

# Smart organization – digitalization of combat sports services

## Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

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## Abstract

### Background & Study Aim:

Smart organization is a digital organization, an essential aspect of which is the use of mobile digital technologies in the management of combat sports services, and, in particular, the management including diagnosis and monitoring of one's own physical activity. Smart organization means converting resources, converging processes, implementing gamification mechanisms, and streaming data. The main purpose of the article is to identify the functionality of available mobile applications used in the field of combat sports.

### Material & Methods:

A review of the subject literature presents the results of research in the field of digital maturity of organizations and the impact of smart tools on human physical activity 4.0 in organization 4.0. In the overview layer the authors refer to the results of their own research and literature sources dealing with these issues.

### Results:

Applications can be similar or completely different from each other, but each introduces something that is innovative. This is due to the fact that design companies outdo each other in inventing solutions aimed at gaining an advantage over the competition and attracting the customer with modernity and innovation. The analysed research confirms the strong impact of mobile applications and the use of these solutions in combat sports organizations. Smart technologies increase the human ability to become active in the area of combat sports activity.

### Conclusions:

In the digitalization of combat sports services, machine processing algorithms must be supported by cognitive and heuristic processing algorithms. This is necessary for efficient management of data, information, and knowledge.

### Keywords:

human 4.0 • internet • mobile applications • organization 4.0

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**Combat sport** – *noun* a sport in which one person fights another, e.g. wrestling, boxing and the martial arts [31].

**Athlete** – *noun* 1. someone who has the abilities necessary for participating in physical exercise, especially in competitive games and races; 2. a competitor in track or field events [31].

**Physical activity** – *noun* exercise and general movement that a person carries out as part of their day [31].

**Mental health** – *noun* the condition of someone's mind [31].

**Mental training** – a set of exercises and techniques aimed at constantly improving the right mental attitude [25].

**ICT** – information and communication technologies.

**IT** – information technology.

## INTRODUCTION

Smart organization is primarily about the problems of human interaction with the digital and real environment. As Bazewicz and Collen [1] write, interfaces include hardware, software, and human ware. Smart technologies combine these three areas of human interaction with the environment and allow the search for effective, easy-to-use tools that create digital foundations for relationship management [2].

More than 20 years ago, for Afsarmanesh and Camarinha-Matos [3], the future of smart organization was focused around a virtual enterprise, in which members should cooperate and share information that is geographically dispersed, and where it is necessary to use ICT competences [4]. In literature we can find descriptions of the role and importance of mobile technologies in everyday life. Assuming that rest and health care are part of everyday life, it is necessary to increase the level of promotion of these technologies to improve its quality [5]. In many studies, the term smart organization is closely associated with the digital era. For instance, Filos and Banahan [6] define it as 'entities that are knowledge-driven, networked and dynamically adapt to new organizational forms and practices, and are agile in their ability to create and exploit opportunities offered by the digital era'.

This is why researchers Matheson and Matheson [7] indicate that smart organization should develop skills in three pillars: (1.) understanding the organizational environment, (2.) mobilizing resources appropriate to the environment, (3.) achieving goals. In addition to the above characteristics of a smart organization, the technical background [8] is also

pointed out, which allows its activities to be carried out effectively through, among other, an adequate internet network allowing the transfer of necessary files (not only for online meetings, but also for working in the cloud).

Lima [9] suggests that smart organizations should be designed with the same principles as smart cities, making them better places to both work and live, suggesting changes on three levels: (1.) facilitating remote collaboration, (2.) aligning knowledge management systems with the emergence of more collaborative and innovative communities in their ecosystems, (3.) creating a corporate culture of innovation by attracting and developing creative, talented and skilled employees.

Focusing on building a smart organization led the team coordinated by Adamik and Sikora-Fernandez [10] to develop 10 technical and social factors characterizing smart organizations in the era of Industry 4.0, which together form the basis for the so-called Power of Smart Organizations Index (PSOI), which includes such aspects as: percentage of people with access to broadband Internet, knowledge acquisition by employees in the last 4 weeks, or percentage of enterprises using Big Data analysis. However, looking at replacing traditional work relationships with online relationships, Nisar et al. [11] notes that online social networks, including dedicated discussion groups, encourage and engage employees more to acquire knowledge and learn [12]. However, transferring some of the organization's tasks to the Internet, Temelkova [13] notes that it is necessary for managers to pay attention to the acquisition of new competences (e-skills) in the near future, and above all e-leadership, which is also

associated with greater openness to work in intercultural teams. New competencies, referred to in organizations 4.0 as digital competencies, are not only dedicated to management, but to all employees, and, as noted by Quintero [14], they constitute a set of knowledge, skills, attitudes, strategies, and awareness that are used to perform tasks or solve problems. With this definition, one has the impression that digital technology acts as a catalyst for the effective use of competences.

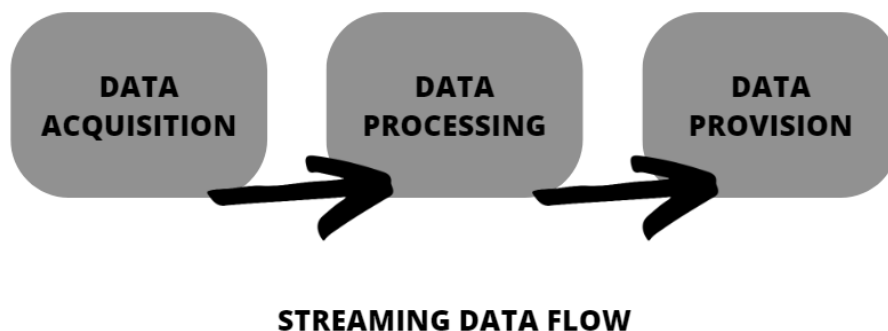
An important competitive advantage of mobile technologies, is the use of the streaming and gamification mechanism. Streaming allows the acquisition, analysis, and diffusion of data into the environment in real time. Gamification is a mechanism that enables comparison in groups in terms of one's own activity and psychophysical quality of life. In particular, the need to compare each other in reference groups is indicated as an element of cooperation and development of the reference level of 'mastery' in combat sports activity. At the same time, as indicated by Sroczyński [15] and Rusiecki [16], the most frequently chosen mobile applications are those applications that meet and fulfil the basic expectations of the user, i.e. fast online access to data and the possibility to compare in reference groups.

As previously presented, the concept of the smart organization was associated with the concept of industry 4.0, and earlier the change of the industrial economy into a service economy, which forced enterprises to find a competitive advantage within the organization (both in processes and new products). However, it is worth noting that the applications of smart organizational features are used in many areas, such as those described by Haiba et al. [17] in the use of recommendations for creating innovations, or Yip et al. [18], who focused on the operation of Canadian hospital emergency departments (ER) in terms of waiting times for the examination and comparing the actual time of providing assistance against the regional and national background. Interestingly, Gamble [19] notes that the improvement of the implementation of the IT system does not accelerate the treatment process (providing help), but provides the patient with the option of choosing an ER point. The combat sports industry is also benefiting from the idea of smart organizations, in which one recurring element is remote working but also cross-cultural teams.

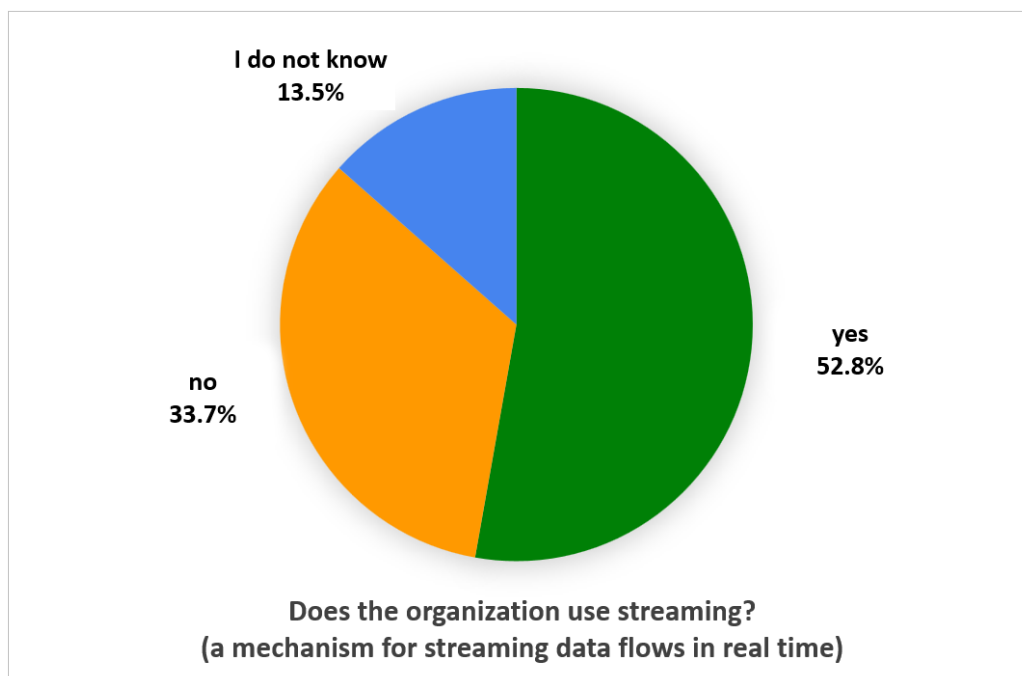
The moment that can be considered as the beginning of mobile applications era is January 9, 2007, the day Steve Jobs introduced the world to the smart phone – iPhone. Of course, smart phones and simple applications (mainly programmed in Java) existed before that date, but there had been no serious market for these applications. The next milestones are July 11, 2008 – the App Store, the day when a digital distribution platform with applications for iPhone was launched, and October 22, 2008 – the premiere of Google smartphone. From that day also, Android users have been able to download mobile applications from the Android Market (today known as Google Play), the equivalent of the App Store for devices equipped with the operating system created by Google. This is how a new branch of industry, and the related mobile application market was created and began its dynamic development. The high popularity of smartphones has its origins in high usability and functionality, which can be extended almost infinitely using mobile applications. It is the ingenuity of their developers, combined with the development of social media, such as Twitter, Facebook, that is responsible for the success of smartphones. In 2016, sales of smartphones with large touchscreens reached nearly \$ 1.5 billion [20].

Survey research conducted by Cieśliński and Tomanek [21] indicates that the development of smart technology is primarily the development of the possibility of acquiring, processing, and delivering data in real time (streaming) and placing the results on streaming platforms that enable comparative analysis results (in this case, physical activity) with reference groups. Two charts below (Figure 1 and Figure 2) show the results of research on the digital maturity of organizations. The research has been conducted among 790 enterprises and combat sports clubs. The first graph concerns the level of use of the streaming data flow mechanism, the second – the gamification mechanism as a tool for motivating physical activity.

The respondents indicate that the streaming data flow mechanism is used in over 50% of organizations. At this point, it can be stated that the organization 4.0 is not yet fully mature in terms of the use of modern smart tools. The following sub-chapters describe the functions of smart technology, smart market in motivating physical activity, and cognitive models of algorithm for organization management 4.0.



**Figure 1.** Smart technology development mode [21].



**Figure 2.** The level of data streaming in the organization [21].

The research is embedded in the smart space, i.e. the mobile and intelligent space of human 4.0 using mobile applications and organization 4.0, i.e. the digital organization using the data streaming mechanisms of Cieślinski [22]. The main purpose of the article is to identify the functionality of available mobile applications used in the field of combat sport. The research question is whether, and to what extent, smart applications help and motivate to combat sports activity.

### SMART TECHNOLOGY FUNCTIONS

Smart combat sport sets new directions for mental training. An aspect that is important for a large number of mobile application users is the ease of navigating through the application. IT specialists working on the application are trying to limit the so-called 'unwanted clicks', in addition to this feature, it is also important that the application is accompanied by an intuitive data entry mechanism: the less typing, the better for the user. However, simplicity with fewer clicks is

not always a good idea, an example where more clicks is not a problem are banking applications. Additional clicks for customers are not a problem in the case of additional confirmation of transfers, users are not ready to give up the sense of security; in this case more data to enter is better.

Smart combat sport positively affects the accumulation of combat sports experience. Intuition is an indispensable element of any application. When it comes to the effectiveness of the interaction of mobile applications, the most comprehensively using gestures pass the test. The advantage of using gestures is easier navigation because gestures successfully replace many action buttons, such as 'delete', 'back' or 'next'. The intuitiveness of the application improves the readability and transparency of the project, resignation from unnecessary elements that may prevent the user from quickly finding the target place, such as a button to go to the next screen, a search result. Each application has its own workflow, which should be minimalistic; in the case of mobile applications, it is better to focus on specific functionality than to pack all possible facilities and services into one product. This has a direct impact on the ergonomics of use and proper identification of elements. Much more often, users reach for programs in which the architecture is simplified and logical. In connection with the research conducted in AdMob [<https://admob.google.com/home>], users of mobile devices primarily use the following functionalities: contacting friends and creating communities on the Internet (45%); downloading files, i.e. games, music, images, photos (46%); browsing information on social networks (9%).

There are several areas of everyday life that have been changed by mobility:

1. Coordination of everyday life and micro organization of time – thanks to mobile devices, users can manage their leisure time better, with easy access to personal calendars and other devices allowing them to update the behaviour of those involved in the interactions.
2. Safety and health – the possibility of generally available Internet and globalization services support the user's sense of security. The portable nature of the devices supports the speed of communication in the event of a crisis situation.

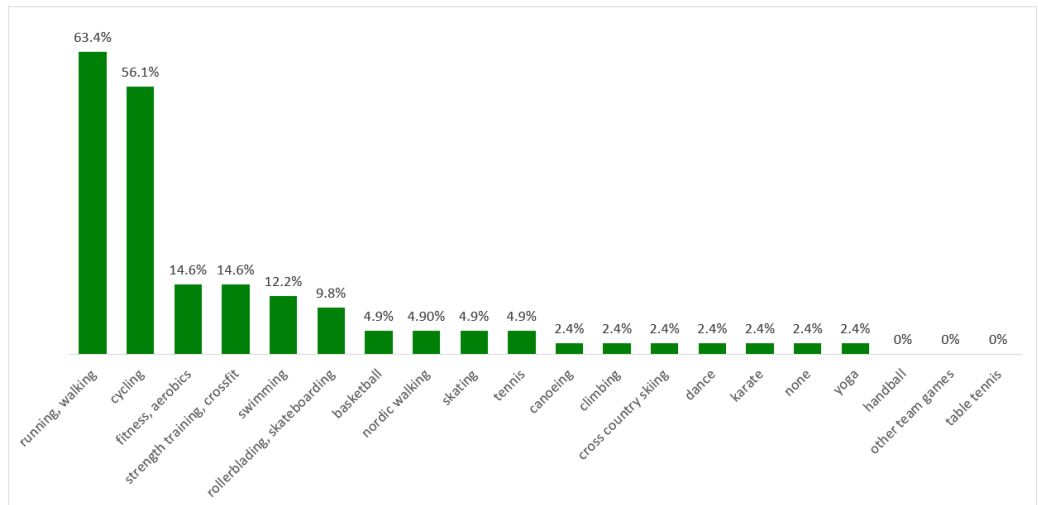
3. Possibility of self-expression – one of the most used elements of mobile devices is self-expression in the mobile community. Thanks to the possibility of tagging photos and posting them on social networks, users can inform others about what they are doing, where they currently are and what is important to them.

4. Family ties – the universality of mobile telephony has made it easier to stay in touch with family members. Parents also gained the ability to observe their children's activity almost at any time, which allows them to better fulfil their duties towards children and capture disturbing phenomena.

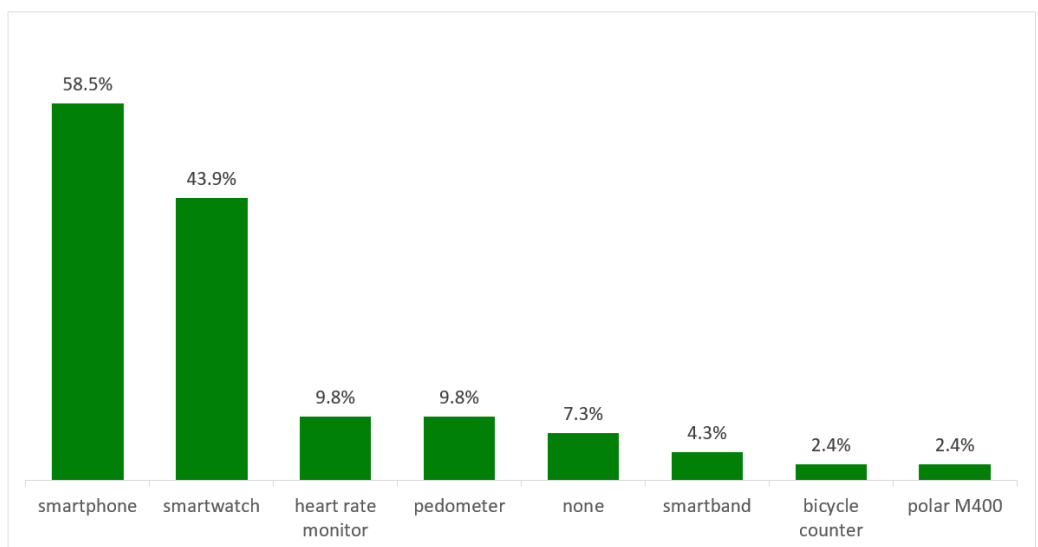
Accordingly, digital tools are, on the one hand, limitations of physical activity. They are a strong professionally, socially, and playfully tool with which human 4.0 spends more and more time. On the other hand, these tools can change the attitudes of human 4.0 by using them to manage the organization 4.0 [23] and his/her own physical activity [24]. Therefore, research in this area, i.e. do people who are active spend their free time using modern smart technologies to monitor this activity? These assumptions are confirmed by the research of Piepiora and others in the field of the strength of motivation and changes in the mentality of physically active people using mobile applications [25]. Smart combat sport positively affects the mentality of athletes.

Smart applications are used by the majority of physically active people (Figure 3). Mobile applications are most often used by people who practice running (63.4%) and cycling (56.1%). When asked about the most frequently used smart tools, smartphone applications (58.5%) and smartwatches (43.9%) were the answer (Figure 4).

Preliminary research of smart organizations, using the example of combat sports services, allows us to determine new predictions related to digitization. Smart organization and combat sports services are connected with the need to answer the question of how the digital transformation of an organization is progressing and how, in the context of combat sports services, one can describe a human functioning in an organization 4.0. It is pointed out that it is characteristic that a person in an organization 4.0 must also be compatible with such an organization, hence it is necessary to define a human 4.0, a human equipped with smart tools.



**Figure 3.** The level of use of smart applications.



**Figure 4.** The most frequently used smart tools.

### ORGANIZATION AND HUMAN 4.0 – COGNITIVE METAMODELS

Smart organization means conversion of resources, process convergence, implementation of gamification mechanisms and streaming data flow. Human 4.0 is a human who fully uses smart tools at work and leisure. This is a human on whom the organization 4.0 forces the use of modern tools to achieve a higher level of mobility, or to monitor one’s health through psychomotor activity. The starting point for the description of the cognitive models of the organization 4.0 and the human 4.0 is the tip described in Stanisław Lem’s book.

Already in 1964 Stanisław Lem wrote what modern digital technology would be like [26]. As a starting point, we will use an illustrative table of classification of effectors, that is, systems capable of acting, which Pierre de Latil publishes in his book *Thinking by Machine* [27]. He distinguishes three main classes of effectors. The first one, determined effectors, includes simple tools (like a hammer), complex tools (calculating machines, classic machines) and coupled (but not feedback) with the environment, e.g. an automatic fire detector. The second class, organized effectors, includes systems with feedback:

automata with built-in determinism of operation (automatic regulators, e.g. of a steam engine), automata with a variable purpose (programmed from the outside, e.g. electric brains) and self-programming automata (systems capable of self-organization). The latter include animals and humans. One more degree of freedom is added to systems which are capable of changing themselves to achieve an end (de Latil calls this freedom 'who', in the sense that while the organization and material of his body is 'given to man', the systems of this of a higher type can – not having freedom only in terms of material, building material – radically transform their own systemic organization: an example may be a living species in a state of biological evolution). The hypothetical Latilian effector, more advanced, is able to select the material. At the same time, it can develop itself [28]. Therefore, it can be said that an organization 4.0, which uses the latest mobile digital technologies to provide services, can be described as in Figure 5. The basis of such an organization is algorithms, i.e. specific tools for a detailed description of the procedure, ensuring that they meet the expected functions and thus contribute to the achievement of the organization's goals. At the same time, algorithms must be digitized and described using a specific programming language, data analysis, i.e. acquiring, processing and diffusion for further analysis enabling data transformation to the level of useful information and finally new knowledge.

Organization 4.0 is an organization that is managed by algorithms. Digitization processes are processes that require algorithms. An algorithm is a way of proceeding to achieve the planned goal with high certainty. It is claimed that there are problems that can be algorithmized, but there

are also problems that require heuristics. There is a trial and error method between an algorithm and heuristics [28]. The development of an organizational data processing algorithm is the basis for post-modern management. Organization management 4.0 is the algorithmization of data processing. Management in a digital organization is the process of obtaining data, processing it, and delivering it in the form of useful information, i.e. knowledge to the client.

The algorithms on the basis of which modern digital tools function allow for quick feedback. Nothing motivates people more than knowing that what one does brings results. Another motivating factor today is the awareness of the fact that after training with this type of application, our activity will be displayed on Facebook to our friends, who, seeing the effects of our efforts, may want to join us or compete with us. No matter what the feedback will be, each of the entries is in its own way motivating to continue practicing combat sports. Below, the smart services market is briefly described in the context of combat sports services.

### SMART MARKET AND PHYSICAL ACTIVITY

The market of smart applications is developing at a very fast pace, with newer and newer solutions attracting and motivating more and more of physical activity enthusiasts. Taking care of one's health has become very fashionable; regular exercises with applications and sharing the effects of your training is now a fashionable phenomenon. Some of the most popular applications are described briefly below [29].



**Figure 5.** Theoretical model of organization 4.0.

**Nike+ run club** – a free application for iOS and Android, which provides information on the number of calories burned during the activity and running speed.

**Samsung Health** – offers many different options, the basic ones include pedometer, setting goals related to a healthy lifestyle, weekly summaries, monitoring of physical activity, daily diet, weight, and sleep.

**Strava** – it allows one to monitor the progress, in some cases comparing it with third parties. The application allows one to use it in the mobile and web system.

**Map My Fitness** – the basic function of the application is to record the duration of physical activity and the number of calories burned. The application allows one to use an extensive database of exercises. Basic activities include running, cycling, push-ups, walking, swimming, and climbing stairs.

**Garmin Connect** – the main function of the application is a workout diary, which includes activities such as: recording exercise sessions, planning workout units and cycles, recording changes that occur in individual phases of training.

**Fitatu** – an application used to control the amount of calories consumed. By entering the products consumed during the day into the application calculates how many macronutrients and calories have been consumed during the day.

**Adidas Running by Runtastic** – the application, apart from standard jogging and running, also tracks cycling, walking, fitness, tennis, and even other forms of activity such as rugby, gymnastics or golf and many others. The application monitors the distance, speed, time, altitude, calories burned, running route thanks to the GPS system.

**RunKeeper** – the application monitors the speed of movement, training time, calories burned, and the distance traveled. It allows to control the results achieved by the user and motivates to the next training.

**Google Fit** – the application monitors physical activity. It records data such as pace, route, speed, terrain to make it easier to track one's progress and build motivation for the next workout.

Facebook and Google are increasingly providing the opportunity to create communities of people involved in a particular combat sport in a way that promotes physical activity in the offline world, also supports event planning, allows the posting of videos and photos of events that allow sharing experiences with people who share similar interests in combat sport. In the rather short period of time that social media platforms have been in operation, there have been many studies confirming the positive and motivating effect on physical activity through sharing of personal training results. Sharing the effects of one's work on social networks allows one to reach friends and family, whose opinions are important to a given person, and who do not participate in this activity themselves. Social support plays a very important role in continuing training. This support can take many forms, the most popular of which are encouragement, guidance, and information. Online communities can help people achieve a sense of motivation and encouragement to engage in physical activity.

There are also obstacles to the use of these types of applications, which may discourage potential users from sharing their workouts and physical activity achievements on social networks, as they may create a demotivating factor that the activity is not a sufficient feat to share with others. It can make users fearful of their friends that it is mundane information and can cause fear of being seen as someone who brags about small insignificant feats.

Smart activity market, or more broadly, smart health, is an enabling market for the development of organizations and human 4.0, understood as the essence of digitalization. Such a significant development of this market increases positive attitudes towards physical activity and, at the same time, improves monitoring of this activity by other 'smart health' or 'smart diet' applications. Organization 4.0 and human 4.0 require increased physical activity as part of mental and physical health. The described functionalities of mobile applications require development towards streaming and gamification platforms that will enable data acquisition in real time, processing them to the level of usable information and, consequently, generating new knowledge in the field of this activity and comparing this activity in reference groups. The creation of the 'World Cloud Atlas of Mobile Applications for Physical Activity



and Health Prevention' in the future will offer access to reference data for all social groups as well as those of different ages and abilities, which will enable the inclusion of those excluded from this activity.

## DISCUSSION

Today's generational framework is determined by technological advances [30]. Therefore, smart technology has become the social norm of major combat sports organizations. The basis for the use of modern digital tools is the functioning of the organization in accordance with the directions of digital transformation, including resource conversion, process convergence as well as data streaming and gamification. Human 4.0 is a person who fully uses, or even has to use, modern digital tools in order to work and rest effectively. Organization 4.0 allows one to gain knowledge about the effectiveness of one's work or leisure almost immediately and in real time. Smart organization requires effective management of algorithms that are the construction of modern digital applications. Managing algorithms means building flowcharts that simplify reality, reducing organizational complexity, enabling decision-making and greater motivation. In the case of combat sports services and activities, smart tools are the basis for high efficiency of this service, the consequence of which is health, greater energy, and willingness to work. This is more and more important in smart civilization because the life of a human 4.0 is mostly computer work and lack

of physical activity, which leads to many civilization diseases. Research on the digital maturity of an organization shows that the most important elements of its development include the possibility of implementing data streaming mechanisms, process convergence (the unification of the effects of their courses in the real, digital and media space) and gamification, i.e. comparing one another in reference groups in terms of physical activity and consequences of health prevention.

Smart organization, smart physical activity is a modern model of managing one's own physical activity and part of health promotion. Digital organization 4.0, digital human 4.0 require the use of modern digital tools of the 'smart' type, i.e. an application that will suggest what 'our health looks like' and what needs to be done to fit in the median of reference groups, and which groups are collections with increased health status due to physical activity and health prevention activity.

## CONCLUSIONS

Machine processing algorithms must be complemented by cognitive and heuristic processing algorithms. The former are used to manage data and the latter are to manage information, and the third type of algorithm is used to process knowledge. The assessment of the area of application use is described at a high level of generality; for a broader understanding of the scale, it is necessary to obtain real user data in the future. However, this is extremely difficult for licensing reasons.

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