THINKGOODMOBILITY: MILLENNIALS' VIEWS ON THE FUTURE OF MOBILITY IN EUROPE

GOODYEAR EMEA

IN COLLABORATION WITH

Think Young

We lobby for young people

A REPORT BY GOODYEAR EMEA AND THINKYOUNG

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EXECUTIVE SUMMARY

Millennials (age 18-30) see car ownership as a firm part of their future: 85% think that they will own a car in 10 years. They expect this car to serve their individual mobility needs and to be sustainable, safe and smart, without any compromise on affordability.

SUSTAINABILITY

Millennials want an eco-friendly future and see the sustainable car playing a big part in this.

When asked to identify the key challenge for the automobile industry in 2025, the most frequent answer was to build a sustainable car with a focus on environmentally-friendly technology (59.3%).

Young people envisage fuel-efficient vehicles as the best chance of meeting this challenge. They do not want their freedom of choice or movement to be restricted.

Government regulation was viewed as a key tool in achieving sustainable mobility. 44.6% of respondents selected CO_2 emissions standards and 35.7% saw incentives for the use of fuel-efficient cars as crucial features in regulation.

Throughout the survey, affordability was identified as a key concern: **in future mobility it is clear that young people want a focus on both sustainability and affordability.**

SMART TECHNOLOGY

Millennials want smart, affordable and connected cars, but their chief preference is that smart features and technology serve the safety agenda.

Besides sustainable mobility, Millennials also envision smart mobility - or the use of technology - as a way of optimizing the way we get from one place to another.

When asked about the key challenges for the automobile industry in 2025, a smart car with higher levels of connectivity (31.5%) was the fourth most popular choice. However, the second most prevalent choice was an affordable car able to keep up with the latest technologies (55.7%). **Smart vehicle technology is clearly popular among millennials in Europe, but it must be affordable.**

When asked what changes they would most like to see in mobility by 2025, young people's top choice was smart safety features (47.4%). The second most common choice was "communication with other cars to anticipate and adapt to sudden changes" (39%).

Only 20.8% of young people saw minimum requirements of smart technology as a crucial feature to be regulated.

Vehicle autonomy has a role to play in smart safety. Yet, millennials (40.6%) prefer basic levels of autonomy (e.g. cruise control and anti-lock brakes). The biggest hurdle to fully autonomous, self-driving cars in 2025 was identified as reliability (55.5%), followed by affordability (45.7%) and security and privacy concerns (38.5%).

As they have middling confidence in autonomous cars due to reliability and safety concerns, millennials want the development of autonomous cars to focus on safety and a stress-free experience.

PERSONALIZATION

Millennials may want a smart, sustainable, affordable car but the vast majority also believe it will be a personalized experience.

When asked about the key challenges for the automobile industry in 2025, a personalized car was the third most frequent response (31.7%).

85% of respondents believe they will own a car in 10 years, and **81.6% suggest it will be personalized to them.**

Popular future developments in the field of personalization include:

- Adaptable CO_2 emission levels (33.5%)
- Vehicles that adapt to all terrains and weather conditions (32.8%)
- Vehicles that adapt to selected fue consumption targets (28.7%)
- On-demand car services (24.8%)
- Vehicles that adapt to driving style (19.5%)

This report is the first to investigate the views of young people studying Science, Technology, Engineering Arts & Design and Mathematics (STEAM) from 12 European Countries on the future of Mobility.

INTRODUCTION

POPULATION GROWTH, ECONOMIC DEVELOPMENT, CHANGES IN SOCIETY AND TECHNOLOGICAL ADVANCES IN RECENT DECADES HAVE INCREASED MOBILITY ACROSS THE GLOBE

An increasing number of people are making more journeys than ever before. This could be seen as a sign of increasing prosperity and social participation. Yet, at the same time, it can be linked with the parallel phenomenon of increasing population and urbanisation. Currently, 60% of all distances travelled are urban[1].

Alongside an overall increase in mobility, new patterns are emerging. Thanks to digital communication advancements, online meetings can replace travel to real meetings, and consumers can order goods online rather than making a journey to the shops[2]. Flexible working hours and self-employment have shifted emphasis away from the traditional commute, and 15% of households worldwide now accommodate single occupants[3]. This suggests that many journeys are completed by single travellers.

Economic anxieties and environmental concerns are also becoming key factors that influence patterns of mobility . Young people in particular are likely to choose travel options according to these criteria, favoring the most affordable, sustainable and/or reliable alternative. Future mobility options will also encompass the use of smart technologies and personalization. As such, vehicles optimized for efficiency will respond to individuals[4] needs.

This report is the first to investigate the views of young people studying Science, Technology, Engineering, Arts & Design and Mathematics (STEAM) from 12 European countries on the future of mobility. The development of mobility will have a significant impact on the lives of the millennials surveyed and indeed on society as a whole. Given the subject of their studies, they could eventually work in mobility-related industries and influence these developments directly. This makes their views on the future of transport especially interesting.

The main concerns of European millennials were sustainability and affordability of future transport. Although smart technology and personalization were secondary concerns, they were welcomed where they might bring sustainable or economic benefits and improvements in safety, without compromising on budget, independence or privacy.

As well as pan-European variation – with distinct trends emerging in some countries –residents of urban areas were also more likely to embrace alternatives to traditional driving behaviors than those in rural areas.

1 Van Audenhove, Korniichuk et al., 2014, cited by Rode, P., et al., 2014. Accessibility in Cities: Transport and Urban Form. London: NCE Cities.
2 Ballantyne, J., and Stuart, P., 2014. Four Notes on the Future of Mobility. APF Compass, July 2014, pp. 7-8.
3 Curry, A., and Hughes, C., 2012. The Future of Sustainable Transport in Europe. London: The Futures Company.
4 Ibid.

The survey suggests young people across Europe do not want to be seen as the generation that stood still. With greater awareness of the environmental impact of their choices, they are demanding early action to deliver products and services that will ensure a move towards safe and sustainable future mobility, with no compromise on affordability. In particular, they want greater adoption of incentives for the production and use of environmentally friendly cars and measures for increased fuel efficiency.

PART ONE:

SUSTAINABLE AND AFFORDABLE MOBILITY

A sustainable mobility system must meet the needs of future as well as present generations.

Leading voices say the sustainable mobility system should be safe for the environment, society, industry and the local ecosystem, and should be open to all[5]. This would bring numerous benefits, enabling an overall improvement to its users' quality of life. Widespread implementation of sustainable mobility would protect the environment and society. It would slow the pace of climate change and pollution through compliance with environmental targets[6], and by maximizing energy efficiency. Thus, both mobility and the wider ecosystem are safeguarded for the future.

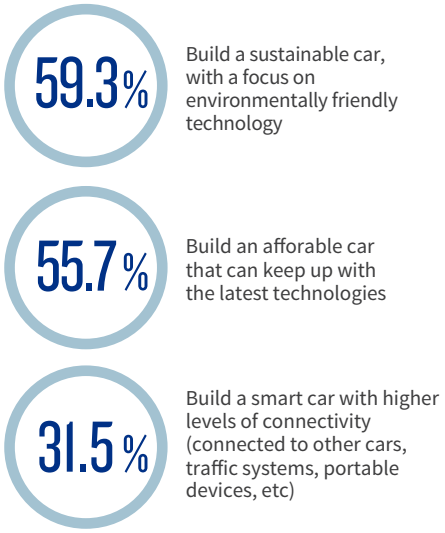
Literature states sustainable mobility also yields economic benefits as it incorporates the construction of a sustainable infrastructure and reduces the cost of accidents, environmental impact or congestion. Given the economic anxieties of both governments and individuals, these kinds of savings are likely to be a major incentive for the adoption of sustainable mobility systems. Indeed, in the survey, millennials identified sustainability followed by affordability as the top two future challenges for the automobile and transport industries.

5 Pitsiava-Latinopoulou, M., Basbas, S., and Christopoulou, P., 2006. Transport systems: trends and policies. In: C. A. Brebbia and V. Dolezel, eds., 2006. Urban Transport XII. Southampton: WIT Press.
6 Ibid.

VIEWS ON SUSTAINABLE MOBILITY

Sustainability is consistently given high importance throughout the survey. **59.3% of respondents identified the creation of a sustainable vehicle as a key challenge for the automobile industry in the next 10 years.** Young people in Slovenia (69.2%), Spain (68.7%) and Sweden (69.0%) were most adamant about the need to confront the challenge of a sustainable car. Meanwhile, the support for this option was stronger amongst respondents who do not already own a car than amongst those who do (chosen by 62.6% and 57.4% respectively).

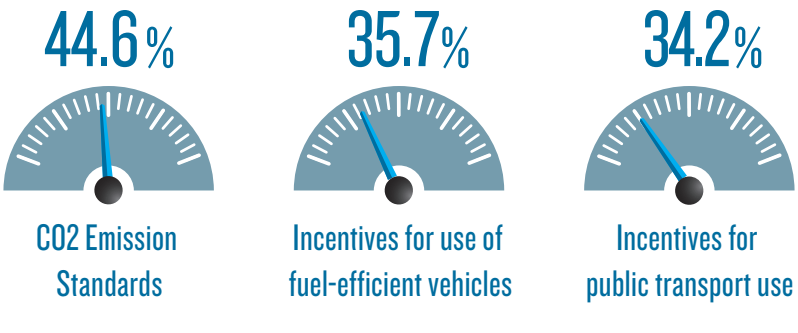
WHAT KEY CHALLENGES DO MILLENNIALS SEE FOR THE AUTOMOTIVE INDUSTRY?



CO_2 EMISSION STANDARDS

Millennials clearly value the importance given to regulation related to environmental impact: CO_2 emission standards (selected by 44.6% of participants), incentives for use of fuel-efficient vehicles (35.7%), incentives for public transport use (34.2%) and fuel standards (27.9%) were chosen as crucial regulations for transportation in 2025. This generation is clearly determined to safeguard the environment and wants to ensure that their chosen mode of transport, whether private or public, minimizes their carbon footprint and operates to maximum fuel efficiency. This is in line with the EU Climate and Energy policy package. It sets the target of a 20% reduction in EU greenhouse gas emissions from 1990 levels by 2020[7] .

CRUCIAL REGULATIONS FOR AUTOMOTIVE INDUSTRY



Some progress has been made already. EU carbon emissions have decreased since 2006, and the rate of increase is slowing in other parts of the world. In 2013, the EU was responsible for 11% of global CO_2 emissions[8]. Indeed, stringent regulation concerning CO_2 levels for cars and fuel-efficiency standards of tires are already in place[9] as well as incentives for the use of fuel-efficient tires.

PAN-EUROPEAN VARIATION

Reduction of CO_2 emissions was especially important for millennials in Luxembourg (59.1%), Slovenia (52.5%) and Spain (51.2%). Similarly, a vehicle that could adapt CO_2 emission levels to the driving environment was widely selected by participants as a desirable change for the future of mobility: it was the most popular option in Luxembourg (50.3%), France (37.1%) and Slovenia (40.3%).

7 European Commission, 2012. Citizen's Summary: EU Climate and Energy Package
8 Olivier, J., 2014. Trends in Global CO_2 Emissions: 2014 Report. The Hague: PBL
9 Regulation (EC) No 661/2009

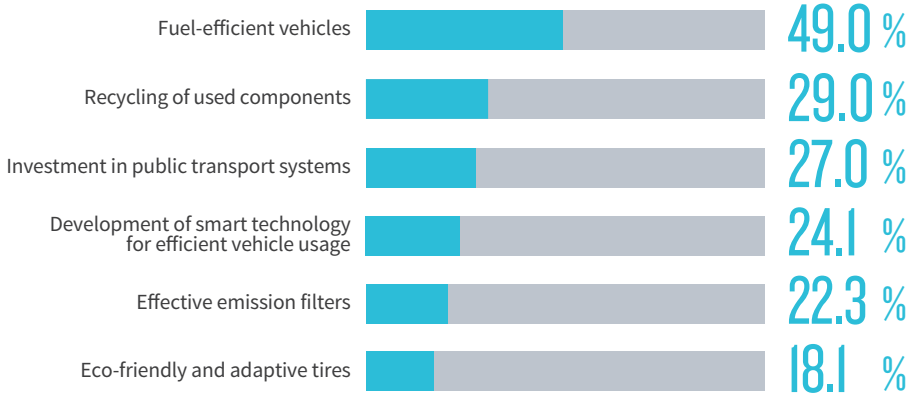
RURAL-URBAN VARIATION

Nonetheless, support for regulation of CO_2 emissions for vehicles decreased as the size of the respondent's place of origin increased: 48.2% of respondents from a village selected this option, decreasing to just 34.9% for those from cities with more than 2 million inhabitants. This was unexpected given the tendency towards higher levels of air pollution in urban areas. However, it might be a good indicator of the different challenges in mobility to be addressed in rural and urban areas. Whilst those in rural areas see private motor vehicles as a vital means of connection with other areas, those in cities have many more available transport alternatives, and other priorities. Also, restrictions on parking and vehicle ownership were selected by 3.9% and 6.2% of village-residents, compared to 9.6% and 9.0% in cities of over 2 million inhabitants.

FUEL EFFICIENCY

Alongside efforts to reduce CO_2 emissions, "incentives for the use of fuel-efficient vehicles" was chosen by 35.7% of participants as a key area for regulation in the future, and fuel efficiency was identified as a particular area of focus within the broader sustainability agenda, chosen by almost half (49%) of respondents. The development of "extremely fuel efficient tires" was also the second most popular option for possible tire developments, chosen by 32.9% of participants. This suggests that millennials are realistic about the need for fuel-powered transport systems to serve societal needs, but feel that they must be optimized to ensure fuel resources are used as efficiently as possible. In each case, fuel efficiency is advocated most strongly by respondents from Slovenia and Turkey.

SUSTAINABLE FOCUS FOR AUTOMOTIVE INDUSTRY



RECYCLING

Recycling of used components also ranks highly as a desirable focus for sustainable efforts in the automobile industry (chosen by 29% of respondents overall). This option proved popular in Slovenia (37.9%) and France (37.1%), although it received only 18.1% of responses in Poland.

PUBLIC TRANSPORT

The sustainability-focused initiatives discussed so far – reduction in emissions, increases in fuel efficiency and recycling of used components – can be applied equally to private and public means of transport. Nonetheless, the survey does show that almost a third of millennials appreciate

ELECTRIC VEHICLES :

Perhaps the most interesting uses of new technologies in mobility are those that aim to facilitate sustainability and safety, combining two millennial concerns for the future of mobility. One example of this, which is already available today, is the electric car. The electric vehicle eliminates the need for a fuel-burning engine, and could potentially be powered by renewable sources of electricity or by the vehicle itself. This renders its environmental impact much lower than that of a conventional motor vehicle, much as electrification of rail or metro systems have reduced the fossil-fuel dependence of traditional fuel-burning elements of public transport systems.

Nonetheless, uptake of the electric vehicle has so far been relatively low, arguably due to practical concerns such as a lack of charging stations to facilitate long-range travel, and possibly also due to a lack of public awareness of their advantages: consumers have concerns about the cost, range and style of electric vehicles in their current form[10]. However, uptake seems to be increasing: there was a 36.6% rise in the number of electric vehicles registered in the EU in 2014[11], and 44.1% of respondents in a separate survey said they would be likely to purchase an electric vehicle in the future[12]. Another recent study notes that the cost of lithium-ion batteries essential to electric vehicles has fallen steadily from 2007 to 2014, and this decline looks set to continue[13].

10 Ibid.
11 ACEA, 2015. New electric vehicle registrations in the European Union.
12 Curry and Hughes, 2012.
13 Nykvist, B., and Nilsson, M., 2015. Rapidly falling costs of battery packs for electric vehicles. Nature Climate Change 5, pp. 329-332.

the necessity of public transport as part of a system of sustainable mobility. 27% of participants felt that investment in public transport systems should be a focus for future sustainable efforts, and 34.2% would like to see incentives for public transport use as a feature of future mobility.

GENDER VARIATION

Support for public transport was slightly stronger among females than males in both instances. In the question relating to investment, 29.6% of females selected the public transport option against 25% of males; in the question relating to incentives, it was selected by 39% of females and just 30.5% of males.

PAN-EUROPEAN VARIATION

Geographically, public transport options were particularly favored by young people in Italy (investment: 41.8% and incentives: 43.6%) and Slovenia (investment: 40.6% and incentives: 53.4%).

Slovenian respondents seemed particularly inclined to select options related to sustainability across the board, so it is likely that their approval of public transport here can be explained by their view of public transport as a more environmentally friendly mode.

Nevertheless, widespread selection of public transport options might also be motivated by its relative affordability in comparison to owning and operating a private vehicle. Alternatively, this might be a signal that respondents of a certain country feel more effort needs to be diverted into improving public transport systems where they live. Similarly, lower percentage returns from other countries for public transport options might not necessarily mean that people are against public transport or its potential sustainable value; rather, they might feel that public transport provisions are already adequate and widely-used in their area and therefore not a priority for further investment or incentive schemes.

RURAL-URBAN VARIATION

This may explain why the prospect of incentivised public transport use was more likely to be chosen by those in towns (37.5%) and villages (38%) than those in larger cities (where the option received between 34.2% and 25.8% of responses). Whereas public transport schemes in cities are already established, efficient and widely-used, the pattern of population density in towns and villages is less well-suited to current public transport and as such its use often involves an inevitable sacrifice of independence or convenience for travellers. Thus, residents of towns and villages might feel that financial incentives for public transport use would be an appropriate compensation.

This reflects a need to create effective planning strategies to take account of the changing density of modern cities, not only in the EU but globally. Public transport works best in compact cities where everything can easily be accessed from a central network, whereas cars require space. In some more economically developed countries we are seeing a declining density, which in turn prompts a rejection of reliance on public transport in favor of increased use of cars[14]. In parallel, we have seen the creation of "megacities", defined by the United Nations (UN) as cities with a population of more than 10 million people[15]. These megacities, such as New York, Mumbai and Tokyo, are characterised by congestion, poor transport planning, high levels of pollution and overdependence on motor vehicles[16]. All of this is likely to have significant impacts on future mobility patterns of the young people surveyed.

CAR OWNERSHIP

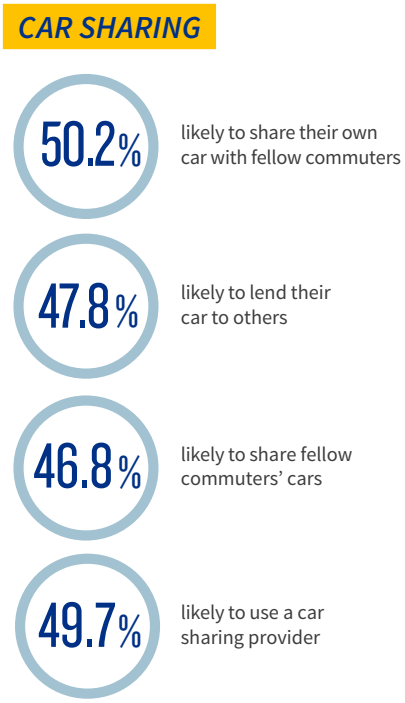
PAN-EUROPEAN VARIATION

Despite resounding support for the adoption of sustainable approaches, **millennials were firmer still in their belief that they are likely to be car owners in 10 years time, with 85% of respondents agreeing or strongly agreeing with this statement.** The overall agreement rate for all countries was above 70%, with most above 80%. Conviction was strongest in Luxembourg where 92.6% was in overall agreement, followed by Slovenia (91.5%), Italy (90%) and Poland (89.7%). At the other end of the scale, young people in the Netherlands were the least enthusiastic in their agreement (74.8%).

14 Rode et al., 2014.
15 Igwe, A., 2006. The transport challenge in the sustainability of megacities. In: C. A. Brebbia and V. Dolezel, eds., 2006. Urban Transport XII. Southampton: WIT Press.
16 Ibid.

CAR SHARING

Although it is clear that many young people envisage owning their own car in 10 years, there is evidence too of their tentative willingness to partake in car-sharing initiatives. Young people affirmed that in the future they would be more likely to share their own car with fellow commuters (50.2% agreement or strong agreement), lend their car to others (47.9%), share fellow commuters' cars (46.8%) and use a car sharing provider (49.7%).



PAN-EUROPEAN VARIATION

The results indicate different national attitudes towards car-sharing: whereby millennials in some countries would prefer formalised car-sharing schemes, whilst others would prefer informal lending, borrowing and sharing through peer-to-peer networks. For example, Polish respondents were most likely to share their car with other commuters (59.5%) and lend their cars to others (62.5%), whilst Italians were most likely to use a car-sharing provider (65.5%).

RURAL-URBAN VARIATION

At the same time, the size of the respondents' place of origin is a clear influence on their feelings on car ownership and car-sharing. Those who live in towns (86.1%) or villages (89.3%) are more likely to agree or strongly agree that they will own a car in the future than those in cities (82% for those in cities with more than 2 million inhabitants), and less likely to want to share their cars in any situation. Young people from villages registered agreement and strong agreement rates between 37.3% and 43.2% for the four car-sharing statements, compared with rates of between 53.1% and 59.7% for those from cities with more than 2 million inhabitants.

Again, the issue of population density is likely to be the most significant factor behind these decisions, with people in more remote, rural areas relying more on cars for personal transport, whilst those in compact, urban areas can depend more easily on public or shared transport.

DISAGREEMENT

However, the prospect of any form of car-sharing is much less popular in Luxembourg, where between 56.7% and 63.3% of respondents disagreed or strongly disagreed with the four relevant statements, and in Belgium, where disagreement was noticeable but less strong. Given their strong belief that they will own a car in the next 10 years, it appears that the young people in these two countries are more reluctant to adopt non-traditional behaviors around car ownership and car-sharing.

USING PRIVATE AND PUBLIC TRANSPORT

Increased mobility levels have largely been underpinned by a rise in use of private cars. Although there is evidence in a Ford Motor Company survey[17] to support a decline in private car use amongst young people and environmentally conscious citizens in some affluent European countries[18], the overall global trend is one of growth, with the world's total motor vehicle fleet expected to reach 1.7 billion by 2035[19]. This is supported by the findings of this survey, where 85% of respondents expected to own a car in the next 10 years.

Along with the new car-sharing initiatives growing in popularity, public transport systems are currently the principal alternative to private cars, along with walking and cycling (including bicycle-sharing schemes, which have been successfully adopted in many cities around the world including Paris and London). Corresponding to an increase in private vehicle use, we have also witnessed a decline in use of public transport.

For now, a key debate within the field of sustainable mobility is how efforts should be concentrated on balancing a sustainable transformation of the automobile industry and private motor vehicles with an optimisation and enlargement of public or shared transport systems.

17 Ford 2015
18 Curry and Hughes, 2012.
19 International Energy Agency, 2011, cited by Rode et al., 2014.
20 Regulation (EC) No 661/2009

Together, these steps should enable us to achieve a reduction in CO_2 emissions. In order to address this, the automobile industry is already working to maximize fuel efficiency and to introduce new, more environmentally-friendly technology. In this regard, the EU implemented regulation[20] in order to establish more stringent limits for wet grip and rolling resistance (linked to fuel efficiency) for tires as well as CO_2 standards for cars and vans.

In close collaboration with the tire industry, the European Union also introduced tire labelling[21] in 2012 as a key aspect of reaching the goals set for sustainable mobility. It requires tire manufacturers to indicate the rolling resistance (linked to fuel efficiency) and wet braking class (linked to safety) on a scale from G (least efficient) to A (most efficient), as well as a measure of the external rolling noise value of their tires. It provides important information about the safety and environmental aspects of a tire and enables consumers to make clear comparisons between products and choose the tire that's right for them. The aim is to improve road safety and also the economic and environmental efficiency of road transport by promoting more fuel-efficient and safer tires with low noise levels.

At the same time, when operating to maximum capacity and efficiency, public transport could bring significant cost reductions when compared with current reliance on private motor vehicles, which is likely to be an important factor for millennials, given their support for affordability in the survey. Investment in bus or rail systems, walking or cycling schemes can in some cases be more efficient than investment in road travel alone[22]. Perhaps it is for this combination of environmental and economic advantages that public transport has enjoyed a small but significant "renaissance" in cities such as London, Berlin and New York[23]. Of course, it is also true that public transport simply might not suit some locations due to low population density and high sprawl, or some people, who might require a greater level of independence of travel than allowed by fixed routes and timings of public transport. In these situations, reform of the conventional private motor vehicle and its use may be most appropriate, or there may be other sustainable solutions.

MULTI-MODAL TRANSPORT:

In order to best satisfy the demands of smart and sustainable mobility, and to avoid potential conflicts between them, some theorists have advocated a focus on multimodality, where a range of modes of transport – potentially including autonomous and electric cars, but also car-sharing options, cycle-hire schemes and more usual public transport provisions such as rail, metro/subway and bus lines –are integrated for maximum efficiency and sustainability by computerized means, for example through a smartphone application[24]. This would provide a simple and accessible way for transport-users to combine multiple transport methods to achieve maximum sustainability, speed and ease. Such an application will also be able to incorporate responsivity to current conditions, and divert people away from busy areas, further building on a current trend within the automotive industry whereby in-car smart features offer guidance on multi-modal routes alongside standard GPS functionalities. Curry and Hughes note that 49% of respondents of their survey would be happy to use multi-modal transport options in the future[25].

VIEWS ON AFFORDABILITY

Behind sustainability, affordability of transport emerged as the secondary concern of the young Europeans surveyed. The creation of "an affordable car able to keep up with the latest technologies" was second most widely-chosen as a key challenge for the automobile industry in the next decade, identified by 55.7% of participants. It was especially significant for young people in Slovenia (72.8%) and Spain (69.7%). It was slightly more important for those who currently own (56.5%) or share (57.5%) a car than those who do not (54.3% and 54.0% respectively).

FISCAL INCENTIVES

Fiscal incentives were a popular method of promoting sustainability amongst millennials who are concerned both for the environment and their own economic situation. Incentives for use of fuel-efficient vehicles (35.7%) and incentives for use of public transport (34.2%) were the second and third most highly ranked elements for regulation over the next 10 years, and both options were especially popular in Slovenia (55.6% and 53.4%). Meanwhile, implementation of congestion charges, toll roads or road taxes was comparatively unpopular, chosen by only 14.2% of participants overall. Millennials want to be financially rewarded for their sustainable choices rather than penalised for less sustainable ones, and support is highest for measures that enable both financial and sustainable benefits.

21 Regulation (EC) No 1222/2009 of the European Parliament and of the Council of 25 November 2009 on the labeling of tires with respect to fuel efficiency and other essential parameters
22 Rode et al., 2014.
23 Rode et al., 2014.
24 Stevens, 2011.
25 Curry and Hughes, 2012.

PART TWO:

SMART AND PERSONALIZED MOBILITY

Along with sustainable mobility, we can expect smart mobility – or the use of technology to optimize the way we get from one place to another – to become another key influence on the development of transport systems and on individual choice of transport.

In their study, Curry and Hughes predict that, while the decline of the car as a status symbol among young people may have been overstated, technology will become the new indicator of status in transport, and will be particularly important for young, urban males[26]. At the same time, technology will allow vehicles to be tailored to the needs and personal preferences of drivers and passengers, resulting in much more personalized experience of mobility.

The nature of technological advances means that it is comparatively difficult to make confident and exact forecasts about future trends in smart mobility; however, we can speculate based on current attitudes and available technology. In some cases, we will see familiar technology used in innovative ways; in other cases, new, disruptive technologies will bring fundamental changes.

26 Curry and Hughes, 2012

VIEWS ON SMART TECHNOLOGY

The development of smart technology through the harnessing of IT products including sensors, monitoring systems, automated controls, modelling and other decision support applications, has become increasingly prevalent within the automotive industry. These developments have ranged from increased levels of connectivity in cars and more sophisticated safety features to the move towards a fully autonomous and self-driving vehicle.

In terms of youth priorities for smart technology, **building "an affordable car which can keep up with the latest technologies" was selected by 55.7% of young people.** However, smart technology alone was a lower priority for young Europeans than sustainability or affordability. Building "a smart car with higher levels of connectivity" was the lowest-ranking challenge for the automobile industry in 2025, attracting 31.5% of responses, along with building a personalized car, chosen by 31.7% of respondents. The prospect of a smart car was least widely-chosen in France (20.3%) and Sweden (21.5%), but more popular in Luxembourg (38.6%) and Turkey (39%). Technology is important to millennials in Europe, but it must be balanced against affordability. Equally, relatively low scores for options relating to smart technology need not signal young people's rejection of a new wave of smart technology in mobility. We might speculate that, rather, they do not see it as a "challenge", given that significant technological advances are already evident in mobility. Likewise, nor do they see it as a feature that requires regulation, with just 20.8% selecting "minimum requirements of smart technology for efficient vehicle usage" for this question.

SMART TECHNOLOGY AND VEHICLE EFFICIENCY

Use of smart technology was not widely seen as a crucial focus for future sustainability efforts, with the option of "smart traffic management by vehicles" being selected by the lowest percentage of participants overall (17.1%), and receiving just 4% in Spain. However, when it was linked to efficient vehicle usage, respondents were slightly more receptive to the prospect of smart technology: as a focus for future sustainability efforts, "development of smart technology for efficient vehicle usage" scored more highly, as the fourth most highly ranked option with 24.1% overall and stronger support in Belgium (32%) and Poland (30.6%).

GENDER VARIATION

It is interesting to note that each of these three smart technology options was favored more highly by males than females, producing differences of 5.6% for smart traffic management, 8.3% for smart technology related to vehicle efficiency and 4.6% for minimum requirements of smart technology. In all cases, though, the options relating to smart technology were less widely-selected than options more obviously relating to sustainability.

SMART TECHNOLOGY AND SAFETY FEATURES

With regard to potential benefits of smart technology, young people were most eager to see "smart safety features" (selected by 47.4% of participants overall) and "communication with other cars to anticipate and adapt to sudden changes" (selected by 39%). The smart safety features option was most popular in Slovenia (62%) and the UK (57.9%), and more widely selected among females (50.3%) than males (45.1%). Car-to-car communication appealed most to respondents in Belgium (52.3%) and Poland (48.7%), and was more popular among males (41.9%) than females (35.4%). **Safety is clearly a central criterion used by millennials to assess future trends in mobility.**

FUTURE CHANGES IN MOBILITY

Young people are eager to see smart safety features

Young people are eager to see communication with other cars to anticipate and adapt to sudden changes

SMART SAFETY FEATURE OF TIRES

Equally, the data shows that millennials would welcome smart technology designed to further improve tire performance and minimize the need for tire maintenance. This again is likely to be underpinned by a desire for improvements in road safety. When asked to identify ideal features of car tires for the future, 41.2% of respondents selected "tires that have a sensor informing me when to change my tires, warn me when there is an issue with one of the tires." This prospect was particularly attractive to participants in Germany (51%), Slovenia (49.1%) and the UK (49.8%). Sensor technology on tires that would allow them to adapt to different environments also attracted responses from 30.9% of participants, most significantly from Slovenia (39.7%).

TIRES

41.2%

of Millennials want tires that have a sensor informing them when to change tiers, warn them when there is an issue with one of the tires

PRIVACY CONCERNS

The survey did highlight privacy concerns arising from increased vehicle connectivity and integration with devices. The option of "cars with full integration with mobile devices for monitoring purposes" was by far the least-popular potential development in mobility of the future, selected by just 11.9% of participants. The young people from Spain (7%), Sweden (7%) and Slovenia (7.2%) were the least supportive of this idea. It is probable that this averseness to integration is underpinned by an international sense of unease surrounding reports of privacy invasion. Indeed, the recent reports of hacking of smart vehicles[27] give weight to these concerns.

Similarly, security and privacy concerns were identified as a possible obstacle to the development of autonomous cars in the next 10 years by 38.4% of respondents, and especially by those from Luxembourg (50.5%) and Slovenia (48%).

This resistance to any compromise on privacy could be linked to a more general unwillingness to relinquish any sense of personal independence, as evidenced where respondents were against future regulation of speed limits (chosen by 14.8% overall), vehicle ownership (8.5%) or parking (6.1%).

SMART TECHNOLOGY TODAY

Several smart features for motor vehicles are already available such as Tire Pressure Monitoring Systems (TPMS), parking assist technology, electric power-assisted steering, blind spot detection, automatic braking and adaptive headlights. Furthermore, several car companies offer vehicles with features of semi-autonomy, including adaptive cruise control[28], semi-automated "Intelligent Drive" system[29] and autopilot features[28].

Smart safety features were chosen by 47.4% of survey respondents as desired changes in mobility for the next 10 years.

With regards to safety in tires, measures currently in use include Run Flat tires, designed to function at very low inflation so that drivers may safely travel to get help if they suffer a puncture[30]. At Goodyear, new technology is also under development, with Air Maintenance Technology being advanced to ensure a correct tire pressure. In addition, smart technology can also be employed through a chip for smart communication between tires and cars to ensure maximum safety and stability[31] and for the identification of tires using RFID (radio-frequency identification) technology[32].

Meanwhile, an increasing number of cars are equipped with telematics and other smart features, particularly commercial vehicles. These applications assist drivers enabling preventive driving and optimizing routing schemes. GPS systems improve fuel- and time-efficiency by enabling the selection of the fastest route depending on up-to-date traffic information.

27 Reuters, 2015.
28 Volvo, 2015.
29 Mercedes-Benz, 2015. Intelligent Drive next Level as part of Driver Assistance Package
30 Tesla, 2015. Model S; Volvo 2015.
31 Goodyear, 2012. Innovation Through Technologies.
32 Goodyear, 2012.

This will continue over the next decade with the development of Smart Vehicles. Smart Vehicles might also incorporate a high element of connectivity (the car's connection to the internet and thus to a network of other cars and service providers)[33]. Car-to-car communication achieved by connectivity – available through several applications such as Waze[34] – allows sharing of traffic, parking and road conditions, which helps road users to avoid congestion and hazards whilst driving in a fuel-efficient manner. This was another popular prospect for the future of mobility, chosen by 39% of young people. Meanwhile, integration of other technological devices and social media allows the car to satisfy the 21st century demand for constant communication. Just as mobility and urban planning are intertwined in the implementation of sustainable actions, these potential applications of connectivity will contribute to the broader development of "smart cities"[35].

Connectivity additionally has the potential to revolutionise the interaction between the consumer and the car industry, causing a "shift from product to service relationships"[36]. In the future, it might allow data collection to benefit the manufacturer and numerous other service providers, including insurance companies, civic authorities, fleet operators, dealer networks, fuel retail and leasing companies[37]. This data might facilitate more targeted and personalized service levels to end-consumers.

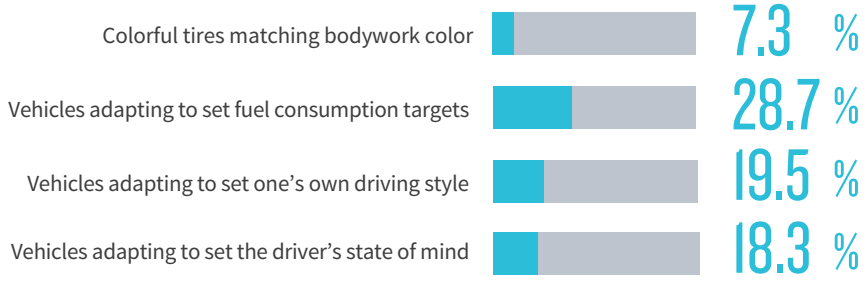
VIEWS ON PERSONALIZATION

Young people demonstrated that personalization will be a desired feature in the next decade, but is not seen as a particular challenge. A substantial majority of 81.6% were in agreement (49.5% agreeing and 32.1% strongly agreeing) that they would like a car that could be specifically personalized to their technological, sustainability and usage preferences, yet a more moderate percentage (31.7%) selected the creation of a "personalized car, specific to each individual consumer's needs" as a key challenge for the automobile industry in the next 10 years

FUNCTIONAL PERSONALIZATION

It appears that millennials are most supportive of personalization when it is connected to key concerns such as sustainability and safety, but dismissive of personalization for purely aesthetic purposes. Very few participants (7.3%) selected the option of colorful tires matching bodywork color as a desirable feature. However, the prospect of vehicles adapting to set fuel consumption targets (28.7%), to one's own driving style (19.5%) or to the driver's state of mind (18.3%) were more popular.

SUSTAINABLE PERSONALIZATION FOCUS FOR AUTOMOTIVE INDUSTRY



33 ATOS, 2012. Envisioning automotive futures: connected cars for smart mobility.
34 Waze, 2015. About Us.
35 Curry and Hughes, 2012.
36 ATOS, 2012.
37 Ibid.

PART THREE:

AUTONOMOUS VEHICLES SMART, SUSTAINABLE AND SAFE

Beyond the electric vehicle is the possibility of the autonomous – or driverless – car, currently being tested by key players in both Silicon Valley and the automotive industry.

Google's version is already averaging around 16,000 kilometres per week on public roads[38]. **Following today's literature on the future of mobility, autonomous vehicles could offer the connectivity, safety features and sustainability credentials of existing electric or smart vehicles, with further improvements.**

Notably, autonomous vehicles will blur the lines between private and public transport[39]: there will no longer be a strong need for people to own private vehicles if they could easily summon an autonomous one.

This may amplify the trend for "dis-ownership"[40]. Already, we are seeing the advent of car-sharing providers such as BlaBlaCar through which drivers can be matched up with passengers wanting to make the same journey. For the future, we might envisage a system of shared autonomous vehicles[41], either through schemes managed by central agencies where several people are matched up to complete the same journey in the same vehicle, or simple peer-to-peer sharing networks, where a group of people might share ownership of one autonomous vehicle.

38 Google, 2015. Google Self-Driving Car Project: Monthly Report June 2015.
39 Hars, A., 2010. Autonomous cars: The next revolution looms. Thinking outside the box: Inventivio Innovation Briefs, 2010(01).
40 Curry and Hughes, 2012.
41 Hars, 2010.

VIEWS ON AUTONOMOUS CARS

When it comes to how confident millennials are in autonomous vehicles, we see that 31.7% of respondents went for the middle ranking for confidence, but above this another 33.1% went for the second highest and highest levels, suggesting extremely confident.

When participants where asked to specify their preferred level of autonomy most selected a basic or medium level (40.6% and 37.1% repectively).

When asked if they would prefer to own an autonomous car in the future, respondents' rates of overall agreement (45.6%) and overall disagreement (47.8%) were almost equal, though disagreement was narrowly the most widely-selected option.

AUTONOMOUS CARS

33.1%

Of Millennials are confident to extremely confident in self-driving cars

PAN-EUROPEAN VARIATION

Some countries registered stronger disagreement. Conceivably, negativity surrounding autonomous cars in Poland (where 56.5% of respondents selected either "disagree" or "strongly disagree") and Slovenia (68.3% "disagree" or "strongly disagree") could be linked to affordability concerns. In these two countries, affordability was chosen as a significant challenge to the development of autonomous cars in the next 10 years (by 52.4% in Poland and 61.9% in Slovenia). For Luxembourg (72.3% "disagree" or "strongly disagree") a strong resistance to autonomous cars was present.

Contrastingly, high percentages of overall agreement were present in Turkey (61.5%) and Spain (61.2%).

In fact, Turkey is the striking exception to all of these trends: respondents there favored a high level of autonomy (45.0%) and were the most confident about the prospect of a self-driving car, with 48.5% opting for "extremely confident".

GENDER VARIATION

Males, conforming to the general trend, were almost equally likely to agree or disagree that they would like an autonomous car, whereas females were more likely to disagree (42.9% responded "agree" or "strongly agree", whilst 48.6% responded "disagree" or "strongly disagree").

BENEFITS AND CHALLENGES OF AUTONOMOUS CARS

The most widely-chosen future benefits of autonomous cars were reduced traffic accidents (60.8%) – again confirming that safety is an important consideration for millennials – and reduced driver stress (42.0%), closely followed by reduced traffic jams (39.6%). Tellingly, increased mobility for non-drivers was rated more highly by those who did not own a car (40.8%) than by those who did (34.5%).

On the other hand, millennials' main reservations in respect to autonomous cars are, unsurprisingly, reliability (selected by 55.5% of participants) and affordability (45.7%), followed by security and privacy concerns (38.4%). Moreover, when respondents were asked to identify the main benefits of autonomous cars, the lowest scores related to areas of key concern for young people as identified elsewhere in the survey: fuel efficiency ("increased fuel efficiency" scored 35.1%), financial cost ("reduced mobility costs through car sharing" scored 22.6%) and public transport ("tackling the lack of infrastructure for adequate public transport systems" scored 18.2%).

AFFORDABILITY OF AUTONOMOUS CARS

Data from the survey shows that cost and affordability are important considerations for millennials when they evaluate potential future developments in mobility. Affordability was ranked as the second most significant obstacle to the adoption of autonomous cars in the next 10 years, chosen by 45.7% of participants overall, proving especially salient for young people in Slovenia (61.9%) and again slightly more so for those who currently own a car (46.4%) than those who do not (44.4%).

A reasonable proportion of millennials evidently perceive the autonomous car as an unaffordable phenomenon, something that is further evidenced by the low rating of "reduced mobility costs through car sharing" as a potential benefit of autonomous cars: the least popular option in the Netherlands (16.5%), Poland (21.6%), Turkey (19%) and the UK (18.7%), and the second least popular overall (22.6%). It seems that many young people simply do not believe that autonomous cars will bring a reduction in mobility cost; in fact, they expect the opposite.

However, it is reasonable to expect that, in line with other new technologies, the price of autonomous vehicles will decrease as they become more widely-used.

USING AUTONOMOUS CARS

Crucially, safety is expected to improve through the use of autonomous cars, as computerized control removes risks caused by human error. Safety benefits were very important for young people in the survey: 60.8% selected reduced traffic accidents as the most important advantage of autonomous cars. Developers of disruptive autonomous technologies as well as the automotive industry in general are working to ensure that the road safety benefits are maximized whilst any potential risk – for example of system failure, or hacking – is minimized.

Literature says shared autonomous cars will also theoretically bring economic advantages for consumers: with increased utilization, renting would be expected to fall below the cost of owning[42], and parking and roadway costs would be reduced[43]. Feasibly, autonomous vehicles would improve the efficiency of the transport system, both in terms of the vehicle's fitness-for-purpose (travellers would be able to select one suitable for specific circumstances) and in terms of road usage (cars could be programmed to stop and start simultaneously, eliminating time lost to gradual starting of queuing vehicles, and it would theoretically be possible to ensure that vehicles would only travel when full to capacity)[44]. More efficient road use would lead to less congestion and, in turn, rises in economic productivity and reductions in emissions.

Besides this, agency management of a fleet of autonomous cars could make use of electrical vehicles or alternative fuel sources more easily than current users have so far been able to, by situating fuelling and charging points across their operation zones. Agency-controlled autonomous vehicles could also address social issues – delivering meals-on-wheels, or acting as emergency service vehicles, as well as revolutionizing mobility for non-drivers, elderly and disabled drivers[45].

Critics both for and against autonomous cars agree that the above benefits would be attained only through use of vehicles with the highest possible level of autonomy[46]. However, only 22.4% of young people in the survey prefer to have a fully autonomous car in the next 10 years.

A particular challenge in the development of autonomous cars and their reliability is to ensure that the vehicles behave in an ethical manner. A key question is whether it is ethical for vehicles to influence who or what might be harmed in a collision, in acting to avoid or mitigate potential damage. Autonomous vehicles' reactions to potential collisions, which must be programmed in advance, might be informed either by a set of instructions or by artificial intelligence[47]. This is just some food for thought before autonomous vehicles can be widely introduced.

42 Ibid.
43 Litman, T., 2015. Autonomous Vehicle Implementation Predictions: Implications for Transport Planning. Victoria: Victoria Transport Policy Institute.
44 Ibid.
45 Ibid.
46 Ibid.
47 Goodall, N. J., 2014. Ethical decision making during automated vehicle crashes.

CONCLUSION

Through this survey, millennials across Europe have shown their strong support for the development of affordable, safe, reliable and sustainable vehicles in the next decade, reflecting the environmental concerns and economic anxieties of millennials today. They envision a future where ownership of such a vehicle will allow them to enjoy free and independent mobility without compromising their commitment to safeguarding the environment. Improvements in fuel efficiency and CO_2 emissions were key priorities, which could of course be applied not only to private vehicles, but also to commercial and public vehicles. Regulation and incentive schemes were considered important to achieving these goals.

Personalization and the integration of smart technology were very welcome where they could enable sustainable outcomes and safety benefits. As well as the development of electric vehicles, more fuel-efficient engines and other alternatives to the conventional car, this integration of smart technology to aid sustainability might also encompass initiatives such as smart phone applications to enable multimodal mobility or car-sharing. At the same time, smart technology and the development of automated features were seen as a useful tool for the improvement of road safety in general, though young people were more cautious regarding the prospect of full automation.

The impetus for the automotive industry and for the tire industry is twofold.

1. It is strikingly clear that sustainability must continue to be a central focus. This asks for a multi-stakeholder approach where the automotive industry and technology developers work together with governments and individuals to minimize the environmental footprint of transportation.

2. The data shows that millennials in Europe today are partly reluctant to embrace the full range of smart technology available in the field of mobility, beyond the key areas of sustainability and safety. By taking away the concerns often related to smart and connected cars and focussing on the benefits of smart technology millennials would be able to make more informed choices around smart technology – and thus obtain the full benefits of sustainable, safe and smart mobility – in the future.

METHODOLOGY

Millennials views on the future of mobility were collected through an online survey that was disseminated between May and June 2015 in 12 European countries; Belgium, France, Germany, Italy, Luxembourg, the Netherlands, Poland, Slovenia, Spain, Sweden, Turkey and the United Kingdom.

The target population comprised students aged 18-30 in Science, Technology, Engineering, Arts and Mathematics (STEAM) both at undergraduate and graduate level. The population reached amounted to 2564 individuals with at least 200 respondents from each country.

The questionnaire included mainly multiple choice questions, of which most were presented in mutually non-exclusive terms: meaning that respondents were asked to list their top 2 or 3 preferences. In line with previous research, this translates in percentages that do not add up to 100.

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ABOUT GOODYEAR

Goodyear is one of the world's largest tire companies. It employs approximately 67,000 people and manufactures its products in 50 facilities in 22 countries around the world. Its two Innovation Centers in Akron, Ohio and Colmar-Berg, Luxembourg strive to develop state-of-the-art products and services that set the technology and performance standard for the industry.

For more information please visit: http://www.goodyear.eu/corporate_emea/

ABOUT THINKYOUNG

ThinkYoung is the first think tank that focuses on young people. It was founded in 2007 and has expanded to have offices in Brussels, Geneva and Hong Kong. It is a not for profit organisation, with the aim of making the world a better place for young people, by involving them in decision making processes and by providing decision makers with high quality researches on youth's conditions. ThinkYoung makes studies, surveys, documentary movies, policy proposals and education programs: up to today, ThinkYoung projects have reached over 600'000 young people.

For more information please visit: http://www.thinkyoung.eu/