage purchases without leaving one's seat).



These technological innovations contribute to the improvement of the utility of the facility. Accordingly, they can generate a number of effects of non-traditional valuation, not least social benefits such as: urban regeneration, creating a sense of community, well-being, a sense of security and neighbourhood connections. These mentioned benefits affect all citizens to varying degrees. For some, they may occur, for others not. The extent to which the benefits are perceived may differ as well. For some, the benefits may have little meaning, for others, much more.”

Afterwards, respondents were presented with a payment card including twenty-five different tax amounts (from 1 to 250 Polish zloty). Then a hypothetical scenario was read:

“Imagine that investments and modernization works, including the implementation of technological innovations, are required at the football stadium in (the respective city: Gdansk/ Poznan/ Warsaw/ Wroclaw) so that its further operation is possible. Failing this, the stadium in (the respective city: Gdansk/ Poznan/ Warsaw/ Wroclaw) will be closed for an indefinite period of time. In view of the lack of public financial resources, it is recommended to create a local residents fund with voluntary contributions. It has been recommended to hold a referendum vote for all the citizens of (the respective city: Gdansk/ Poznan/ Warsaw/ Wroclaw). How would you vote on this proposal in view of contributions at the following tax amounts? By agreeing to the specified amount, you will be obliged to make a one-time payment in the form of an additional tax burden on top of your household property tax. This payment will support the implementation of technological innovations at the stadium in (the respective city: Gdansk/ Poznan/ Warsaw/ Wroclaw).”

The last sentence of this hypothetical scenario seems to be particularly important. Although the valuations, according to the theory, are connected to social effects, their source is not so much the presence of the stadium as the implementation of technological innovations.

This aspect has been clearly highlighted in order to minimize the risk of equating the valuation with the existence of the stadium as such, regardless of the presence of any planned innovations. The format of a payment card (Mitchell & Carson, 1984) with a single question regarding the exact value of WTP was selected at the preparation time of the research questionnaire. No pilot study was conducted with the objective of calibrating the rates. Nevertheless, the highest values of WTP were supposed not to exceed those applied during



other research connected with the utilization of the stadium in Gdansk at the time of Euro 2012 (Zawadzki, 2016). Indeed, at the time of the study, no respondent indicated the highest rate (250 PLN), although there were a few cases when the second highest rate (200 PLN) was selected.

Following the recommendations of the National Oceanic and Atmospheric Administration (NOAA) report, it was made clear to the respondents, when providing their valuations, that their choice to pay a certain amount in this study (WTP) would be equal to a burden on their household budget of exactly the same amount, which in turn could limit their purchase of other private or public goods (Arrow et al., 1993). In addition, to mitigate any hypothetical bias, some *ex ante* approaches were attempted (Loomis, 2011). The first approach was “cheap talk” informing respondents that “previous surveys have shown an overstatement of WTP”. Therefore, to prevent such an overstatement, respondents were reminded to “state how much they would pay if they were to spend their own money”. The second approach consisted of informing the respondents explicitly that “the availability of the sports facility for the community will be based on the results of the survey, and the amount they are likely to pay is equal to the likelihood of the facility’s availability”.

The theoretical model is confirmed by the empirical section of the paper, which distinguishes the determinants that have an impact on the willingness to pay statements (Table 2). A regression analysis is utilized to test if the dependence of the WTP level on the adopted variables is in line with expectations and whether, in this respect, the study can be considered reliable. The determinants for willingness to pay were chosen on the basis of previously implemented research in the broad context of sport. For this reason, the assumption was made that the subsequent factors had a positive impact on WTP: the education level (Suessmuth, Heyne and Maennig, 2010), the level of income (Wicker, 2011), general interest in sport (Atkinson et al., 2008) and the perception of intangible social benefits influenced by sport



(Zawadzki, 2020). The occurrence of intangible social effects like well-being was expected to be the source of the stated level of WTP, although there is no well-known case to link WTP and social effects on the basis of the introduction of technological innovations in the context of sport. Hence, there is a group of “technological innovation” variables, which was employed in the study to test the relationship between the WTP level and the implementation of technological innovations at the analyzed sports facilities. Nonetheless, there was no clear connection between social effects and technological innovations. It is assumed that they overlap each other, so that one technological innovation might influence communities in different ways, leading to various emotions and social effects. On the other hand, WTP was negatively influenced by the following determinants: women as participants of sporting events (Walton, Longo & Dawson, 2008) and the quantity of family members in the household (Castellanos & Sánchez, 2007). In addition, middle-aged respondents are likely to express lower levels of willingness to pay compared to young people and the elderly (Johnson, Mondello, Whitehead, 2007; Zawadzki, 2016).

The employed format of questions represents the feature of the dependent variable in the form of WTP, which is non-negative, and at the same time, for a large number of responses it equals zero. Indeed, the obtained results reveal that the total number of respondents who indicated a zero value was substantially large (over 38% of all responses). The dependent variable is accordingly a left-censored zero value. Taking the above into consideration, the decision was made to employ the Tobit model, which considers the left-censoring of the dependent variable (Tobin, 1958). Moreover, the model has been utilized by numerous researchers, who applied it in CVM studies in the context of sport. This is also in line with the canon presented by many authors dealing with CVM issues in the field of sport (Johnson et al., 2001; Owen, 2006; Atkinson et al., 2008; Zawadzki, 2016).

The mean values of the proposed WTP have finally been utilized in order to obtain aggregate values of the social intangible benefits caused by the introduction of technological innovations. It is worth mentioning that the respondent, in answering the queries in the payment card format (yes/no), approves the lower amount (for example 1 PLN) while refusing the next highest amount (2 PLN). This means that the actual willingness to pay is determined by an amount not less than 1 PLN and less than 2 PLN. It was assumed in this case that WTP in the conducted research was conservatively coded at the lower of these two amounts (in this case, 1 PLN). Thanks to the careful selection of respondents in terms of gender and age, a representative sample was obtained for the populations of the cities of Gdansk, Poznan, Warsaw and Wroclaw. It allowed the mean offers of WTP to be transferred to an aggregated level. Finally, the obtained results were compared to the actual maintenance costs of the football stadiums. This provided a comprehensive way to determine the scale and direction of the impact of technological innovations at sports facilities on the communities of the host cities of Euro 2012 in Poland.

Results & discussion

Among the respondents, females slightly outweigh males (apart from in Gdansk), with a clear dominance of people who participated in non-sporting events at the facility compared to those who participated in sports events, including football matches. An analysis of the mean values available in Table 3 indicates the highest WTP offers in the case of residents of the capital of Poland - Warsaw. In this respect, the differences between the four cities are considerable, although it is difficult to say whether the obtained valuation, expressing support for technological innovation, should be considered high or low, due to a lack of similar studies. Whereas in Warsaw the average level of WTP equals PLN 23.79, in Wroclaw, it is not more than PLN 14.26. One reason for this is the income of residents, which is the highest



for Varsovians, compared to inhabitants of other cities. As it appears in the analysis of WTP determinants (Table 4), income seems to have the greatest influence on WTP offers. In each of the four cities, the level of INC coefficients was positive, with a high level of statistical significance (p-value <0.05).

In addition, Warsaw respondents showed the greatest interest in sport, although not sporting events. Interestingly in Warsaw, attending non-sporting events at the National Stadium turned out to be a statistically significant determinant of WTP, while in all the other three Polish cities, the importance of attending sporting events should be stressed (Table 4). This can be explained by the fact that the stadiums in Gdansk, Poznan and Wroclaw are venues for local football clubs that play their matches in the highest competition class in the country. The stadium in Warsaw, despite being the largest, is not a venue for any club, and the target group includes, apart from the rarely played matches of the Polish national football team, primarily supporters of musical events. Only in 2019, did concerts at the National Stadium present such stars of the world music scene as Phil Collins, Bon Jovi and Metallica. In addition, some significance regarding WTP can be attributed to the youngest respondents from Warsaw, although a more thorough statistical analysis does not confirm a relationship between age (AGE; S_AGE) and the willingness-to-pay level.

A significant proportion of the respondents indicated the occurrence of social benefits deriving from the existence of the football stadiums in the Euro 2012 host cities. The creation of a sense of community (S_COMM) was indicated to the greatest extent, amongst these intangible effects. Depending on the city, between 31% and 40% of respondents pointed out the occurrence of this social effect due to the existence of the football stadium. It is worth emphasizing that in each of the four cities, respondents indicated the occurrence of social benefits in all five categories proposed in the hypothetical scenario. Considering the impact of the perceived social benefits on the willingness-to-pay values, the importance of well-being

should be emphasized. The WBEING variable was indicated by the respondents of all four cities as an important factor determining the level of the proposed WTP offer. One explanation is that this social effect may lead to experiencing social opportunities, including spending time with family and friends or the opportunity to meet new acquaintances (Kaplanidou, 2012). Well-being is very often linked with the feel-good factor, which is determined by satisfaction and fun, which have a special social value (Chalip, 2006). The significance of collective identity is also expressed by the variable S_COMM, which affects the respondents' level of WTP in both Gdansk and Poznan. The perception of the social benefits indicated above can be reflected in the importance of technological innovations that contribute to social interaction, joint meetings and the promotion of socialization. This is the case in Gdansk, where respondents considered the determinant related to equipping the stadium with devices enabling the organization of public viewing events (PV) as statistically significant.

Interestingly, from 8% to 24% of respondents indicated support for the implementation of technological innovations in the Euro 2012 stadiums, depending on the city and type of innovation. It is difficult to clearly state which of the proposed technological innovations enjoyed the greatest recognition, due to the diversity of results in individual cities, but the smallest importance should be attributed to the implementation of mobile applications for better time management and for improving the quality of life of the event participants.

The variable APPS, in three out of the four cities, was indicated by the smallest number of respondents (from 8% to 10%). In addition, the analysis of WTP determinants in Table 4 indicates that, in Gdansk, the APPS variable has a negative impact on the level of the WTP offer. Another example of a negative impact on the willingness-to-pay level occurs in the case of the stadium in Warsaw and concerns the installation of a wireless fast internet. Both cases



are associated with the use of electronic devices when at the stadium and can be explained by the consumers' reluctance to use them during events at the stadium, due to being distracting.

This is similar to the case of the fans of PSV Eindhoven and Manchester United, described earlier, although it is worth emphasizing that the approach to this problem depends on the location of the sports facility and the results should not be used for making generalizations. This can be confirmed by the results in Gdansk, where the variable W_NET had a positive effect (coeff. = 20.89; p-value = 0.0050) on the proposed level of WTP.

An interesting although fully understandable relationship between the demonstrated social effects and technological innovations was demonstrated by respondents in two cities: Gdansk and Warsaw. In both cases, the significant determinants of the WTP level were both the variable associated with a sense of security and the variable regarding the use of drones to ensure the safety of airspace in the vicinity of the stadium.

The analysis of WTP determinants associated with technological innovations indicates that respondents attach great importance to the idea of building solar panels in the vicinity of their stadium. In three out of four cities, the variable S_PANEL was statistically significant at least at the level of 10%. These results may be related to the increasing level of social responsibility for the environment in the European Union in general, but in Poland in particular. Many government programs have recently appeared in the country that promote, through financial support, projects related to the use of renewable energy sources, for both individuals and companies.

Aggregated values were calculated according to the mean value of WTP, considering the number of 18+ residents of each city. They describe the total value of social benefits deriving from the existence of each stadium and are explicitly linked with the implementation of technological innovations at each venue (Table 5). According to these results, the valuation of the intangible benefits for all four sports facilities amounts to almost PLN 70 million. The



amount was affected to the greatest extent by the valuation of the National Stadium in Warsaw. Not only was the mean value of WTP the highest in the Polish capital, but also the number of the population. As a result, the aggregate value expressing support for the implementation of technological innovations at the stadium in Warsaw is over 40% higher than the annual stadium maintenance costs, calculated at PLN 30 million. This is a surprisingly high amount confirming the importance that local communities attach to the existence of large sports facilities in their cities, and the willingness of residents to participate in the technological modernization of these venues. In the other three cities, the aggregate valuation of social benefits is significantly lower and fluctuates around PLN 9 million. However, the obtained amounts should still be considered high compared to the annual cost of maintenance. In each case, the share of the aggregate valuation exceeds 40% of the stadium's annual maintenance costs and makes all of the Polish stadiums in Euro 2012 profitable when included in the financial statement.

Conclusions

The sports industry, which is a particularly competitive environment, can benefit from acting in a more innovative way by engaging in new technology. Although the scope of sports innovations may be highly complex, in this paper, an endeavor has been made to value the social benefits deriving from technological innovations at the Euro 2012 football stadiums in Poland, by means of CVM. The construction of a hypothetical scenario of events connected the social effects obtained by the residents of four Polish cities with technological innovations, which were given appropriate monetary values. On the one hand, this allowed the importance to be shown that should be attached to technological innovations in the context of the functioning of sports facilities. On the other hand, it gave the opportunity to link technological innovations with social innovations by determining the relationship between

social benefits and the amount of WTP, expressing support for the implementation of technological innovations at the stadiums. Therefore, this paper may have implications for policy makers who are interested in the link between the sports sector and local development. The research has proved the importance of technological innovations at the Euro 2012 stadiums in Poland. The residents of four Polish cities valued the social benefits related to the implementation of these innovations at PLN 70 million. It is difficult, due to the lack of similar studies elsewhere, to determine whether this amount is high. However, it accounts for about 80% of the total maintenance costs of all the stadiums, which in 2019 amounted to PLN 88 million. Therefore, on the basis of this part of the research it has been proved that local community perception of technological innovations may be considered an important factor in justification of using public funds for financing large sport's facilities.

The regression analysis indicates that such readiness to support the implementation of technological innovations at the stadiums depended primarily on income. An important determinant of the WTP level was that of participating in various events taking place at the stadiums, although not always sporting events. The amount of the proposed offers for technological innovations at Polish stadiums was determined by the perceived social benefits. In particular, respondents pointed to the occurrence of well-being as a variable characterized by statistical significance in each of the four cities. Generally, the idea of implementing technological innovations was appreciated by respondents, and influenced the amount of the WTP offer. Not least, it is worth emphasizing the interest in the idea of installing solar panels, which would, on the one hand, make stadiums more energy independent, and on the other, generate lower maintenance costs in the future. Respondents whose WTP was affected by a sense of security within the stadium, at the same time pointed to the need to use drones, which seems to be a logical complement.



However, the proposal to implement technological innovations has not always had a positive impact on the level of WTP. The example of the stadium in Warsaw shows that respondents were cautious about the idea of installing fast wireless internet in the sports stadium. In turn, the residents of Gdansk expressed their reluctance to implement mobile applications. Although these were supposed to contribute to better time management and improve the quality of life of event participants, the respondents were of a different opinion. This shows that the implementation of technological innovation is not enough. Additional conditions must be met, including identifying the expectations of stakeholders.

The presented research concept is not free of flaws. Firstly, it appears only to value the potential benefits, although, as it was mentioned above, there are also some threats from the implementation of technological innovations at sports facilities. The valuation of these costs is missing, yet it may be assumed that they appear (e.g. new technology may cause distraction during the event time). Only their inclusion would allow the net benefits of technological innovations to be estimated, which would probably also lower the resulting amount of aggregated values.

Secondly, the studies omitted the fact of the very likely occurrence of protest responses, which might have caused interference in the obtained results. In CVM research, not every response in the proposed offer corresponds to the real state. This also applies to some of the zero values, which would have been higher if, for example, the payment mechanism had not been tax-based. This means that by taking into account protest responses, higher mean WTP values can be assumed, which should still be considered low because of the conservative approach of choosing the lower value of the offer in the payment card format. Identifying protest responses would, however, complicate the already extensive research. At the same time, in the authors' opinion, protest responses would not affect the achievement of the research objectives, although their presence should be taken into account in the future. It



would be particularly valuable to extend the location of the research to cover other worldwide sports facilities to obtain more comprehensive results of the effect of WTP on the implementation of technological innovations at such venues.

Finally, it is worth mentioning that the paper is published at a dramatic point in the flow of corona-waves. As a consequence the "world football-state" and its big arenas are endangered, since the coming back of mass events in "elephants" is not ensured in the near future. Nonetheless the overscaled sporting arenas exist, still generating high maintenance costs.

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Table 1.

The expenditure connected with the preparation of the stadiums for Euro 2012 and their sources of financing

Stadium's location	Scope of works conducted	Central budget		Local government budget		Total expenditure incurred [PLN mln]
		[mln PLN]	[%]	[mln PLN]	[%]	
Gdansk	erection	144	16.7	718.3	83.3	862.3
Poznan	redevelopment	110	16.3	565.56	83.7	675.56
Warszawa	erection	1914	100	0	0	1914
Wroclaw	erection	110	12.2	794.22	87.8	904.22



Table 2.

WTP determinants employed in the study

Variable	Symbol	Description
Socio-economic		
Age	AGE	Number of years
Square age	S_AGE	Squared number of years
Gender	GEND	1 = male; 2 = female
Education	EDU	From 1 = University degree To 5 = Primary education
Income	INC	Gross monthly income: from 1 = to 2200 zloties; to 9 = above 10000 zloties
Household size	HHSIZE	The number of members in the household
Defining the attitude to sport & attending events		
General interest in sport	INT_S	From 0 = none to 4 = very strong (every day)
Interest in football	INT_F	From 0 = none to 4 = very strong (every day)
Attending sports events at the facility	S_EVENT	0 = no; 1 = yes
Attending non-sports events (cultural, musical) at the facility	NS_EVENT	0 = no; 1 = yes
Social benefits		
Urban regeneration	URBAN	0 = no; 1 = yes
Creating a sense of community	S_COMM	0 = no; 1 = yes
Well-being	WBEING	0 = no; 1 = yes
Sense of security	SECUR	0 = no; 1 = yes
Neighbourhood connections	N_CONN	0 = no; 1 = yes
Technological innovations		
Drones	DRON	0 = no; 1 = yes
Solar panels	S_PANEL	0 = no; 1 = yes
Public viewing equipment	PV	0 = no; 1 = yes
Wireless fast internet	W_NET	0 = no; 1 = yes
Mobile applications	APPS	0 = no; 1 = yes



Table 3.

Mean values of WTP and its determinants in Euro 2012 host cities

Variable	Gdansk n=240	Poznan n=275	Warsaw n=251	Wroclaw n=293
WTP	18.775	16.77	23.79	14.26
AGE	37.83	39.27	36.74	40.83
S_AGE	1.711.63	1.858.25	1.630.24	1988.17
GEND	1.47	1.52	1.51	1.52
EDU	2.23	2.84	2.53	2.35
INC	3.37	3.26	3.47	3.23
HHSIZE	3.25	3.55	2.88	2.87
INT_S	1.84	1.93	2.08	1.72
INT_F	1.81	2.11	1.62	1.80
S_EVENT	0.11	0.08	0.08	0.15
NS_EVENT	0.18	0.19	0.17	0.15
URBAN	0.36	0.26	0.21	0.24
S_COMM	0.40	0.32	0.36	0.31
WBEING	0.36	0.29	0.23	0.19
SECUR	0.18	0.12	0.33	0.14
N_CONN	0.08	0.15	0.12	0.19
DRON	0.24	0.13	0.23	0.17
S_PANEL	0.15	0.16	0.21	0.17
PV	0.08	0.09	0.24	0.12
W_NET	0.10	0.12	0.14	0.08
APPS	0.08	0.08	0.10	0.09



Table 4.

Analysis of WTP determinants by means of Tobit model

	WTP _{GDANSK}		WTP _{POZNAN}		WTP _{WARSAW}		WTP _{WROCLAW}	
	coef.	p-value	coef.	p-value	coef.	p-value	coef.	p-value
const	-43.3677	0.0488**	-68.381	0.0345**	-35.3502	0.2477	-98.4688	0.0039***
AGE	0.824757	0.3801	0.59057	0.6507	0.847023	0.5180	-0.0262293	0.9853
S_AGE	-0.01148	0.2734	-0.0105	0.4661	-0.015810	0.2914	0.00147103	0.9248
GEND	-2.79989	0.5699	-2.0927	0.7503	-6.13351	0.3687	8.57274	0.2450
EDU	-4.10238	0.0401**	1.06015	0.6868	-7.34134	0.0091***	-0.0014736	0.9996
INC	2.50816	0.0451**	5.71527	0.0055***	13.8820	<0.0001***	12.5130	<0.0001***
HHSIZE	0.075515	0.9653	3.46661	0.0654*	-1.80391	0.4084	0.0997303	0.9643
INT_S	2.82012	0.4375	6.53646	0.1475	7.15384	0.1854	14.5651	0.0016***
INT_F	5.83966	0.1148	-1.7980	0.6630	-6.45428	0.2433	-5.26977	0.1961
S_EVENT	38.3619	<0.0001***	44.3017	<0.0001***	-7.80733	0.4988	18.4438	0.0416**
NS_EVENT	4.04860	0.5540	-9.3085	0.2902	21.6203	0.0245**	5.65807	0.5607
URBAN	3.66531	0.4543	8.43691	0.2912	-0.489193	0.9622	-2.30722	0.7814
S_COMM	19.8271	0.0003***	22.1459	0.0013***	3.82000	0.5825	11.4195	0.1082
WBEING	24.8317	<0.0001***	20.8868	0.0030***	16.9789	0.0257**	19.9602	0.0124**
SECUR	13.6855	0.0230**	14.4432	0.1274	13.4080	0.0591*	0.767231	0.9397
N_CONN	-5.02787	0.5477	11.0343	0.2018	-16.4552	0.1107	20.4416	0.0119**
DRON	14.3769	0.0044***	-2.1102	0.8340	22.1541	0.0036***	-10.3622	0.2322
S_PANEL	9.43023	0.1094	15.5737	0.0570*	14.2274	0.0683*	27.8602	0.0006***
PV	21.1565	0.0092***	4.15556	0.6966	3.69291	0.6346	-1.84843	0.8567
W_NET	20.8884	0.0050***	-11.243	0.2555	-20.9510	0.0308**	-0.456241	0.9692
APPS	-13.5599	0.0844*	-6.8830	0.5703	-0.203210	0.9849	-4.48716	0.6928
Chi -square	170.6710	6.42e-26	85.7654	4.04e-10	127.5229	1.13e-17	103.4365	3.04e-13
Log likelihood	-940.584		-840.029		-890.2071		-884.3880	
Sigma	30.8349		44.7532		45.113		47.2012	

Notes:

***significant at the 1 per cent level; **significant at the 5 per cent level; * significant at the 10 per cent level.



Table 5.

Comparison of aggregated values and the maintenance costs of Euro 2012 stadiums

Specification	Gdansk	Poznan	Warsaw	Wroclaw
Yearly maintenance cost of the stadium	PLN 19 mln	PLN 18 mln	PLN 30 mln	PLN 21 mln
Aggregate valuation of technological innovations at the stadium	PLN 8,79 mln	PLN 8,99 mln	PLN 42,43 mln	PLN 9,15 mln
% of the valuation of technological innovations in the maintenance cost of the stadium	46,26 %	49,94 %	141,43 %	43,57 %

