

MILLENNIALS' PERCEPTION OF AUTONOMOUS VEHICLES

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Abstract: *Examining the influence of information technology on the business value has been the main challenge for several researchers in the last few decades and it is not changing today with new technological improvements. Since one of the latest technological issues is related to the autonomous vehicles, this paper thus reviews some important challenges related to them. Nevertheless, they may present a next major shift not merely in business models' change but in the overall transformation and perception regarding transportation in general. The purpose of the paper is to examine the attitude of millennials toward autonomous vehicles and based on the attitude to consider anticipated changes in business models. Altogether, 364 individuals participated in the research. The results show that despite the fact that respondents are quite excited with the capabilities of new technologies, they are more reserved regarding the use of AV.*

Keywords: *Business models, technology, autonomous vehicles, digitalization*

1. INTRODUCTION

Organizations are nowadays facing the challenges that are driven by the new technologies, innovations or the advent of new online based companies. Contemporary technological trends, such as cloud computing, social media, internet of things, data analytics and others, yet not each separately, but rather the complexity of coordinating all these aspects together are bringing several new challenges. These new technological improvements are forcing organizations into changes and driving the digital transformation. One of the main challenges of the existing companies is how to transform their business models.

Nevertheless, examining the influence of information technology on the business value has been the main challenge for several researchers in the last few decades and it is not changing today with new technological improvements. This paper thus reviews some important challenges related to autonomous vehicles (AV) since they may present a next major shift not merely in business models' change but in the overall transformation and perception regarding the transportation in general.

One of the groups that will be highly influenced or affected by the AV technology is definitely current millennials. Therefore, the paper focuses on their perception regarding AV technology. The purpose of the paper is to examine the attitude of millennials toward AV technology and based on the attitude to consider anticipated changes in business models by different involved stakeholders.

A special questionnaire was thus prepared in order to get an overview of millennials' attitude. The questionnaire was amongst other composed of several items measuring the attitude toward

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new technologies and AV, items measuring challenges of AV, rationality and security of AV. The data collection started in May and was concluded in July 2018. Altogether, 364 individuals participated in the research.

The paper is divided into two main parts, firstly some important concepts for AV are briefly presented following by presenting the results on the millennials' perception regarding AV.

2. CONCEPTS IMPORTANT FOR AV

Since new technologies are emerging from year to year, this paper focuses on the most establishes concepts that are important for autonomous vehicles from the business perspective. Thus, internet of things, cloud computing and big data are shortly presented, since all these concepts are also interrelated. Nevertheless, the growth of big data is produced through cloud computing [11], while the latter has enabled significant development of the Internet of things.

2.1 INTERNET OF THINGS (IOT)

The internet of things denotes a concept that relies on self-directed communication of different physical objects equipped with sensors and communication technology. There are many potential employments like smart homes, smart cities, smart healthcare or industrial automation [4]. Due to many different applications of IoT, the paper focuses on two main application areas that are also closely connected to autonomous vehicles, namely smart grids and smart cities.

Smart Grids

Energy utility organizations are facing challenges comparable to market liberalization a decade ago [9]. Drivers of current changes are increasing demand for effective and efficient use of energy, increasing production from renewable energy, requirements for an efficient energy market and technological innovations such as smart grids. One of the concepts of smart grids is the advanced metering infrastructure, which provides the basic IT platform on which a variety of services for all participants in the utility market can be developed [17]. It refers not only to electricity but also to other energy products and can give providers the basic IT infrastructure for multi-utility energy supply. The latter requires changes in business models and business processes as well [7].

With the introduction of appropriate consumption management programs in the form of various utility packages, it is possible to allow consumers the possibility to lower energy bills by adjusting the consumption, to reduce investments in the network for distributors due to reduce in peak load growth trend, and to achieve better environmental results. However, the basic problem is how to adequately respond to the new challenges and adjust the business models of supply chains as well as consumer behavior in order to ensure efficient multi-utility management.

Smart cities

A city can be considered smart if it has integrated wireless communication platforms [10]. In the modern world, there are more and more large urban areas that are exploiting new technologies to integrate different aspects of life in cities by introducing a concept of smart cities. Such urban areas based on the strategy of introducing smart cities are bringing to its residents a more comfortable life, to its business entities a more favorable environment for their activities, and to the global level a vision of a cleaner environment. Basically, a smart city is defined as the city that has incorporated a digital technology in all of its functions needed for

its residents and organizations. IoT provides a platform for sensors and devices to communicate within the smart city and enables increasingly useful information sharing across platforms making it the next revolutionary utilizing the Internet technology. The implementations of IoT in smart cities refers to developing intelligent systems like smart grids, smart homes, smart transportation, smart water, smart waste management and smart energy [8].

The growth of big data and the evolution of IoT technologies have an important role in the utilization of smart city initiatives. Big data present the possibility for cities to get valuable information from a large dispersed amount of data collected through different sources, while IoT allows the integration of sensors and their communication in the real-world environment by using highly networked services [10].

2.2 CLOUD COMPUTING

One of the main challenges in the last decade is related to the cloud computing and how to use effectively use it. Allowing access from anywhere and anytime, it offers a new way for individuals and organizations to communicate and work over the internet [3]. Cloud computing is now perceived as a global trend that has gained attention from both academic and practitioner communities in the last decade. Although the development of cloud computing has not reached the maturity level, there is still a lack of research on it [1]. In the initial years, researchers focused on the definition of cloud computing and studied how it could be applied to existing solutions. Therefore, most of the articles were dealing with the conceptualization of cloud computing. Later, when the consensus on the definition was somehow achieved, the research moved to the technical dimensions of cloud computing including architectural designs. Even though cloud computing has achieved great progress in recent years; it is expected to continue its growth [15].

Cloud computing offers several benefits from the technology and functionality perspectives as well like increased flexibility, availability, and functionality [18]. Nevertheless, it offers a scalable IT system infrastructure that is enabling organizations to start or develop its businesses at lower starting costs [12]. However, there are also several important issues related to cloud computing like security, privacy, reliability, legal matters, open standard, freedom, and long-term sustainability [14]. It has been suggested that these issues should be solved before the wide deployment of cloud computing [18], which seems to be beyond the reach.

In the last years, cloud users moved from understanding what cloud computing is to rather examining how to use it [1]. However, due to the change from previous business models or on-premise computing to cloud computing, organizations and individuals have to obtain or develop new skills and knowledge.

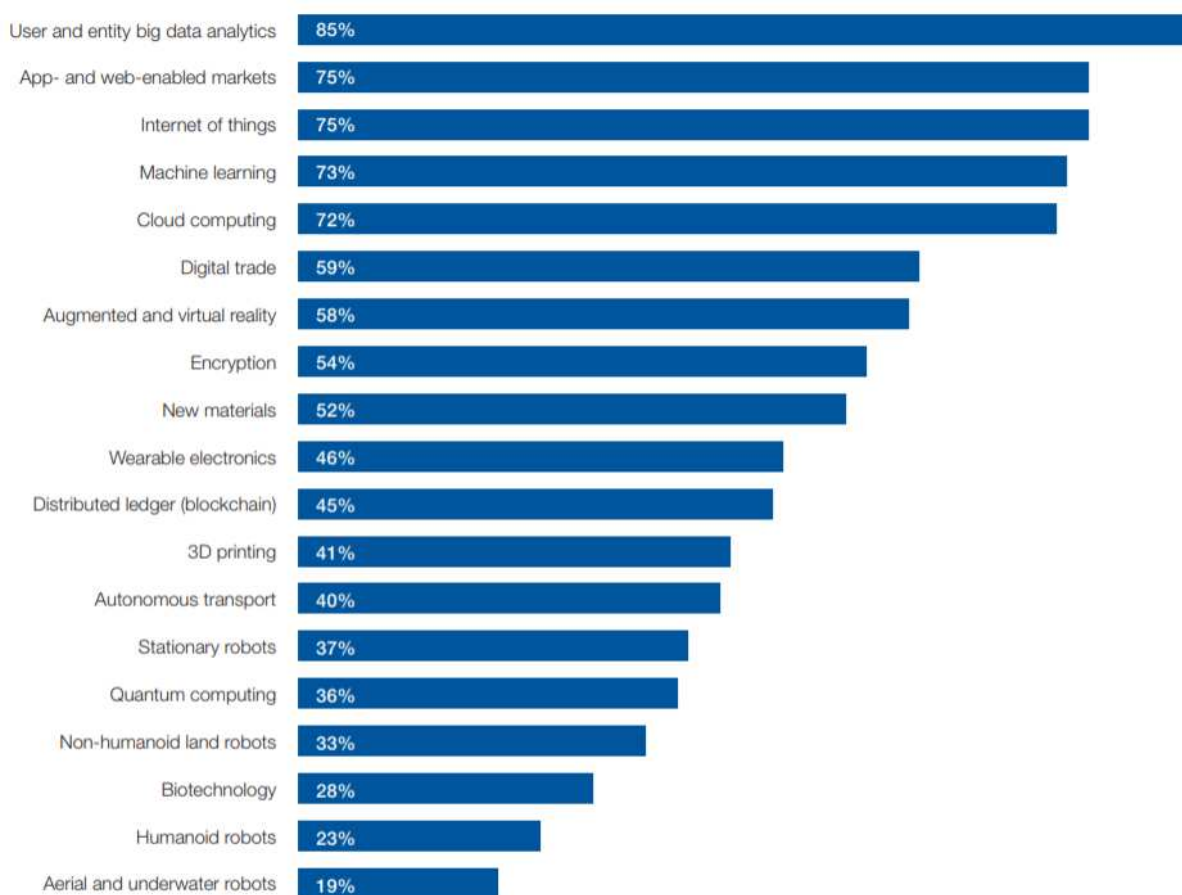
2.3 BIG DATA

Big data is a concept that originated from the need of large organizations like Yahoo, Google, and Facebook to analyze large amounts of data [6]. It presents a concept that is related to the increased volume of data that are difficult to store, process and analyze using traditional database technologies. Although the term big data is quite new in the field of information technology, several researchers and practitioners have already used it in previous literature. It was, for instance, referred to a large volume of scientific data for visualization [2]. Currently, several different definitions of big data exist. It was also defined as the amount of data that is hardly efficiently stored, managed and processed [13]. Recently, a different explanation from

3V like Volume, Variety, and Velocity to 4V like Volume, Velocity, Variety and Veracity have been offered to define big data [5], [11]. The 4V definition of big data is commonly recognized since it denotes both the meaning and necessity of big data as well.

Big data and big data analytics present enormous potential for different applications. One of the main sources for producing huge amounts of data are namely IoT, multimedia and social media. Also, cloud computing and big data analytics are related since big data analytics enables users to process queries across multiple datasets and receive results in a timely manner, while cloud computing provides the underlying data processing platforms [11]. Additionally, it has been forecasted that there will be an enormous increase in demand for big data skills in the near future. It is even expected that the increase in demand for these skills will grow by 160% in the United Kingdom alone [19].

Figure 1: Technologies likely to adopt by 2022 [16]



Thus, it is not surprisingly that these concepts are placed on the priority list of the majority of companies that were included in the Future of Job Report [16]. According to the planned investment by the companies surveyed in 2018 (Figure 1) 85% of them are likely to expand their adoption of big data analytics. Likewise, the majority of companies are expected to expand their adoption of the internet of things and making extensive use of cloud computing. Although the estimated use of autonomous transport appears to remain somewhat more limited comparing to the technologies the will be most likely adopted by 2022, the proportion of companies that are planning to adopt the technology related to autonomous transport is not to be overlooked.

3. DATA ANALYSIS AND RESULTS

The questionnaire is, among other indicators that are not relevant for this research, composed of several items measuring the attitude toward new technologies, attitude toward AV, challenges of AV, rationality and security of AV and way of spending available time in AV. If not stated otherwise, we used a structured questionnaire with five-point Likert scales.

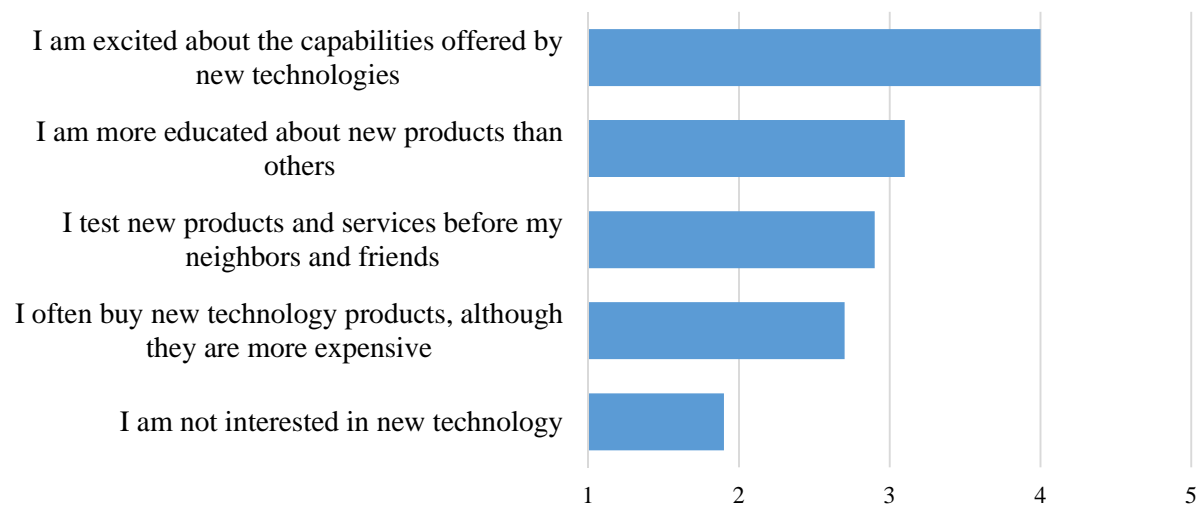
The research question was empirically tested using data from individuals aged between 20 and 30. A public web link was created and published online, and thus randomly disseminated among individuals. Altogether, 364 individuals with all the data valid for the analysis participated in the research. The respondents' profile is shown in Table 1. The data collection started in May and was concluded in July 2018.

Table 1: Profile of the respondents

		Percent (%)
Gender	Male	41
	Female	59
Valid driving license	No driving license	5
	Less than 3 years	12
	3-5 years	67
	6-8 years	9
	More than 8 years	6
Frequency of driving	I don't drive	5
	Less than once per week	11
	1-2 times per week	17
	3-4 times per week	21
	More than 5 times per week	46

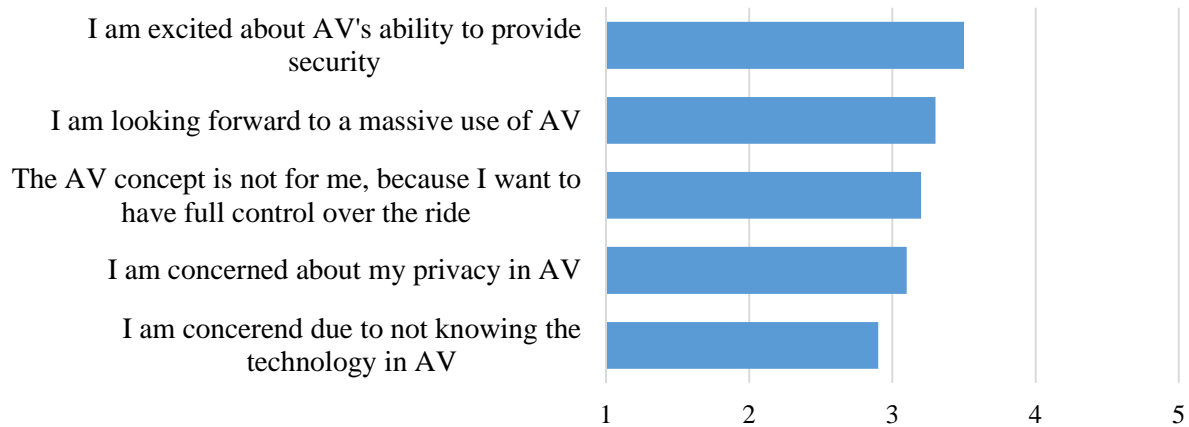
Expectedly, millennials are in majority quite excited about the capabilities that are offered by new technologies and also consider themselves as being more educated about the new products comparing to others as it is evident from the Figure 2.

Figure 2: Relation to modern technologies



While only a small proportion of the millennials is not interested in the new technology, it is not the case for AV. Despite the fact, that the majority of millennials is quite excited about the AV’s ability to provide security and are looking forward to a massive use (Figure 3); their excitement is considerably lower comparing to the technologies in general.

Figure 3: Attitude towards AV



Even though the millennials are not concerned about the privacy in AV, they exposed several issues that should be solved before mass usage of AV with regulation the legal basis on the first place, following by focusing on the cybersecurity. An important issue to consider is also related to preparing and maintaining roadmaps that are currently too slow and demanding.

Table 2: Main issues to solve before mass usage

Issues to solve before mass usage	Average	Std. dev.
To regulate the legal basis	4,3	0,73
To focus on cybersecurity	3,9	0,90
To prepare and maintain roadmaps	3,5	0,94
To deal with poor weather conditions	3,4	1,06
To deal with the complex processes that are currently not adequately controlled by artificial intelligence.	3,1	1,01

In order to propose or to develop proper business models related to AV, it is crucial to know millennials’ preferences regarding spending their time during driving with AV. The majority would like to spend the time - that would be otherwise spent by focusing on driving – by listening to music. All other preferences are considerably lagging behind, yet planning different activities or making phone calls seems to be quite important as well. Taking some rest, which is also a relatively highly ranked preference, may wrongly be considered as having no influence on the business models. Yet, providing different services including improved resting or sleeping may be found as a reasonable solution for many millennials that were included in the survey. Contrary, game-related activities are not considered as a high priority preference of millennials; however, due to a very high standard deviation on this preference, there may be significant differences among some millennials which are worth to be research into greater detail.

Table 3: Spending time during driving with AV

Preferences - time spent	Average	Std. dev.
Listen to music while driving	4,3	0,77
For planning activities	3,9	0,91
Making phone calls	3,8	0,95
Taking some rest	3,8	1,03
Work-related activities	3,7	0,93
Using for education	3,6	1,01
Saving time - using for lunch or snack	3,6	1,11
Watching movies	3,4	1,12
Game-related activities	2,7	1,21

The majority of surveyed millennials believe that AV are more environmentally friendly and will make their lives easier, particularly related to parking places. Moreover, millennials are also more in favor of using AV on short distances (public transport within a city) comparing to using them on longer distances such as travel journeys etc.

Table 4: Preferences of millennials related to AV

Preferences	Average	Std. dev.
AV will make my life easier, as I will not be concerned with finding a parking space.	3,7	0,92
AV are more environmentally friendly and thus also socially and economically beneficial	3,7	0,87
For public transport (within a city) I would rather drive with an autonomous bus	3,3	0,99
I'd prefer to sit in an autonomous taxi rather than in a taxi with a driver	3,1	1,02
I would rather drive with an autonomous bus on a trip	2,9	0,98

The forecast about AV seems to be positive, at least from the perspective of predicted feelings of millennials related to AV. The majority of surveyed respondents believe in comfortable feeling, although the proportion of millennials with nervous feelings should not be neglected.

Table 5: Predicted feelings of millennials in AV

Feelings	Average	Std. dev.
Comfortable	3,9	0,78
Nervous	3,2	1,00
Safe	3,1	0,94
Scared	2,8	1,01

4. CONCLUSION

The paper presented an overview of some of the important concepts for autonomous vehicles together with the results based on the survey on more than 300 millennials. All these new technological advancements and concepts are forcing current businesses into digital transformation and are presenting a challenge for new business models; and therefore, knowing the perception of the generation that will probably be an important consumer of these

technological advancements in the recent future is highly important. Recent future is named above with a particular purpose. From mid-2019, two autonomous buses will operate in Vienna in a pre-specified route. Thus, it is not a distant future anymore.

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