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WEARABLE TECHNOLOGY IN THE PERCEPTION OF YOUNG CONSUMERS

TECHNOLOGIA WEARABLE W OCENIE MŁODYCH KONSUMENTÓW

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ABSTRACT

The paper presents the issues of wearable technology, their role and use in the current economy. Ubiquitous digital transformation and universal access to broadband Internet are the foundation for the creation of interoperable ecosystems, where wearable technology is responsible for communication often in the relationship between machine to machine and machine to human. The authors researched the level of knowledge about these devices and the degree of their use. It turned out that despite the knowledge of worn devices and relatively positive attitudes, the degree of their use is low. The article is theoretical and empirical.

Key words: wearables technologies, digital transformation, young consumers

ABSTRAKT

Opracowanie przedstawia problematykę urządzeń noszonych, ich rolę oraz wykorzystanie we współczesnej gospodarce. Wszechobecna transformacja cyfrowa oraz powszechny dostęp do szerokopasmowego internetu są fundamentem tworzenia współdziałających ekosystemów, gdzie urządzenia noszone odpowiadają za komunikację często w relacjach machine to machine oraz machine to human. Autorzy zbadali poziom wiedzy na temat tych urządzeń oraz stopień ich wykorzystania. Okazało się, że pomimo znajomości urządzeń noszonych oraz względnie pozytywnych postaw stopień ich wykorzystania jest niski. Artykuł ma charakter teoretyczno-empiryczny.

Słowa kluczowe: technologie wearables, transformacja cyfrowa, młodzi konsumenci

JEL: M310, M370, O330, O320

Introduction

The XXI century is called the time of digital transformation in the economy. Klaus Schwab, founder and president of the World Economic Forum in Davos, described this period as the fourth industrial revolution. He characterized it as an era of intelligent technology and sensors, interacting in one ecosystem, which affects not only the business area, but also the everyday life of communities (Schwab, 2018). According to IDTechEx forecasts, the market for sensors and wearable technology (WT) is to reach USD 100 billion by 2023, and USD 150 billion by 2026 (Mazurek, 2019). The transformations were also strongly influenced by broadband

Internet access, especially on mobile devices. In 2018, the number of subscribers for this type of connection to the global network exceeded 60 per 100 inhabitants worldwide (Frąckiewicz, 2019). In turn, according to Best Computer Science reports, by 2020 the number of smart devices (including the WT) connected to the Internet will amount to approximately 200 billion (Tarabasz, 2018).

The aim of the article is an attempt to identify the degree of knowledge and use of the mentioned WT by young consumers and attitudes towards them. Its realization was based on empirical research conducted on a sample of 173 units.

Literature review

The literature review is based on four scientific databases: Science Direct, Scopus, Springer and Web of Science (Table 1).

Table 1. The results of the literature review

Selection criteria	Number of records in the repository			
	Science Direct	Scopus	Springer	Web of Science
"Wearable technologies" or "wearable technology" — title, abstract and keywords	318	13 571	2 623	1 282
Articles published in English, in journals as research articles and literature reviews	209	4 495	757	619
Articles in the areas of business, management and marketing	15	8	15	46
Articles in open access	5	215	6	
Total quantity after removal of duplicates	25			

Source: own elaboration.

The process of reviewing the scientific bases consisted of several stages. The first stage included filtering based on the search for "wearable technologies" and "wearable technology" in the titles of works, abstracts and keywords. In the next stage, the results were narrowed down by another category — an article published in English, in journals as research articles

and as literature reviews. The criteria of the thematic area — business, management, marketing or social sciences — were then added. The next selection level consisted in selecting only those works which were published within the framework of open access or co-financing of the Ministry of Science and Higher Education. At the very end, the articles that appeared simultaneously in several indicated databases were removed. Finally, 25 studies were received. The oldest of them — and these are two works — date back to 2015. The first one describes the phenomenon of the WT quite superficially and the authors focus on the use of this technology in tourism and e-tourism (Gretzel et al., 2015). The second article describes the WT as a near future. These devices help to blur the border between man and computer, which the authors call a cyborg. They are characterized by a certain extension of the body's capabilities. They describe application possibilities such as real-time sweat composition analysis based on temporary intelligent tattooing, water and electrolyte level measurement, oral health monitoring and human body language translation (Yeoman, McMahon-Beattie, 2015).

The following year it was written about the era of the WT. They were focused on their use as sensors and measurement points, which enable monitoring both the states of activity and physiology, however, a certain direction related to medicine was also defined. The use of this type of device as a limb prosthesis was described. This direction gave potential for the development of transgressive ideas such as trans- or post-humanism (Matos et al., 2016; Vinay et al., 2016).

In 2017, the WT was described as a potential tool for communication between a brand and a consumer (Wu et al., 2017; Tanti, Buhalis, 2017). These devices, due to their permanent connection to the Internet, collect large amounts of data, which enables the brand to analyse consumer behaviour in real time, e.g. through solutions based on sharing customer location or an effective payment channel, ensuring high quality marketing service and special sales services on customer request (Wu et al., 2017). On the other hand, the subject of personal data protection, privacy and the risks and consequences of continuous Internet connection is discussed. Specialists pointed out such risks as monitoring and interception of data, among others in the form of private photos from the device's memory or taking pictures of the environment without the user's knowledge. It also

describes the essence of awareness of the type of private data exposed to sharing and their security (Ghazinour et al., 2017).

In 2018, a completely new approach to the WT was shown. They began to interfere more in the lives of consumers by designing things that were part of their everyday lives, with additional functionality and sensors, such as intelligent jewellery, duvets or sleeping bags (Wissinger, 2018; Biswas et al., 2018). There is also a classification of these devices as components of the Internet of Things ecosystem (Maglogiannis et al., 2018; Srinivasa et al., 2018; Koo, Fallon, 2018; Tussyadiah, Jung, Dieck, 2018). The development of this technology has further enabled the creation of a WBSN network that automatically monitors the heart rate of the user and indicates the abnormalities that may be indicative of the disease (Soudani, Almusallam, 2018).

This year's publications have also covered the use of WT in medicine, for example as an IR detector with which communication takes place by blinking of the eyes and simple head movements of paralysed people (Malik, Mazhar, 2019). Public safety (Alsamhi et al., 2019) and customer communication (Cena, Likavec, Rap, 2019; Alt et al., 2019; Berkemeier et al., 2019) were also discussed.

Methodology of empirical research

The aim of the empirical study was to try to answer the following questions:

- Is the WT phenomenon known among the representatives of the young generation?
- To what extent do young consumers declare the use of these devices?
- What are the attitudes of the young generation towards the WT and what are they dependent on?

The empirical survey was based on two survey techniques: auditorial and internet using a questionnaire. The research instrument consisted of two parts. The first one concerned the recognition of whether the

participants of the survey know and use the WT. Next, the respondents were asked about their preferred forms of payment and asked to respond to the scale (from 3 to –3 with antonyms at the poles of the scale, where 0 is a neutral value) to the terms characterizing payment with a smartphone and an intelligent watch. The last question in the first part concerned the identification of consumer attitudes, based on the Likert's scale question (from 1 to 5, where 1 meant "I definitely do not agree", while 5 meant "I definitely agree"), relating to the implantation of the WT under the skin, the replacement of smartphones by the WT in the future or treating these devices as a new channel of communication between the brand and the consumer. The second part of the questionnaire included metric questions on the demographic and social characteristics of respondents.

Respondents to the survey were selected on purpose. The category of belonging to the sample was age. Only young people — up to 30 years of age — were included, due to the fact that they are consumers with particularly high technological competences (Linkiewicz, Bartosik-Purgat, 2017; Gregor, Gotwald-Feja, Łaszkiewicz, 2017; Tkaczyk, 2018; Stopczyńska, 2018; Gregor, Kaczorowska-Spychalska, 2018), which favour the propensity to use new technologies without which they cannot imagine life (Twenge, 2019). Detailed data on respondents are presented in Table 2.

The study involved 173 persons. 43% of them are men, the remaining 57% — women. As already mentioned, the age of respondents was limited to 19–30 years. Most of them (75%) were people aged 19–24, the rest (25–30) were 25%. More than half of the respondents (almost 57%) were people with secondary education, slightly more than 43% with higher education. Nearly 3 of the respondents are students, 18% are employed people who do not study. On the other hand, over 8% of respondents declared that they combine professional work with studies. The vast majority of the respondents live in cities (almost 83%), mainly in cities with more than 500 thousand inhabitants (almost 54%).

Table 2. Sample characteristics (n = 173)

Variables	Respondents	
	Count	%
Gender		
Man	74	42.8
Woman	99	57.3
Age		
19–24 years old	130	75.1
25–30 years old	43	24.9
Education		
Medium	98	56.7
Higher	75	43.3
Occupation status		
Student	127	73.4
Professional (work)	32	18.5
Student working	14	8.1
Place of residence		
Village	30	17.3
A city with a population of up to 50 000 inhabitants	18	10.4
A city of between 50 000 and 200 000 inhabitants	27	15.6
A city of between 200 000 and 500 000 inhabitants	4	2.3
A city of more than 500 000 inhabitants	94	54.3

Source: empirical research.

Analysis of test results

One of the detailed objectives of the empirical research was to identify the knowledge of the concept of WT and to find out whether the representatives of the studied group use them. Knowledge of the concept of wearables was declared in over 44% of cases.

Then, the percentage of respondents who know and use the cited examples of WT was examined (Table 3).

Table 3. Declared knowledge and use of WT of respondents (n = 173)

WT	Percentage of respondents	
	Knowledge	Usage
AR glasses (Augmented reality)	67.6	6.4
Smartband	85.6	22.0
Smartwatch	97.1	17.9
Smart jewellery (ring, bracelet, earring, cufflinks/tie)	34.7	2.9
Headphones	92.5	42.8
Smart clothes	28.9	0.0
Smart tattoos	9.8	0.0
Smart contact lenses	27.2	2.9
Smart implants/chips implanted under the skin	61.9	0.0

Source: empirical research.

The most well-known devices, among respondents, are smart watches, indicated by over 97% of respondents, headphones — almost 93% and smart band, which knowledge was determined by over 85% of respondents. Smart clothes, lenses and tattoos are the least known. However, it is worth paying special attention to the results determining the knowledge of smart chips, which are implanted under the skin and AR glasses — both examples were indicated as known by more than 60% of respondents. The first one, smart chips, was made popular by a test conducted in Sweden in 2018 on a sample of 3 000 people (Ma, 2018). The rice grain-size devices implanted under the skin around the wrist enabled, among other things, payment for shopping, opening the door or unlocking secure storage devices (Gillenson et al., 2019). AR glasses, on the other hand, were distributed, mainly through Google Glass by Google, which enabled, among other things, quick access to information from the Internet, discreet taking photographs and recording video material (Kęsy, 2017). However, the use of WT is low. Almost 43% say they use headphones, 22% use smart bands and almost 18% use smart watches. In the case of other devices, the respondents did not declare using them or did so to a negligible extent.

One important detail should be noted here. Comparing the level of knowledge of the term WT and the results from Table 3, we can see that they are not compatible with each other. This means that respondents probably do not associate this concept with devices such as smart watches or bands.

In a next step, the preferred payment methods were examined to identify which percentage of the sample uses the WT for this purpose (Table 4).

Table 4. Preferred forms of payment among the representatives of the research group (n = 173)

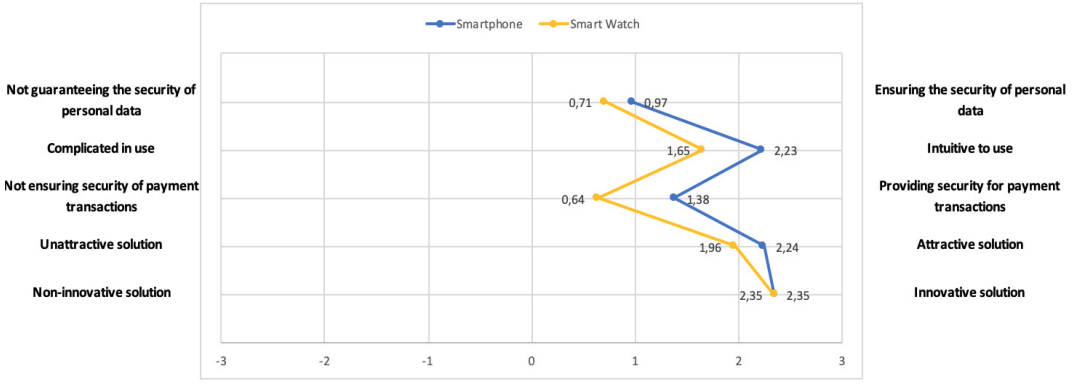
Methods of payment	Respondents	
	Count	%
Cash	111	64.1
Payment card (debit, credit card, etc.)	162	93.6
Blik	105	60.7
Contact stickers	23	13.3
NFC tag	6	3.5
Smartphone	55	31.8
Smart watch	9	5.2
Smart band	7	4.1

Source: empirical research.

Interestingly, only 64% of respondents indicated payment in the traditional form — in cash. Almost everyone uses payment cards (debit and/or credit). Over 60% use the Blik system offered by banks. This is one of the examples of instant payments. In Poland, it was launched by the Polish Payment Standard in 2014 on the initiative of six major commercial banks (Jagodzińska-Komar, 2019). The smartphone, whose use among young people until 2019 is to exceed 90% (Gregor, Gwiaździński, 2019), was indicated in the study by less than 32%. Other proposed forms of payment, including WT examples, were declared by less than 15% of respondents.

After identifying payment preferences, attitudes towards the payment process using a smartphone and a smart watch were examined (Figure 1).

Figure 1. Semantic differential for the attitudes of respondents towards smartphones and smart watches (n = 168)



Source: empirical research.

The attitude of respondents to both smartphone and smart watch payment is above neutral (0), which means it is positive. In the case of security of personal data, paying with a smartphone is better perceived, but the difference between these ways of buying is small. Respondents argue that the payment process is more intuitive for smartphones as well. They also believe that a smartphone provides greater security for payment transactions and is more attractive than a smart watch. On the other hand, innovation is perceived in the same way.

Comparing the results from Table 4 and Figure 1, it can be seen that despite the positive attitudes with little differentiation, respondents rarely declared such payment methods. The question should be asked here: why is this the case? In the case of a smart watch, the price of the device may be the barrier, while a smartphone is a device with a very high penetration rate among young consumers; the price is not a problem. The market for mobile devices is very saturated and this form of payment is available in most of the models available on the market. Consumers may not be aware of this, that it is available and how to use it. Identifying the reasons for this is essential and could be a separate research objective in this area.

Table 5. Respondents' assessments in relation to the proposed statements (n = 173)

Statements	Weighted average of responses	Structure of responses w %				
		I definitely agree (5)	I rather agree (4)	It's hard to say (3)	I rather dis-agree (2)	I definitely disagree (1)
WT is secure for my personal data such as passwords, access codes, etc.	3.24	5.8	38.2	34.1	18.5	3.5
WT makes everyday life easier	4.24	41.0	43.4	15.0	0.0	0.6
WT allow me to take better care of my health and physical condition	3.93	28.3	45.7	20.8	1.2	4.0
WT can replace smartphones in the future	3.67	28.9	32.9	20.2	12.1	5.8
WT are a new channel of contact between a brand and a consumer	3.80	22.5	42.8	28.3	5.2	1.2
I would like to implant a WT (chip) under my skin	1.92	3.5	9.2	16.2	18.5	52.6
Using WT means I'm less likely to use my smartphone	2.60	4.0	9.8	45.7	23.1	17.3
WT are just a gadget	2.68	5.8	18.5	31.2	27.2	17.3

Source: empirical research.

The last aspect to be examined was the respondents' attitudes towards the proposed statements on the WT (Table 5). In the process of the analysis, internal dependencies occurring in a set of eight variables describing respondents' feelings were examined. The coefficients on the diagonal correlation matrix exceeded the threshold value of 0.5. For the eight variables analysed, Bartlett's sphericity test was 257.326 (approximate $\chi 2$) at 28 degrees of freedom and the value of $p = 0.000$,[1] while the KMO coefficient was 0.723.[2] The theoretical accuracy of the structure was verified in the next step by using exploratory factor analysis (EFA). The

method of identifying generalised factors of the smallest squares was used. As a result of the analysis, the eight output variables were reduced to three factors explaining in total only 47.356% of the overall variability (which means that less than half of the variability of individual items was explained by the constructed constructs). The factor load matrix was rotated using the Varimax method with Kaiser normalization. The results of the analysis showed that only one or two primary variables can be included in each of the dimensions, and three of them have not entered into any of the factors. No homogeneity of construction was demonstrated and therefore it was decided to analyse individual variables.

Respondents rather agree that the WT is secure for their personal data such as passwords or access codes. The same applies to statements that the WT makes their daily life easier and allows them to take better care of their health and physical condition. Most respondents believe that WT can replace smartphones in the future and are a new channel of contact between a brand and a consumer. More than half of the respondents would definitely not want to have WT implanted under their skin. Most said it was difficult for them to say whether using WT would result in less frequent use of a smartphone, but they rather disagreed that it was just a gadget. It was also noted that:

- variable "gender" differentiates responses for statements 1, 2, 3, 5 and 6;
- variable "age" differentiates responses for statements 1 and 4;
- variable "education" differentiates responses for statements 1, 4 and 5;
- variables: "occupation status" and "place of residence" differentiate responses for all statements.

Conclusion

To sum up, the role and potential of UW is growing year by year. The reports presented by research companies show that in the future there will be more and more devices connected to the Internet. However, the

presented research results illustrate the low level of use of this type of devices, twice as low as the level of knowledge. It is also interesting to note that the UW usage is low in the process of making payments by the respondents, despite their positive attitude. The practice of companies, especially key players in the technology industry, shows that this type of solution is slowly becoming a new standard of payment. In the future it will be possible to make payments not only with a smart watch or chip, but also with smart tattoos, smart jewellery or smart nails. Respondents' attitudes in this area usually depend on their place of residence, gender and age. However, it should be remembered that the presented research results describe only a limited part of reality due to the rather small size of the sample, which leads to the inability to formulate general conclusions. However, the results give a certain view on the discussed issues, setting the directions for future research, which will be more and more frequent due to the growing trend of using this kind of technology.

Footnotes

[1] 1 The null hypothesis that the correlation matrix is a unit matrix was rejected in favour of the opposite hypothesis (Malarska, 2005).
2 It is recommended that the value of K-M-O > 0,5 which means that the test sample is adequate for the assumptions of the factor analysis (Malarska, 2005).

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