

# Factors influencing consumer behaviour and decision to use smart technologies

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## Abstract

**Purpose of the article** is to distinguish the factors influencing consumers' acknowledgement and the decision to use smart technologies on the basis of scientific literature analysis and to verify if the main factors can be revealed by using empirical survey of consumers' behavior.

**Methodology/methods** Scientific literature analyzes and the pilot survey are presented in the article.

**Scientific aim** focus on changes in consumption and consumer behavior factors also the characteristics of smart products are presented and theoretical aspects of consumers' awareness, acknowledgement and adoption of smart technologies are being highlighted.

**Findings** The scientific studies and the pilot survey disclosed the perspective of target group toward innovation adoption and main factors influencing the decision to use smart technologies.

**Conclusions** Theoretical analyzes show that a smart environment is a growing field of research, which covers computing, interaction between a human and a computer, computerized vision, adapting systems and training as well as other services through devices. One of the most distinct theories, concerning the acceptance of innovation in general, is Innovation Diffusion Theory. Theoretical and empirical results show the final part in the process of consumer's smart technology selection is played by internal factors that depend on personal characteristics and personal decisions are related to one's needs and priorities. It is important to emphasize that considering the limited scope of this paper the pilot survey of the target group was carried out to verify if the main factors can be revealed empirically and could be used while developing the profound instrument for future research.

Keywords: consumer behaviour, smart technology, innovation, factors

JEL Classification: M15, M31, O3, P46

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## Introduction

Consumer behaviour phenomenon is widely analyzed in the studies assigned to various scientific fields. Several decades ago, one of the most popular future visions was the adjustment of smart technologies to consumer needs. Therefore, the development of smart products in the market, firstly, affects new business decisions that involve consumers and the satisfaction of their needs. In the works of economists, information about households, their properties, income and economic situation is retrieved from statistical databases, regular consumer surveys are carried out, and economic indicators are measured. Psychologists refine upon the emotional consumers' state and factors influencing their behaviour. Sociologists observe the society, its livelihood and factors shaping its attitudes. Business enterprises are concerned not only with ways to establish themselves on the market, but they also wish to recognize and assess consumers' needs and factors that encourage consumption.

Objective of the article – to distinguish the factors influencing consumers' acknowledgement and the decision to use smart technologies on the basis of scientific literature analysis and to verify if the main factors can be revealed by using empirical survey of consumers' behaviour. Scientific studies that focus on changes in consumption and consumer behaviour factors are being analyzed in the article, characteristics of smart products are presented and theoretical aspects of consumers' awareness, acknowledgement and adoption of smart technologies are being highlighted. Basic results of the pilot survey are presented, which reveal the perspective of target group toward innovation adoption and main factors influencing the decision to use smart technologies.

## 1 External factors effect on consumption

Global economic crisis, environmental changes and transformation of technologies have strengthened the attitude towards deliberate consumption. Economic, and not social, motivation implies the fact that the majority of people have undertaken a rational stand towards consumption issues and became in search of alternatives when purchasing new items. New and rapidly developing attitude with respect to sustainable consumption becomes a so-called collaborative consumption. Scientific studies present not only the interpretations of consumption concept, but also the differing determinants of consumption. Educated people are more inclined to pay interest to innovations and product manufacturing technologies. They search for new information and share their experience through social networks at a regular basis. An increasing number of countries establish various measures that serve as a part of country's sustainable consumption program. The action plan implemented by Czech Republic is intended for education and training of sustainable consumption. Finland's sustainable consumption plan includes sustainable education. In the United Kingdom, the action plan of sustainable development education encourages seeking the sustainable consumption together – I will if you will. The plan covers social programs designed to reduce poverty, fight against obesity and encourage community involvement. In Italy and the United Kingdom, sustainable schools are supported, where the youth is being practically prepared to live a life based on the sustainable lifestyle each day until 2020 – highlighting nutrition, drinks, effective energy usage, and etc. Sustainable consumption program in Sweden includes education components that motivate sustainable consumption in households – Think twice! In the country's higher education system, implementation of learning courses concerning households' economy and consumption is being promoted.

Environmental changes and the search of life quality are related not only to the main idea of sustainable consumption of products, but also to services and the emergence of their consumption in households. Development of a country's sustainable economy can be achieved through three dimensions: environmental, social and economic. Due to the environmental changes, the increase in world's population and the decrease in natural resources on international level, the significance of globally acknowledged sustainability policy is increasing, therefore, the effort is being directed towards integration, which covers challenges of food products supply, new attitude towards agricultural manufacturing, political action plans and programs as well as the installation of technologies, emphasizing the transition to sustainable and safe consumption.

The analysis of scientific literature show the external factors that relate to consumers' economic expectations, marketing elements and their influence on the shaping of consumers' attitude to purchasing. Literature on ergonomics emphasizes the importance of a design's link to product's functionality underline the difference between the awareness of consumers' values and the diffusion of consumption. Porter, Heppelmann (2014) believe that smart products are able to observe, control and optimize, and even work completely independently resting on great quantity of available data, whereas Chang et al. (2014) highlight that the consumers' intent to purchase smart products keeps growing. As studies prove, research areas of the Internet of things and the scope of devices' adoption are also increasing (Kim, Shin, 2015; Hsu, Lin 2016). Various theories and models aid in revealing the benefit of technologies, however, the innovations' characteristics and their development depend on consumers' decisions. As a result, it is important to analyze the consumer's attitude towards smart technologies and factors that influence consumers' choices.

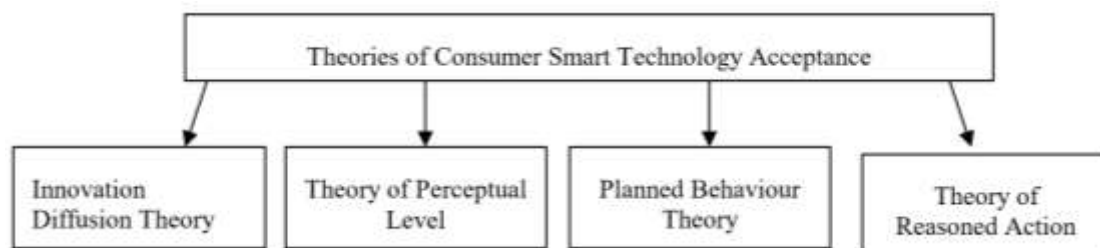
## 2 Theoretical aspects of consumer adoption of innovations

In the life of modern society, the interaction and interdependence between human and technology is also increasing. Scientists analyze the installation, diffusion and consumers' attitude towards technologies from various perspectives. Terms, such as adoption, diffusion or even attraction, are related to different phases of the system's life cycle, although in literature they are often used without definition. Adoption is mostly used when a new technology is actualized (Venkatesh, Davis, 2000), or when the technology is still not implemented, but the intention to use it in the future is being measured as a dependent variable (Shin, 2010). In the context of research studies, adoption means that a consumer is already acquainted with the respective technology and his/her attitude is shaped via actual usage. Diffusion, in its respect, is based on the extent of populations where this technology is introduced. Thus, the diffusion research mostly focuses on the society's level. In terms of attraction, the interest is paid to describing the consequences that the usage of new technologies may cause to both consumers and society (Silverstone, Haddon, 2006). Attraction is sometimes related to initial phase of consumption, but mostly with the actual usage on consumer's and society's levels. In the review publications by Jeyaraj et al. (2006), authors present attraction theory origins, since they are interested in adoption of smart environment on the societal level. These researches focus mostly on consequences that a society faces when using technologies.

Rogers (1983) Innovation Diffusion Theory is often emphasized in researches. This theory has four elements: the innovation itself, communication channels, time and social system. The essence of theory is that a potential adopter goes through five stages when adopting innovation: from discovering innovation, becoming interested in it, information gathering and deciding to adopt or reject it, till implementation of decision to adopt it, and, finally, using the innovation on a constant basis (Faiers, Neame, 2006).

Arts et al. (2011) note that one of the most influential attributes that evokes intention is the compatibility, whereas a relative advantage is the most important attribute, which stimulates both the adopting intention and behaviour; the product's complexity has a positive impact on adoption intention, which is a major barrier to the adoption behaviour. Arts et al. (2011) pinpoint that both intention and behaviour (the latter having a stronger impact) has a positive effect on consumer's sense of innovation, whereas consumer's sociological and demographic characteristics (such as age, education and income) have a limited effect. Besides, consumer's involvement into the creation or improvement of the product also has a strong impact on intention to adopt this innovation.

Researches on consumers' innovation adoption usually do not consider the actual time for adopting the innovation, even though this factor is determined to have influence both on the innovation assessment and adoption decision (Arts et al., 2011). Therefore, when pursuing to get a better understanding on how different potential adopters assess smart technologies before adopting them, the focus is also being paid to Construal Level Theory (Trope, Liberman, 2003) and Innovation Diffusion Theory (Rogers, 2003). Construal Level Theory states that consumers adopt decisions based on various stereotypes. Sometimes consumers' willingness to risk in order to receive something new is greater than the available and verified information. However, reliable and reasonably justified arguments ultimately determine the choice for the majority people.



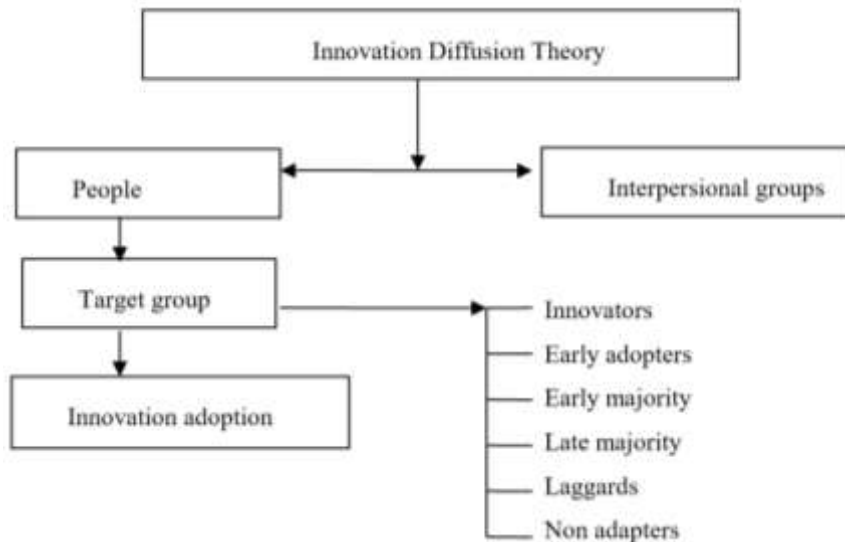
Source: developed by the authors

**Figure 1** Basic Theories of Smart Technology Acceptance

Product's characteristics determine the speed for innovation acceptance and their influence on consumers' adoption decision is evidenced in various researches: starting with the online purchases (Verhoef, Langerak, 2001) and ending with the ecological devices for water saving (Schwarz, Ernst, 2008) or virtual customers' integration practices (Bartl et al., 2012).

The adoption of new innovation is invoked by human interaction via interpersonal networks. Innovations are not adopted by all users in the social system at the same time. Users that belong to target groups can be classified into categories according to the time it takes them to start using the new technology. Criterion for classification is one's sense of innovation, which is defined as a degree according to which an individual is inclined to adopt the new innovation rather early in comparison to other members of the social system. Therefore, Innovation Diffusion

Theory assumes that some users adopt innovations sooner than others. This is determined by a varying people’s openness to changes, risk avoidance and sense of innovation, and it is defined as “an extent, according to which an individual relatively sooner adapts ideas than other members in the system” (Rogers, 2003). Rogers classifies target consumer groups into innovators (technology enthusiasts), early adopters (rapidly adapting), early majority (rapidly adapting majority), late majority (slowly adapting majority) and laggards (last to adapt the innovation). Also persons who shall never accept nor purchase innovation can also be classified – they are unadaptive people (see Figure 2). Thus, these categories are practical in cases when service or technology provider wish to facilitate the innovation adoption of a certain consumer group.



Source: adopted by the authors based on Rogers, 2003

**Figure 2** Consumer Group Classification among Innovation Diffusion Theory

Lately, a new concept is seen to dominate in the field of information technology – Cloud computing. In addition, the tendency of Internet of things is observed in the industry. According to Dawid et al. (2016), the Internet of things revolution is very significant because Internet once had merged data and people, so in the Internet of things century, people shall converge with things and surrounding objects. The author defines the Internet of things as a wireless network of interconnected devices, in which things share information amongst themselves and with people. The Internet of things vision is that sensor devices will help to save time, money, look after our health, remember consumers’ habits and the like.

In Gartner’s (2013) opinion, even though the Internet of things offers new possibilities, it also raises challenges. The popularity of Internet of things is increasing at a significant pace, and the market calculations forecasts 26 milliiards of Internet of things devices by 2020. The amount that has been invested to this new technology and the rapid diffusion of connected devices emphasize a great potential in this sector (Porter, Heppelmann, 2014). These new connected and smart products shall fundamentally change the lives of consumers and can be assumed to be a revolutionary innovation. As a matter of fact, the Internet of things is an exciting stage in the Internet revolution (Hoffman, Novak, 2015). Nevertheless, further growth of the Internet of things raises significant challenges (safety, privacy, trust, and etc.) (Sicari et al., 2015) and ethical issues (Nguyen, De Cremer, 2016). Several authors and specialists distinguish possible threats related to information privacy (Hsu, Lin, 2016) and identify possible problems “related to data protection, lack of human control and dependency on devices” (Slettemeås, 2009). Besides, an increasing number of devices are being included into the ecosystem of the Internet of things; this raises questions regarding the usefulness and added value of these innovations. The success of any innovation related to smart services depends on the perceived values that consumers have in respect of these devices (Wuenderlich et al., 2015).

Researches on technology acceptance pay most of the attention to social consequences that the acceptance of technologies causes. Acceptance is a process, by which the usage of technologies is integrated into daily human’s life. The aim of this method is to describe acceptance and models used by consumer groups as well as the behavior of end users. According to Haddon (2006), acceptance follows after technology adoption and usage and focuses on the meaning that people give to technologies and services, their experience with innovations and roles that

different technologies play in their lives. Furthermore, the process of acceptance indicates the links of the individual to technologies, behavior with them – either rejection or adoption.

The product is assessed according to the way it corresponds to the consumers' perceived needs. If a consumer has to decide whether to adopt the product, the process of appropriation can have influence on his/her decision to purchase the product. After a service or a product is obtained, acquisition process, i.e. acquiring and using, takes place – the owner becomes involved in its consumption and it becomes personal to him/her. In the conversion stage (integration of technology into individual's personal life), innovation adopters demonstrate their adoption to the outer world (Wallden, Makinen, 2014).

However, not all innovations are accepted by consumers. Resistance is not the opposite of acceptance. Plenty of researches examine the relation between not acceptance and resistance. According to Kleijnen et al. (2009), resistance manifests in three forms of consumers' response: rejection (consumer can refuse to accept the smart product), postponement (consumer cannot accept a smart product because of unsuitable circumstances at the given moment) or opposition (consumers can suppose that smart products are a threat and refrain from their adoption and usage). Thus, to understand the reasons why consumers resist these innovations is a significant matter that determines the success of these smart products.

Comparatively few empirical researches are carried out concerning consumers' resistance to innovations (Heidenreich et al., 2016; Heidenreich, Spieth, 2013 and others. According to the conducted researches (Heidenreich, Spieth, 2013), resistance to innovations can be caused due to the product's specific features (functional barriers) and consumer's inner factors (psychological barriers). Considering these researches, it can be stated that resistance to innovation has to be based on factors of two categories: product's characteristics and consumer's traits. However, little research has been done concerning the specific characteristics of smart products and only several researches focus on the role of variables that influence the purchase intention (Chang et al., 2014) or adoption (Kim, Shin, 2015; Hsu, Lin, 2016). Adoption starts only after the initial resistance is overcome. Therefore, it is an essential factor to understand consumers' resistance in the first phase of innovation life cycle.

Resistance can be passive – if consumer is unwilling to accept the innovation, or it can be active – if consumer postpones the decision regarding adoption, because he/she finds innovation too risky. Ultimately, resistance can be very active – if consumer decides to take actions against innovation adoption. Talke, Heidenreich (2014) claim that active resistance to innovations is a result of expressing the attitude, which emerges when the new product is being assessed unfavourably. However, from their perspective, passive resistance to innovations is the result of consumers' tendency to resist novelties.

### 3 Empirical research results

Analysis of scientific works shows the diversity of theoretical background and researches in this field. What determines the need to distinguish main factors influencing the consumers' behavior and their decision to use smart technologies and requires the adoption of existing results with respect to researchers' tasks. It is important to emphasize that considering the limited scope of this paper the pilot survey of the target group was carried out to verify if the main factors can be revealed empirically and could be used while developing the profound instrument for future research. Therefore, the adoption of theories when pursuing to figure out the factors that influence the usage of smart technologies, target group of respondents is selected: young people (ages from 22 to 35), with higher education and stable income. In order to assess the motives that can encourage consumers to choose and use smart technologies, the consumers' surveys included statements, which had to be arranged in terms of importance. So as to analyze the data, answers of each respondent to all of the statements are summed up and a general construct average is calculated using Likert's method using the scale from 1 to 5.

Research results reveal that consumers find safety and privacy to be the most important factors when choosing and using smart technologies ( $M=4,87$ ) (see Table 1). Convenience and information availability ( $M=4,53$ ) as well as the simplicity of technology usage ( $M=4,47$ ) play a significant role for consumers, which consequently influences innovation usage and popularity. Such distribution of priorities can be influenced by respondents' education, which shapes personal values, attitude towards certain things and educates a mature personality. Even 87% of the surveyed are persons with higher university education, and the rest 13% of the respondents has higher non-university education. However, results show a passive respondents' interest in smart technologies, their given benefit and advantages ( $M=3,47$ ), this can cause a narrower spectrum of smart technologies' usage. Financial expenditure is not the most important factor when choosing innovations ( $M=3,47$ ), even though it is still relevant. Such respondents' attitude can be determined by their income and position. The majority of respondents' (40%) income per month is average, 13% receives higher income, and high income, i.e. 1101-1400 EUR/month, is gained by 20% of respondents. Almost third of the respondents 27% assigned themselves to persons receiving a very high income, i. e. 1401 EUR and more. (With reference to the resolution No. 644 of 22 June 2016 of the Government of the Republic of Lithuania "Regarding a minimum monthly wage", a minimum monthly wage is set to be 380

EUR since 1 July, 2016). Among respondents, specialists are dominant – 73%, 7% takes the position of the head of the department and 13% are civil servants.

**Table 1** Valuation means of respondents' attitude towards smart technologies

	Mean	Standard Deviation
Safety and privacy is important to me.	4,87	,352
Convenience and information availability is important to me.	4,53	,516
Simplicity of technology usage is important to me.	4,47	,640
Quality and scope of technology is important to me.	4,40	,828
Independence and possibility for technology self-control is important to me.	4,07	,961
I care about nature protection and preservation of resources.	3,80	1,265
I am actively interested in smart technologies, the benefit and advantages they provide.	3,47	1,187
I am care more about financial expenditure than innovations.	3,47	,915

Source: developed by the authors based on the pilot survey results

The research reveals that respondents are planning their financial expenditure and expensive investments responsibly, and perhaps sometimes they limit themselves by not purchasing a likeable innovation due to its value (M=4,67). But if consumer does not feel the need to instantly buy a certain innovation, he/she can linger, wait for discounts and suitable price, be interested for quite some time and consult other persons. This is illustrated by the view of a great number of respondents stating that opinion of their friends and family is important to them when it comes to purchasing a new product (M=4). Besides, they are determined to wait for the sales so as to purchase the good or service at a lower price (M=3,6).

Results show that two categories of consumers (according to Rogers, 2003) are dominant – early adopters (rapidly adapting) and late majority (slowly adapting majority). Additionally, one of the most significant factors influencing the respondents' choice of smart technologies is the simplicity and reliability of the innovation (M=4,47). This proves that a consumer does not want to put a lot of effort into using a certain system. The ability to rely on technology is important. A major role in the process of decision-making in terms of innovative products is played by respondents' personal opinion and experience (M=4,20). The respondents' unwillingness to risk and try innovations (M=3,33) is attributed to less important factors conditioning the usage of smart technologies. It is a feature of a consumer who belongs to the category of late majority. Furthermore, according to available data, it can be stated that rather a small part of respondents make a decision to use technologies in terms of prevailing stereotypes (M=2,73) and does not give too much significance or attention to one's own image formation in society (M=2,27). These results confirm the prevalence of early adopters, a great part of those who do not wait and want to be the first ones to try out innovations, are brave and independent, and only a rather small part of respondents follow the prevailing stereotypes in the society.

**Table 2** Valuation means of the respondents' opinion regarding the factors influencing the usage of smart technologies

	Mean	Standard Deviation
You are planning financial expenditure and expensive investments.	4,67	,488
Simplicity and reliability of technology is important to you.	4,47	,640
Personal opinion and experience is important to you.	4,20	,561
Prior to purchasing a new product you consult your friends and family.	4,00	,756
You look for and book new products on online stores.	3,93	,799
You are constantly interested in innovations.	3,87	,834
You live an active life.	3,67	1,047

You wait for sales in order to purchase the good at a lower price.	3,60	1,352
You like to take risks and try out novelties.	3,33	1,113
You make decision to use technology in terms of the prevailing stereotypes.	2,73	,884
Image in the society is important to you.	2,27	1,223

Source: developed by the authors based on the pilot survey results

Meanwhile, the obtained results relating to image formation highlight the lack of self-confidence of a small part of respondents. Scientific studies reveal that a great part of consumer choices depends on personal features and psychological characteristics. Thus, the impact of internal factors has a strong influence on consumer behavior related to the choice, usage and adoption of smart technologies. As a result, the obtained results distinguish two types of consumer portraits.

The research cleared up whether the respondents are innovation-friendly and how long it takes to adopt innovation. Even 47% of the survey participants keep their household accounts and live in their own houses, thus, it is perceived that this might have influenced their opinion to assign themselves to such persons who accept innovations (53%) and seek to be the first ones to use them instead of waiting for the product to become famous and recognized in the market.

The research of the wider scope is needed for more reliable and representative results. It is recommended to broaden and develop the survey questionnaire. Nevertheless, the pilot survey results, basically, match the results of other scientific researches and could be used as the basis for further researches.

#### 4 Conclusions

Analysis of scientific studies show that a smart environment is a growing field of research, which covers computing, interaction between a human and a computer, computerized vision, adapting systems and training as well as other services through devices. A common feature of all smart technologies and devices is that attention is paid to existential experience, ability to assess the situation of a specific element and provide consumers with certain related services.

Generalizing the scientific research, it can be stated that two research trends can be distinguished. Some scientists focus on technology impact on consumers, others pay attention to consumers' behaviour depending on their personal characteristics and habits as well as on environmental changes that relate to the lifestyle and consumption of goods and services. One of the most distinct theories, concerning the acceptance of innovation in general, is Innovation Diffusion Theory, which distinguishes stages and elements of the process involving person's innovation adoption that influence the innovation diffusion speed and describes factors that determine consumers' innovation adoption speed. It is noteworthy that innovation diffusion speed depends on innovation characteristics.

Two main groups of factors that impact consumers' technology adoption can be distinguished: external and internal. Users care about safety, privacy, reliability, are aware of usefulness and simplicity for technology usage, its availability and quality.

Empirical research results, basically, match the results of other scientific researches and reveal that the final part in the process of consumer's smart technology selection is played by internal factors that depend on personal characteristics and personal decisions are related to one's needs and priorities. The prevalence of two large groups of consumers, i.e. early adopters (rapidly adapting) and late majority (slowly adapting majority) is exposed. Consumers of the first group stand out for their openness to innovations and ambition to test them first. Consumers of this group are not afraid to risk, but prior to making decisions they first gather and assess information about the new good or service. Meanwhile, representatives of the second group are more cautious and wait for the product to be acknowledged in the market and be tested by others. Such a consumer rarely makes decisions on his/her own and rather addresses other persons for advice and opinion about the technology innovation that they have already tested.

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