

TREND COMPASS 2020

we quantify the future



WELCOME TO THE STATISTA TRENDCOMPASS 2020.

We live in interesting, shape-shifting times. Our world is turning faster than ever, and the pace of change is accelerating on a global scale with more complexity and more interconnections than ever before. And one thing is for sure: it will only go faster in the future.

Recent economic, technological, and political shifts have seen old assumptions and business models being cast aside to make way for a reshaping of consumer needs around the world. Think of streaming instead of linear television for example, or new mobility concepts, like ride-hailing and micromobility. All over the world, new technological advances are adopted every day across all spectrums of business, and the speed of it all can be quite shocking. The way we adopt and adapt to new technology far outpaces our adaptability 50, even 10 years ago. Automation, artificial intelligence, and machine learning are progressing so fast that many established industries and businesses get heavily disrupted.

In a world where change creates major challenges, it also creates opportunities. Companies simply cannot maintain the status quo if they don't want to be outrun by those who adapt to change. If companies continue to do things the way they used to, somebody else in the market will quickly find a way to do it better.

Today it is more important than ever to explore and understand what is relevant to us and our business. In a rapidly changing global environment, with rising competition and new business ideas popping up everywhere, working with trends is critical for companies seeking to drive sustainable growth and remain relevant. The only way to keep

up is by fundamentally shifting our view on change and understanding trends in order to capitalize on them. Because, although trends sometimes seem distant and unrelated to our everyday lives, they might catch up with us quite quickly. So anticipating change and trends is key.

Today, it is ultimately important to have a clear understanding of the shifts that shape our societies, our businesses, and our culture. The key is to pay attention to what's going on in the market. Statista's goal is to provide all the facts you need to understand these markets. Usually, our time horizon spans only three years into the past and three years into the future. However, markets are shaped by long-term trends.

That's why our first Statista TrendCompass 2020 is here. At Statista, we are always keen to derive insight from data, and so it came natural to us to have a deeper look at trends and the dynamic forces behind them. Our aim is to provide you with insightful and data-driven facts on the most relevant trends in order to enable a better and more qualified and quantified decision-making regarding your future business direction.

In our first TrendCompass, which is actually the first half of a comprehensive overview (with the second half coming soon), we are looking at how technological and economic are driving change, featuring 12 key trends that will shake up how consumers and businesses will navigate the future.

All of our 12 trends are illustrated with inspiring innovation snapshots from diverse industries and markets as well as the most relevant and

recent data facts to put them into context. And although it is said that it is difficult to quantify trends, we did it anyway. By evaluating the projected impact on GDP, we help you understand the impact of a trend in the future and better prepare for it.

On the following pages, we are going to take you through some of the major macro- and microtrends that are affecting consumer markets around the world. We have put data into context to inspire your business decisions across industries, categories, demographics, and amidst global themes.

Trends are fun. They keep our businesses interesting and open up new opportunities. So, enjoy reading!



A stylized, handwritten signature in black ink, appearing to read 'Michael Adam'.

Yours, Michael Adam
Chief Content Officer

Statista – we quantify the future

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INTRODUCTION

TRENDS

- ... describe profound changes in society
- ... emerge from niches into the world
- ... have an impact on society and economy
- ... influence how people act, talk and feel, or shop
- ... constantly create and shape new needs and desires
- ... are NOT just fads and fashion

1 // Definition of a trend

Starting very simple: A trend is defined as a movement in a distinct direction. Observing these complex movements is the main task of all trend researchers, who aim at detecting early signs of new evolving behavior patterns, i.e. trends. So a trend is an assumed development in the future that will change something. Trends are not just fads and fashion! Fads and fashion are only the surface of trend waves and mirror short-time manifestations of fundamental consumer trends.

Trends are mostly unconscious strategies of consumers to handle a continuously changing social context, articulating significant value shifts in society. They act as indicators of consumers' changing desires, dreams, aspirations, hopes, and fears. Trends do not work separately, but interact with each other, sometimes even activate one another or mark opposing poles. This is because trends are born out of an essential tension – a shift, a disagreement, or a collision. Digital versus emotional, speed versus mindfulness, human versus machine.

Trends are the source of innovation. They present both challenges and opportunities as they transform the way society and markets function.

TRENDS ARE CHALLENGES THAT CREATE FUTURE.

2 // Drivers of change

Drivers of change are the all-encompassing superforces that move and shape our world. There are four of these superforces that shape trends: technology and economy, and social and cultural shifts. These four drivers help us to filter and understand where trends emerge and what drives them. Is technology for example enabling new consumer behavior? Or is it the social change that makes some mindsets thrive while others fade? Asking these questions and sorting global change into these four dimensions helps us detect where trends originate.

Technological Change

Technology plays a vital role in consumer decision-making and the ability of a business to thrive in the future.

Key question:

What opportunities do new technologies open up?

technology convergence // rapid uptake of new technologies // digital revolution // internet connectivity // digital lifestyles // network society // smart living // virtual and augmented realities // Internet of Things // automation // artificial intelligence // environmental technologies // biotechnology and nanotechnology // genetic engineering ...

Economical Change

Global economic growth has seen a huge upheaval with advanced economies facing pushback.

Key question:

How do trade and business ecosystems evolve?

world citizens // shifts in global economic power // economic upheaval // rising importance of emerging and frontier markets // advanced economy stagnation // saturated markets // business disruption // global inequality // polarization of rich and poor // rising consumption // creative class // growing mobility and logistics needs // rising energy needs // financial crisis // real estate crisis ...

Social Change

Ongoing population shifts are reshaping consumer lifestyles and purchasing decisions.

Key question:

How does the way people live together in a society change?

growing global population // overpopulation and regional depopulation // longevity / new age structures // declining birth rates // DINKs // changing family structures // collapse of social structures // single lifestyle // style pluralism // fluid gender roles // isolation and anonymity // education as a civic duty // selfcare need // youth as a value ...

Cultural Change

Consumers all over the world are taking action, changing the world with new values.

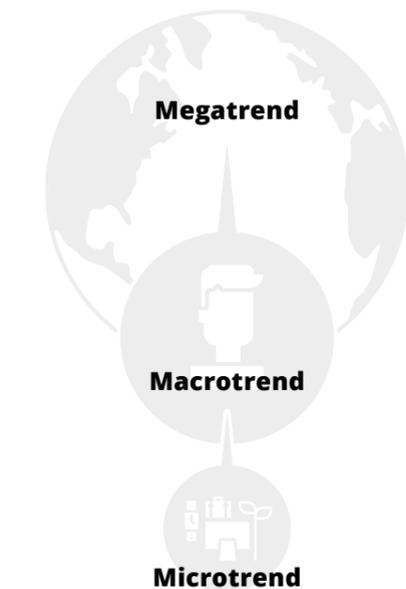
Key question:

How do our values adapt to the changing conditions?

cultural diversity // hybrid ethnics // lack of trust / confidence // emerging security need // climate change // pollution // resource scarcity // critical consumption // conscious consumerism and non-consumption // search for deeper meaning // ecological awareness // longing for anchoring ...

3 // Anatomy of a trend

Unfortunately, trends are a complex and multifaceted species. In order to understand which dynamics and forces create global change, we need to look at the different kinds of trends that interact in a rather hierarchical system.



MEGATRENDS

Let's start with the megatrends – our “biggest” trends, so to say. Megatrends are long-term and wide-ranging transformation processes that shape society and future markets. Imagine megatrends like connectivity, urbanization, and globalization, for example, as huge, unstoppable forces that change our everyday life. There is no need to predict them, megatrends are already here, affecting our daily lives.

Megatrends are huge paradigm shifts within society. They are big, slow-moving currents that remain broadly stable year over year and can be applied across all demographics, regions, and industries. They are well observable over decades and can be projected at least 25 years into the future. Megatrends are the all-encompassing forces – the blockbusters of change. They affect all other trends, hovering above them, and changing the world.

// The all-encompassing 12 megatrends:

Connectivity: Digital and real are no longer separate entities but have become a collective environment. We are always on and permanently connected to everyone and everything.

Volatile Economy: Throughout the world, businesses are increasingly being confronted with dynamically changing commercial environments.

Globalization: The internet has accelerated globalization all over the planet. New decentral partnerships open up and shake up global politics and economy.

Urbanization: The majority of the world's population is living in cities – an amount that is only going to increase in the future.

Mobility: Our 21st century is not only marked by an increased need for mobility but also by its huge variety.

Singleization: The number of single households is growing constantly. Single cultures and individual lifestyles are increasingly being recognized.

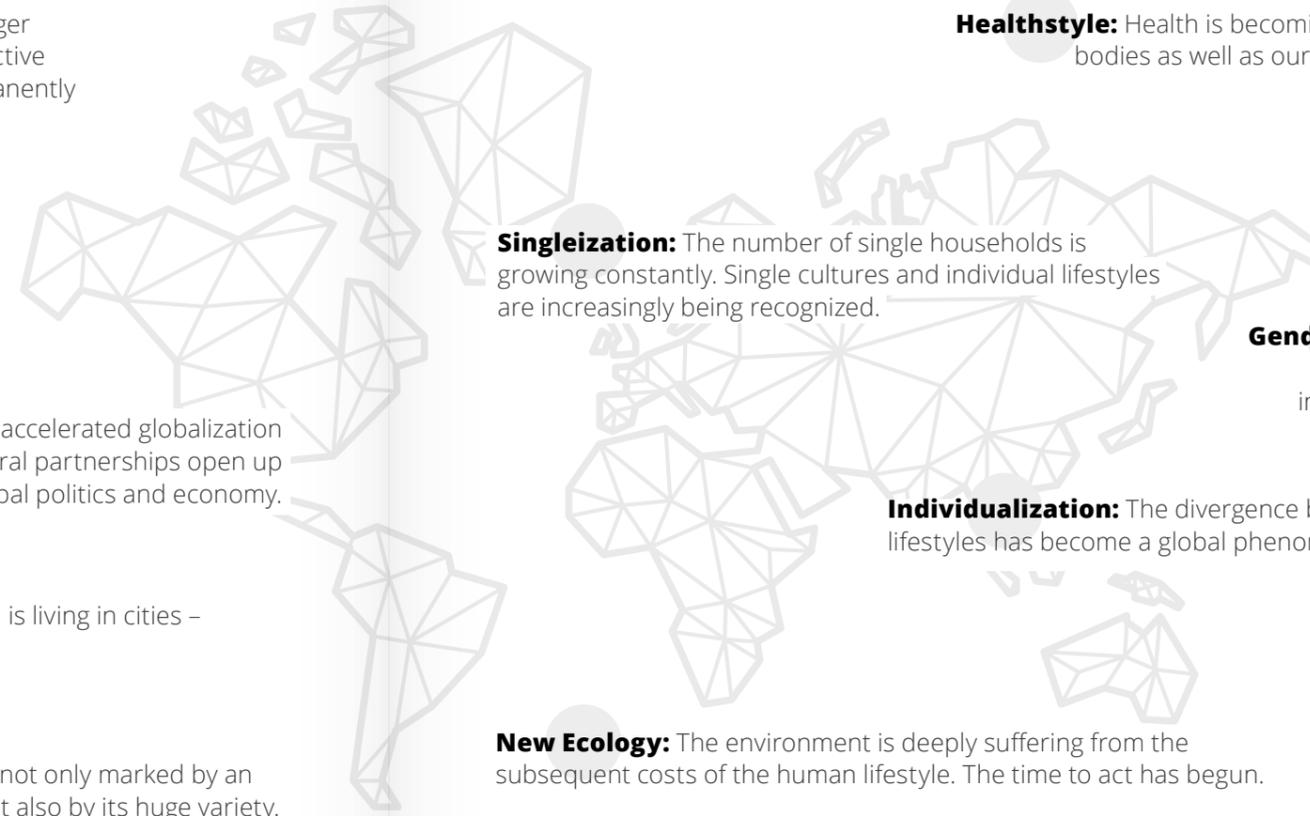
Healthstyle: Health is becoming a lifestyle. Taking care of our bodies as well as our minds has become a necessity.

Gender Shift: Time is up. Gender roles will no longer be accepted as being predetermined, but will increasingly be defined by individuals themselves.

Individualization: The divergence between people's individual lifestyles has become a global phenomena and will increase in future.

Social Imbalance: The world is becoming less fair. Whilst inequalities between states are diminishing on the global level, they are increasing within specific regions and countries.

New Ecology: The environment is deeply suffering from the subsequent costs of the human lifestyle. The time to act has begun.



Anatomy of a trend – at a glance

MACROTRENDS

Macrotrends are medium-term change processes that range from 10 to 15 years. Macrotrends are consumer-related trends that circle around lifestyles and people's attitudes, expectations, and behaviors. They interact with each other and mirror people's values, human needs, fears, and desires, paying off in consumer culture. A new attitude or opinion, a new expectation – any of them can form the basis of a macrotrend. Understanding these evolving needs helps us to find new answers to serve these needs business-wise. Knowing about these trends makes us capable to innovate with new solutions.

MICROTRENDS

Microtrends are market-related trends which act in a rather short-term manner compared to mega- and macrotrends. Microtrends have a lifecycle of approximately 3 to 5 years. Microtrends move from a very early adoption phase into mainstream and tend to wash out. Microtrends emerge when external change (i.e. macrotrends) unlocks new ways to serve these new needs and desires via product or service innovations or new marketing offers. Microtrends are not about the success or failure of these individual innovations; they are simply evidence of it.



MEGATRENDS are the great forces behind change and they explain and depict the way the WORLD will evolve.

25–30 years

Globalization, Mobility

MACROTRENDS show how wants and needs of people will change in the future. They mirror how the four driving forces affect our lifestyle and behavior.

10–15 years

Performance Society

MICROTRENDS are translations of macro-trends within markets. They manifest as an offering in the shape of products, services, campaigns, designs, etc.

5–8 years

Convenience & To-Go-Products

APPROACH

1 // Our daily business

As one of the largest statistics portals worldwide, Statista professionally gathers and compiles business and consumer data from numerous institutes and sources. Over 250 industry experts continuously check thousands of sources, studies, and databases every day, analyzing the most important data, current trends, and publications to inspire with fascinating content. Our experienced analysts, mathematicians, and trend scouts work together to evaluate market and industry trends, identifying crucial connections between market developments and disruptions in consumer behavior.

Looking ahead at 2020, our international team of consumer and industry experts has identified 12 macro trends and 24 related micro trends that will shape future consumer markets, transforming and disrupting entire industries. Every one of our identified trends has authoritative impact on our society, is backed by robust consumer and market data, and comes with inspiring innovation snapshots from diverse industries and countries.

2 // How we track our trends

Our approach to track trends is threefold: At Statista, everything starts with data. Which global consumer or business data proves our trends? And next, what impact will these trends have on our businesses in the future? Finally, as a third step, we are looking for inspiring business cases that might give you insight into latest innovation ideas and business endeavors from all over the globe.

Step 1: Data foundation

“Analyze yesterday, understand today, anticipate tomorrow.”

Trend research is observing those small pieces of the future that are already existing in the present. That is why traditional market research is a helpful tool when it comes to many trend-related questions like market size, investments, consumer adaptation and perception, audience share, and more. Although traditional market research is inherently retrospective, because it is based on data about what consumers were doing and saying yesterday, it gives us insightful hints about how fast, impactful, and sustainable a trend is.

So data can support trend analysis. And with more than 1.5 million insights and facts across 170 industry sectors and 160+ countries on our platform, we have quite some pond to fish in. All of our exemplary data

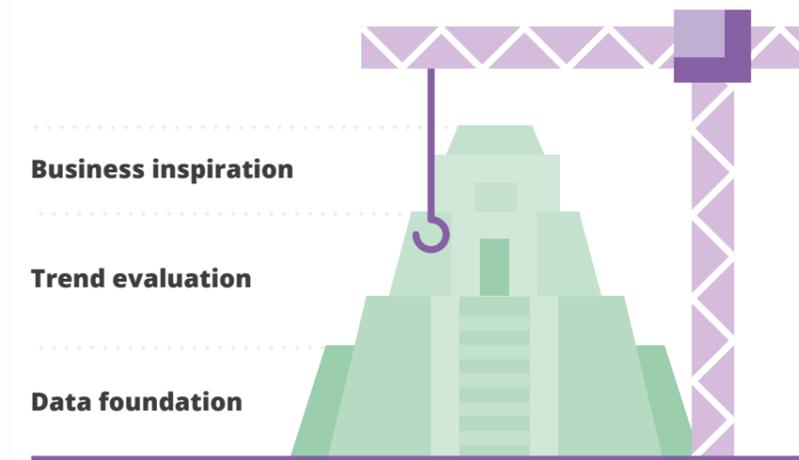
snippets, which we have thoroughly compiled in our TrendCompass, are aiming at providing a better valuation of trends. However, it was not our approach to compare our trends along industries, countries, and demographics – simply because this is not the point. Because today’s consumers don’t live inside industry silos, and neither should you. Focusing only on relevant data inside your industry, your country, or even your specific target group is a sure way to misunderstand the trend. So whenever you might ask yourself how this trend applies to your specific context, remember you are not only competing against other players in your industry, your country, your target group – you are competing against everyone.

Step 2: Trend evaluation

“Putting data into context.”

The next step is all about understanding the evolution of a trend and knowing the impact it might have on your business. That is why we asked an internal expert panel to quantify our trends. Over the last ten years, our consulting practice has shown that in order to meet the needs of number-driven businesses, we need a robust assessment model that is close to the market and that will provide insights into the future. Because any form of quantification serves as guidance, preparing and securing strategic decisions about future markets.

So we have come up with a “trend robustness check” which aims at exploring how trends are evolving in the future: our Relevance Compass. The RelevanceCompass is a unique tool that aggregates a high amount of trend-relevant data from our data pool, calculating the size, impact, and future evolution of our 12 micro trends. We identified major influencing factors for the future development of the trends and designed a database in which its future evolution can be measured best. By analyzing and linking our various data facts, forecast data, and extrapolations, we gain key insights into a trend’s degree of maturity in relation to other trends and its possible future impact – facilitating a better evaluation of the possible impact on your business.



Step 3: Business inspiration

“*Innovation snapshots bring trends to life.*”

Data is not the only reference – we all know how important context is. Local context, industry context, and even demographic context – they help us envision the bigger picture and make trends more tangible. That’s why we decided to enhance our trends not only with profound data but with more lively content: our innovation snapshots. Our global expert team in our 15 international offices from Hamburg to New York and London to Singapore screened for relevant business innovations from their regions and found stunning business answers to our trends that we have compiled in our report, showing that our trends are all “active” globally. Of course, regional differences do still exist. But people are people and trends are informed by fundamental human needs and wants that we all share, regardless of our origin. Trends articulate value shifts and aspirations, and they are becoming increasingly globalized and age-agnostic.

Spotting and learning from new B2C and B2B innovations helps us understand the diverse ways in which existing trends are evolving. All new businesses, products, services, and even marketing campaigns are bets on the future, and not all might end successfully. However, the success of a new business idea does not tell us much about the success of a trend. It tells us a trend is alive and how it is applied on a business

level, helping us to suggest future directions for consumerism. Imagine how many peer-to-peer innovations failed in recent years – some however, like Airbnb, Etsy, and Kickstarter, just to name a few, prove the ongoing trend for peer-to-peer and collaborative consumerism. So a single example is just one attempt to adapt a trend for a specific environment, it does not make a statement on the trend as such.

3 // How our Relevance Compass works

As we will see, the opportunities for innovation are almost endless. In order to develop a successful innovation strategy, it is not only important to identify the most promising (i.e. value-creating) innovation fields for your business, it is also of highest importance to have a clear understanding of the roll-out timeline. Because the right timing is crucial for market success.

To reduce complexity and help navigating innovation development trends, we evaluated each trend by dividing it into two dimensions:

The revenue dimension:

What is the expected revenue potential of products and services comprised by the respective trend on a global scale by 2025? While we provide explicit forecast estimates when detailing each trend, we group the trends in five clusters to facilitate an easier distinction.



As our focus in this TrendCompass is on the end consumer, we focus on forecasting revenue potentials of B2C products and services. However, for some trends that are inherently B2B-oriented, we refer explicitly to B2B figures (like our microtrend Smart Factory, for example).

The roll-out dimension:

Every innovation undergoes a so-called diffusion process, with innovators being the first ones to try out new products and services (representing 2.5 percent of consumers), followed by early adopters (13.5 percent of consumers), early majority (34 percent), the late majority (16 percent), and finally reaching laggards (16 percent) – although not every product might finally reach this last phase of market penetration. Hence, trends that are located among first customer segments in terms of diffusion will show a higher potential for relative growth over time than trends that have already reached the majority of consumers. On the other hand, these early stage innovations might bear the risk of undergoing fundamental changes before reaching their full potential.

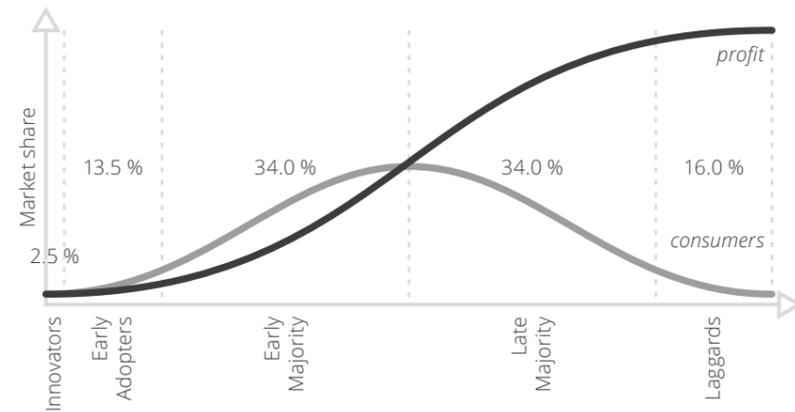
Across all microtrends illustrated and evaluated in this TrendCompass, we expect a direct impact from products and services of 2.7 percent of the global gross development product already in 2025 – with an even higher potential of up to 5 percent until 2030, when they will reach full mass market audiences. And keep in mind: this report only reflects half of the trends we foresee for the next years. In total, the potential would eventually double. And as we expect a GDP of approx. 100,000 U.S. dollars in 2025, the trends in this report address a revenue potential of almost 2.7 trillion U.S. dollars!

For orientation, we would like to highlight three important factors regarding the quantification of the revenue potential forecast in this TrendCompass:

// We do not ask for the generic impact from megatrends (like digitization) in general, but go deeper into microtrends and refer to specific products and services provided by companies as answers to corresponding customer needs.

// We forecast the economic impact only for those consumers that are within reach of the respective trend. For example, consumers living in remote areas or countries without the respective infrastructure to offer opportunities for Advanced Mobility are not included in the forecast.

// We refer to revenues generated by the new product or service segment itself – and not only to the specific add-on component enabling the respective trend. To be precise: Whenever we talk about Age of Assistance and refer to smart household appliances, we refer to the revenue coming from the sale of the entire product (e. g. the smart washing machine) and not only the smart, built-in component inside the washing machine. Or, in other words: It is not only the price premium for smarter appliances compared to “standard” products, but the entire product price.



Innovators 2.5 %* are without doubt of the most important groups when it comes to trends. Innovators are authors of tomorrow and crucial when it comes to adopting to disruption

Early Adopters 13.5 %* are crucial to spreading the word about new ideas and talking about what is going on. They are second-level influencers.

Early Majority 34.0 %* are not opinion leaders. However they act as bridges between Early Adopters and Late Majority adapting to innovations more easily than the main majority.

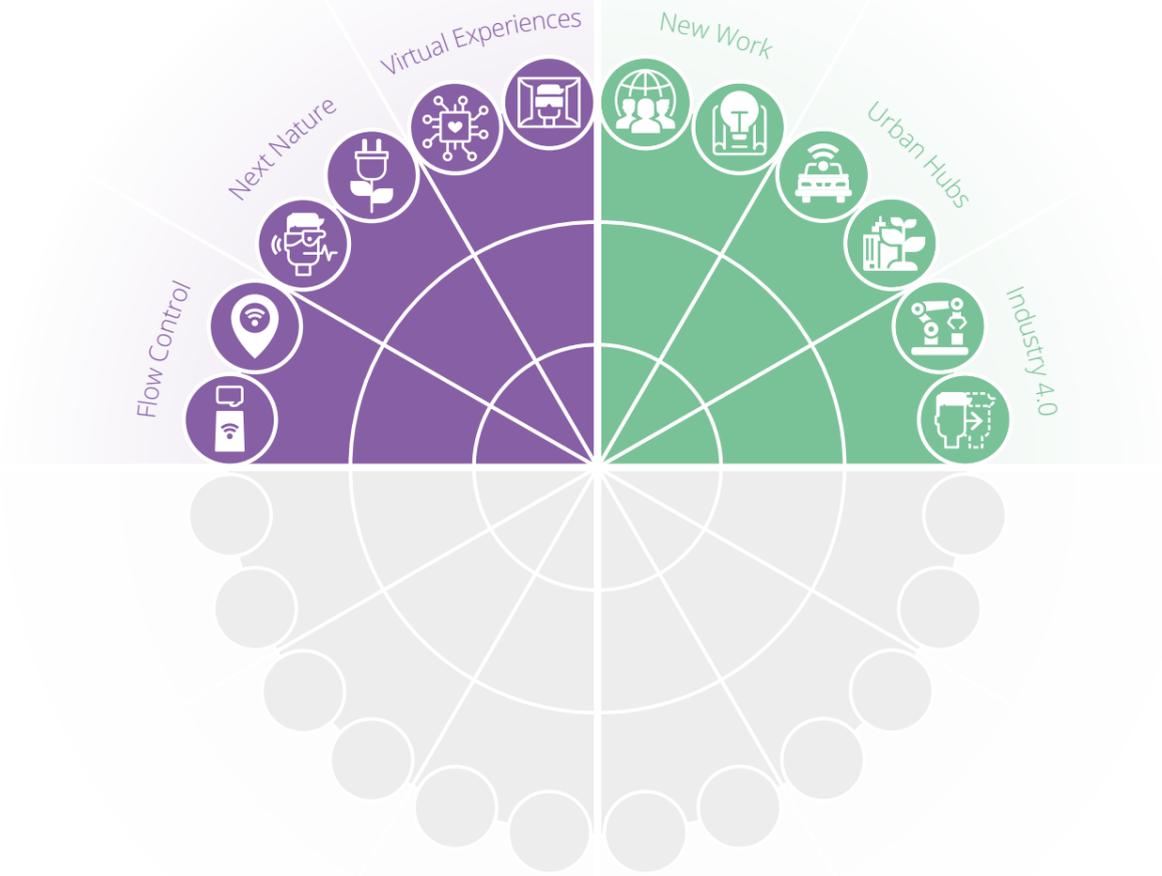
Late Majority 34.0 %* are customers that are rather conservative and who require high levels of reassurance and stability. Late Majority members tend to adopt things in watered-down forms and formats.

Laggards 16.0 %* are the slowest to adopt a new idea. They tend to hold on to notions that are familiar, traditional, and long tested. Whenever a trend is being adopted by Laggards we see that a trend has flatlined, meaning a trend has reached its end.

* Percentage size in relative terms to the rest of the population

01 // TECHNOLOGICAL CHANGE

ECONOMICAL CHANGE // 02



04 // CULTURAL CHANGE**

SOCIAL CHANGE** // 03

** Not part of this TrendCompass

01

TECHNO LOGICAL CHANGE

TECHNOLOGICAL CHANGE

Technology has become ubiquitous, promising more advantages than ever before, and today, it seems impossible to live without it. Digital technologies will continue to influence almost all areas of our living, whereby the speed and dynamics of change will dramatically gain momentum until 2030.

The Consumer Technology Association (CTA) estimated the U. S. consumer tech value at 401 billion U. S.dollars for 2019 with the biggest growth areas in smart home devices (growth pitched at 17 percent) and streaming services (set to rise by 25 percent). Driven by ever faster data connectivity (5G is allowing speeds of up to one gigabyte per second) and the miniaturization of processors and sensors, the networking of objects is taking over a huge amount of our daily lives.

In just over five years from now, technology research firm, Gartner, estimates that we could see over 30 billion devices connected to the web, the majority of which won't be a smartphone, tablet, or PC. As everything from kitchens to cars to entire city systems literally comes online with the advent of the Internet of Things (IoT), we'll see an explosion of devices capturing data and reporting it back to people and other systems in almost real-time.

Developments in artificial intelligence (AI) have made it possible to analyze enormous amounts of data. And there are billions of consumers adding even more data every sec-

ond, enabling powerful solutions based on automation.

With global enterprise investments in the AI market reaching 231.9 billion U.S. dollars by 2025, we are entering an era of "AI first" after being "mobile first". Without the need for human interference, robots and machines are able to discover optimized solutions to complex problems while changing not only our economies but also our everyday lives. And these are more complex than ever. No wonder billions of people are escaping daily stress that comes with the feeling of increased time pressure, immersing themselves in virtual parallel universes. Innovative input devices and technologies, like virtual reality (VR) and augmented reality (AR), allow us to explore new, virtual situations and stories. VR and AR enable us to interact with others and the worlds they help create, far away from our own.

Additionally, advancements in biotechnology and data processing are enabling us to intervene creatively in natural processes. This is altering our understanding of naturalness in

profound ways while offering valuable solutions to today's global challenges: hunger and pollution.

Technology may speed up our lives, but it also offers a new, helpful approach to everyday obstacles, as well as new solutions for old problems.

Trend Drivers

Excessive demands:

Increasing time poverty and growing responsibilities add pressure to our lives. This makes us receptive to uncomplicated solutions that reduce complexity (synchronization of activities, outsourcing of tasks and responsibilities).

Network society:

Everything is connected. The global spread of digitization and virtualization allow us to network all the time while always being on.

Technology optimism:

We get used to technology. The acceptance of new technologies is heavily increasing, especially if it's facilitating improvements in our everyday lives.

Life in remote presence:

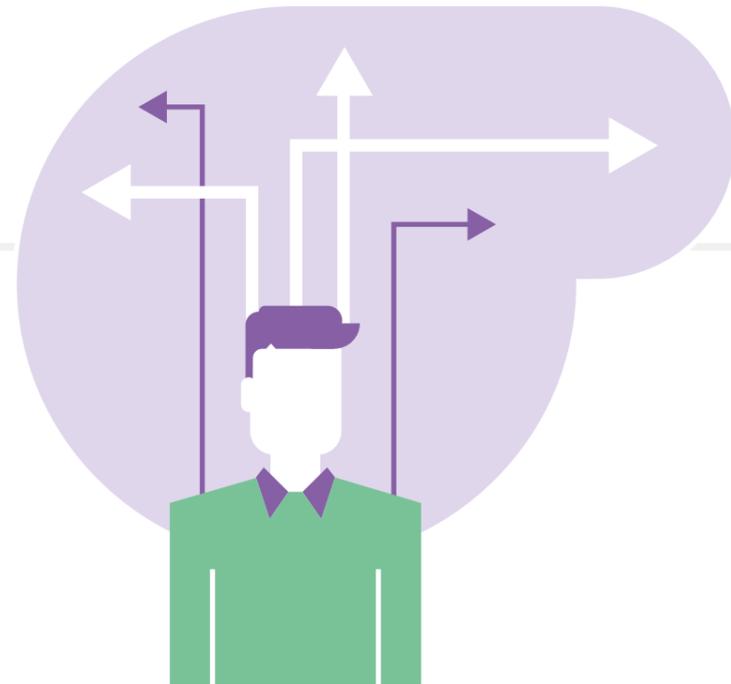
The possibility of global connectivity makes us long for permanent connectedness. The fear of being cut off (FOMO/FOBO as fear of missing out or fear of being offline) has increased remarkably.

2020 Technology macrotrends to watch:

Macrotrend #1

FLOW CONTROL

Excessive demands in our increasingly fast and complex everyday lives are fostering the evolution of new tools and technologies. These help us navigate stress and improve efficiency in every aspect of our lives.



Macrotrend #2

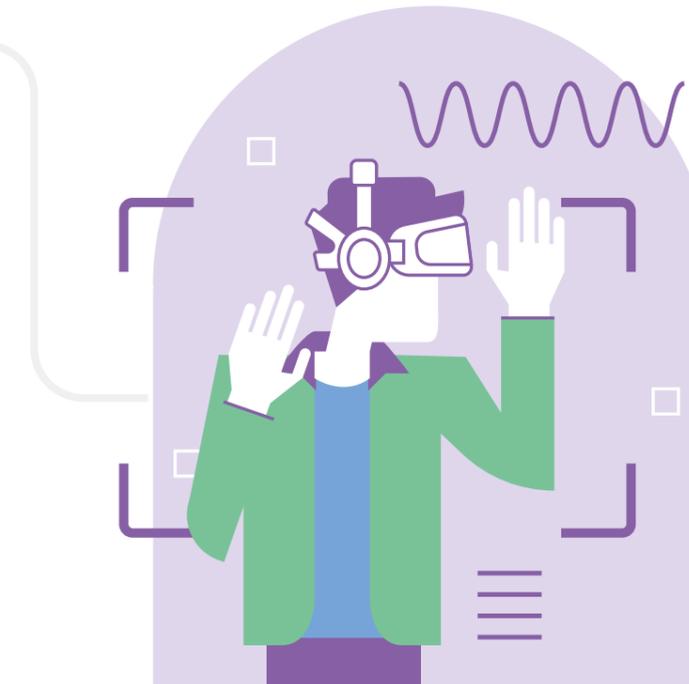
NEXT NATURE

Technological innovations no longer equal extra accessories and aids - they have become an important part of our lives. They are extending our sphere of activity.

Macrotrend #3

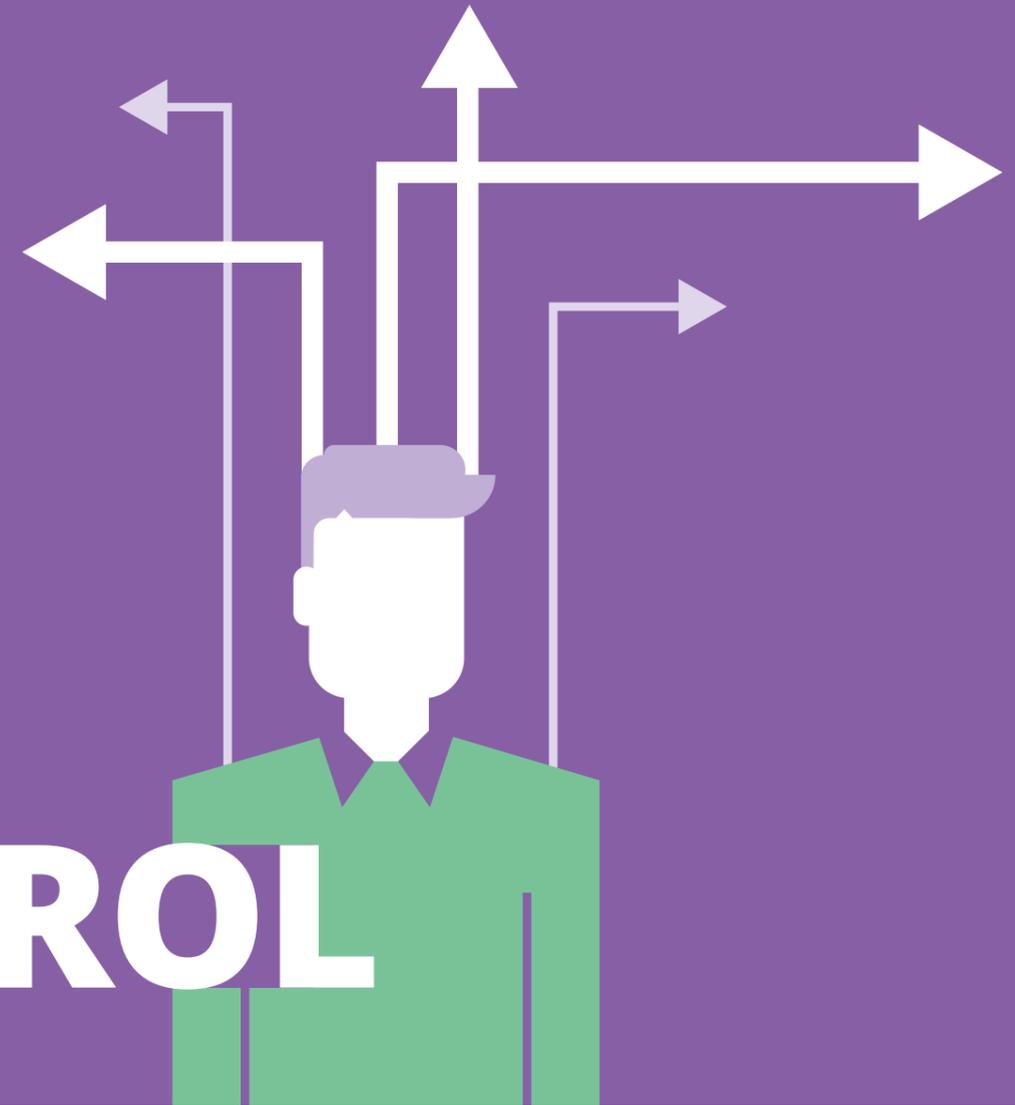
VIRTUAL EXPERIENCES

Innovative virtual experiences are becoming increasingly easier to access for millions of consumers. By blurring offline and online lives, real and imagined worlds, they present new possibilities that support inspiration and stimulation.



Macrotrend #1

FLOW CONTROL



Driven by globalization and digitization, our world is turning towards more fragmented and dynamic lifestyles. The digital revolution promised to save us time, but instead we are busier than ever.

Technology is offering speed and endless possibilities at our fingertips – our everyday options seem infinite. No matter where we are on the generational spectrum, the feeling of overwhelming pressure has become a demographic unifier. The fear of lagging behind because of wrong decision-making or of being cut off (FOMO - fear of missing out and FOBO - fear of being offline) is tremendous. People all over the world are feeling pressure to do, and be, better in every aspects of their lives.

New tools and technologies, helping us to navigate stress and be more efficient, are born from the increasing complexity and speed of our everyday lives. We want to keep up with the flow seeking personal guidance and focus filters to simplify our everyday lives and have a moment of relief.

80 %
of adult respondents do not have time to do all they wanted in a day.

With predictive analytics tools digesting our data, behavior, and preferences in order to decode our personalities, and with smart assistants on the rise, the market for connected existence in the **Age of Assistance** (Microtrend #1) is soaring to new heights. Digital Assistants are being embraced by consumers as they increase efficiency, productivity, and, of course, fun. Moreover, mobile devices and wearables are facilitating **Contextual Tailoring** (Microtrend #2) at any time. Contextually relevant information is captured and transmitted instantaneously to allow for a seamless flow of events.

DRIVERS

WHAT ENABLES THIS MACROTREND?

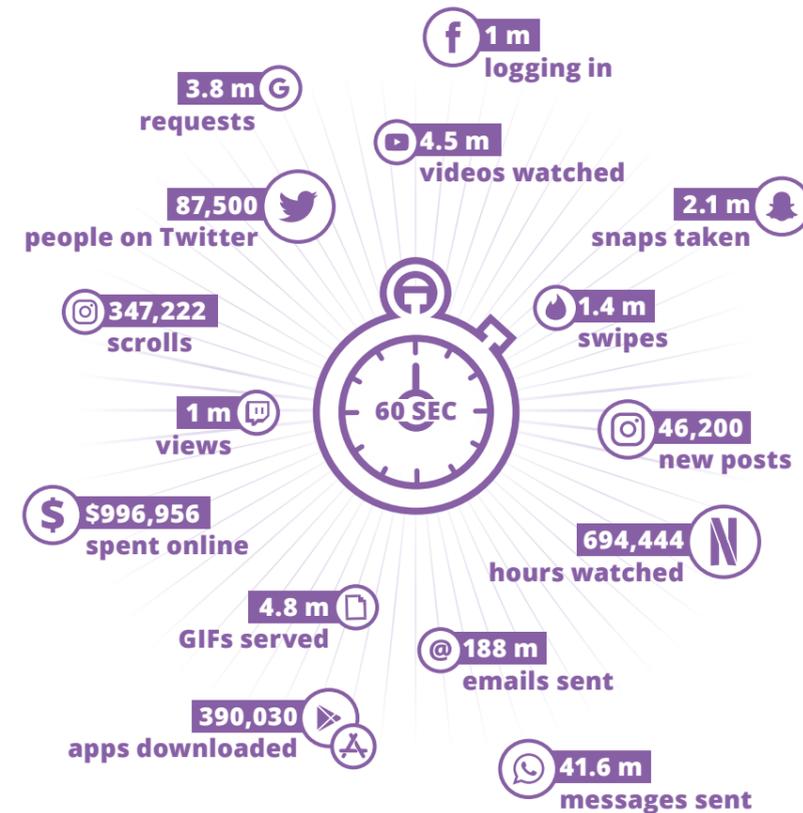
Digitization and connectivity offer an unlimited variety of possible options, leading to a life that becomes more and more complicated. We want to be comprehensively and instantly informed but feel overwhelmed by the sheer volume and diversity of supply. The need for guidance and support increases.

KEY MOTIF

WHY ARE WE KEEN ON SUCH OPPORTUNITIES?

People long for a decrease of complexity and for support to make better decisions and gain back control over their everyday lives.

// Estimated data created on the internet in one minute



MANIFESTATIONS

Microtrend #1

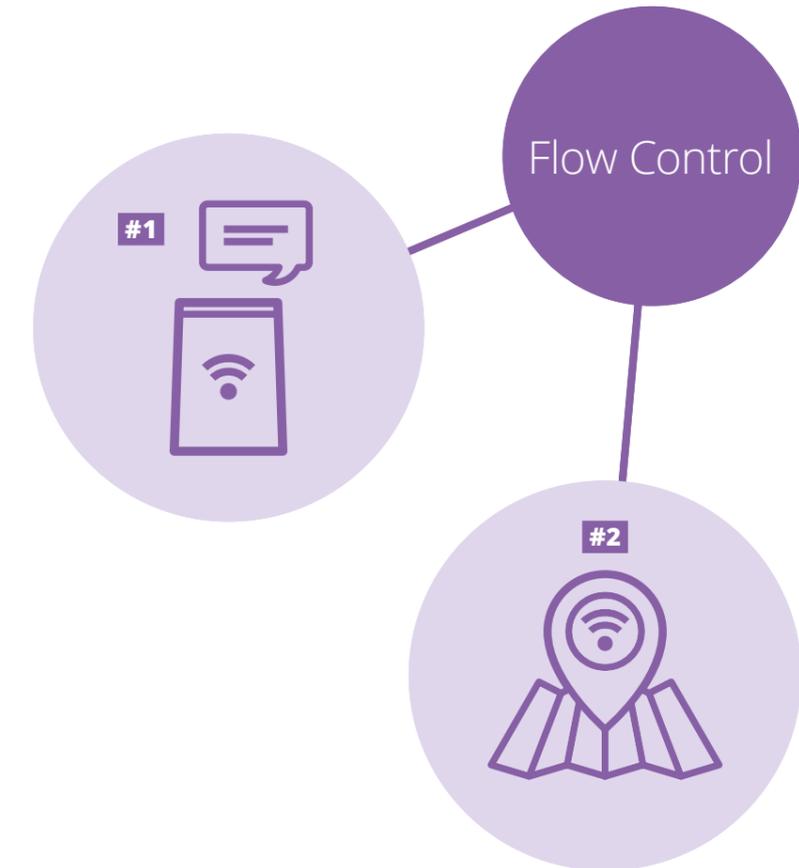
AGE OF ASSISTANCE

While life is increasingly accelerating and choices are multiplying, we are seeking help in outsourcing. Assistant tools that support and help us with nearly everything in our lives allow for a perfect sequence of events and decision-making.

Microtrend #2

CONTEXTUAL TAILORING

We are always online and constantly mobile, longing for instant information at our fingertips – everywhere. Tailored information streams with regards to contexts, situations, and personality profiles allow for best possible knowledge and insights.





Microtrend #1

AGE OF ASSISTANCE

The internet of eyes and ears is undergoing a revolution and, for the first time, is becoming truly mainstream in 2020.

Increasing time poverty and growing responsibility make us receptive to uncomplicated, helpful solutions and personal assistance in nearly every aspects of our lives. We are feeling the pressure to do and be better – whether it is work productivity, synchronization of activities, outsourcing of tasks, or simply seeing numbers drop on a scale.

While some decades ago it was all about making our lives easier by automating manual work, think of the dishwasher for instance, today we seek to enhance our quality of life by further automating our daily routines.

Digital voice assistants (DVA) are leading the evolution towards blended digital and physical experiences. We have seen Amazon's Alexa penetrate the market to become a household name. Google Home and Apple's HomePod are on their way to replicate Amazon's success. And voice is just the starting point of these helpful service structures. In the future, visual and gestural recognition technology will become the predominant interface interacting with smart assistants.



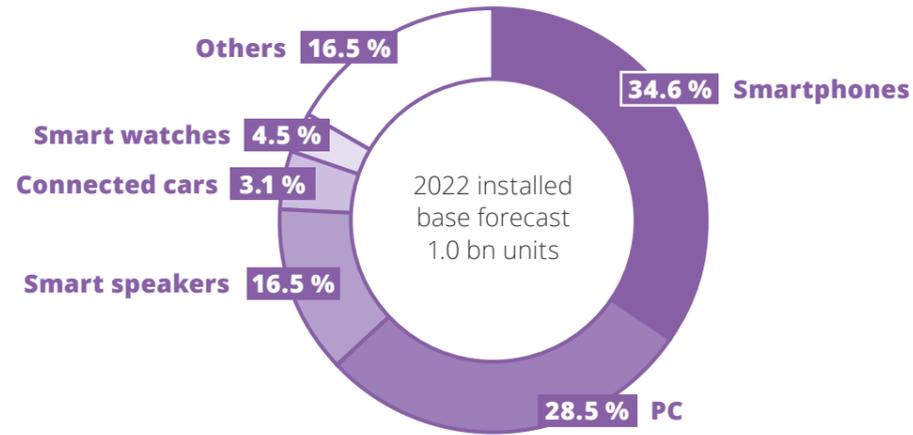
However, the invasiveness of such technology and access to personal information might drive fears of privacy issues. The benefits of comfort and convenience though may will dispel these fears.

What's in the trend?

- SMART HOME // DIGITAL ASSISTANTS //**
- SMART DEVICES // RECOGNITION TECHNOLOGIES //**
- PREDICTIVE ANALYTICS // ARTIFICIAL INTELLIGENCE //**
- CHATBOTS // AUTOMATION // SMART SENSORS //**
- USER PROFILING**

SUPPORTING FACTS

// Smart assistants in the United States



SMART HOME //

Smart home sales are reaching **28.6 million units** (19 percent growth) and 4.5 billion U.S. dollars (16 percent increase) in 2019.

SMART SPEAKERS //

Smart speaker sales are reaching **35.2 million units** (1 percent increase over last year) and 3 billion U.S. dollars in revenue (1 percent decrease) in 2019.



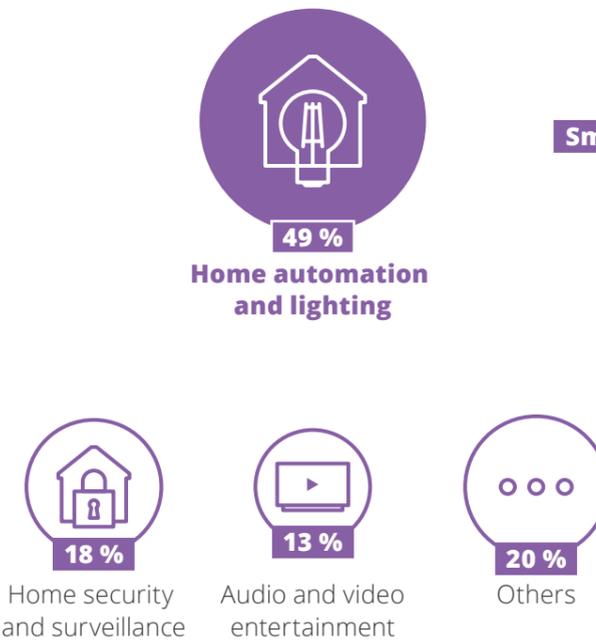
75 % of U.S. households will have installed a smart speaker by 2025.

More and more consumers are discovering how smart tech can alter their daily lives for the better and make them easier.

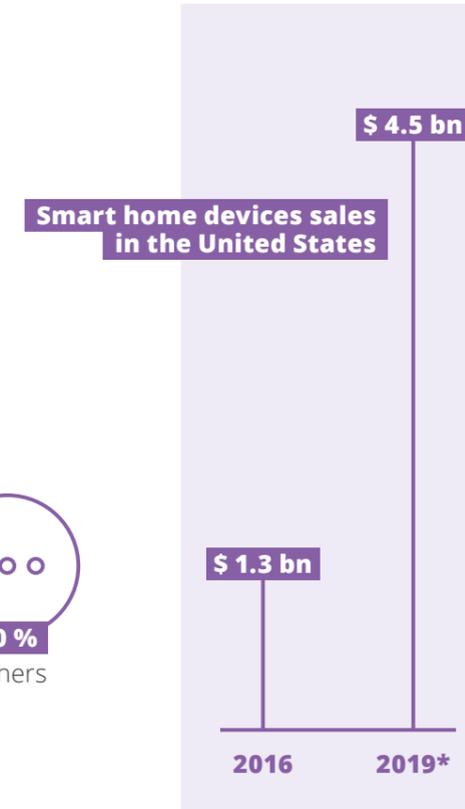
Consumers all over the world are embracing AI-powered technologies as a means to support their daily routines. Globally, we see digital and smart assistants increase in sales. Billions of smart devices and sensors in our homes, offices, cars, in our ears, in our hands, and around our wrists are talking to each other while monitoring activity and automating our daily tasks.

All of these devices with their very own protocols make up the Internet of Things (IoT) – which is heavily expanding during the next few years and has grown from a theoretical concept into a huge phenomenon. Strategy Analytics predicts that there will be around 50 billion connected IoT devices online by 2030.

// Automation and lighting are key growth segments.



* Forecast



// Do you own Smart Home devices – i. e. devices that you can control via a smartphone / an internet connection?

Yes, smart speaker with an integrated virtual assistant

25 %

Yes, multiroom entertainment

14 %

Yes, energy management

13 %

Yes, building safety/security

13 %

Yes, comfort and lighting

12 %

Yes, smart appliances

8 %

None of the above

57 %

Others

2 %



The demand for voice technology is increasing and it will have a profound impact on the way we will find, consume, and act on available information.

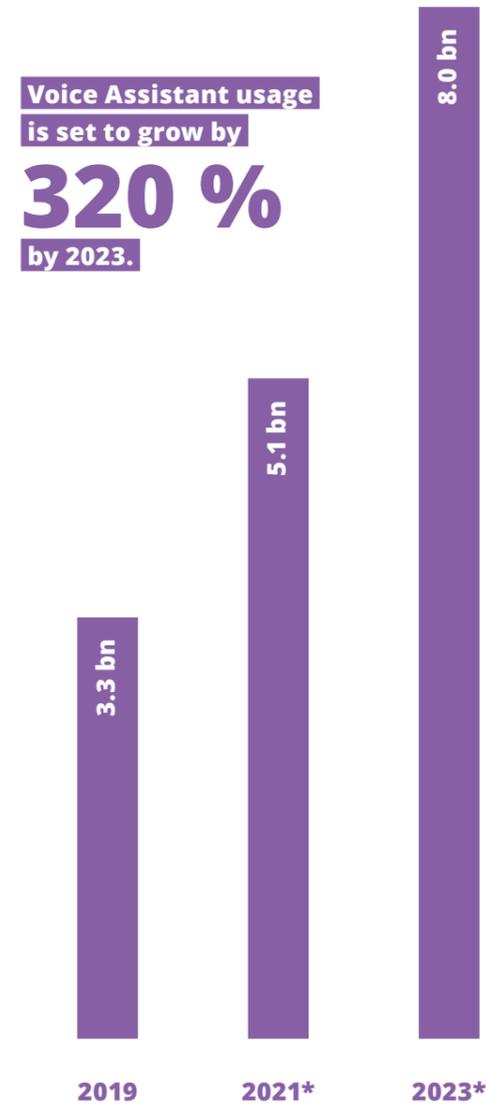
Voice technology is increasingly supporting us in our everyday routines. Be it asking our smart devices to check on the weather, set an alarm, ordering a cab or Uber, or simply switch off the light, start the vacuum cleaning, or water the lawn. The use cases are endless. It is said that the average human can type around 40 words per minute – however, humans can speak approximately 125 words in the same timespan. Imagine what this means in terms of accelerating information flow. It seems no wonder the world is increasingly adopting to the productivity-boosting value of voice technology.

And with prices for digital voice assistants falling to less than 30 dollars, our voice-driven world will accelerate even more, showing no signs of stopping.

The flood of low-priced speakers is fueled by tech companies' main aim to dominate the market and advance the use cases that these devices support. Amazon, for example, is accepting selling the Echo Dot for less than 20 U. S. dollars, making little profit, because it wants Alexa to gain foothold and dominance in our households. Google uses the same strategy, having just dropped prices for the Home Mini from 49 U. S. dollars to 29 U. S. dollars.

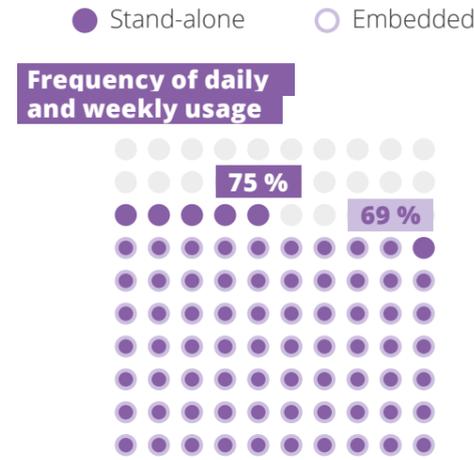
The race for market leadership is on. And while Amazon dominated the early smart

// Number of digital voice assistants in use worldwide.



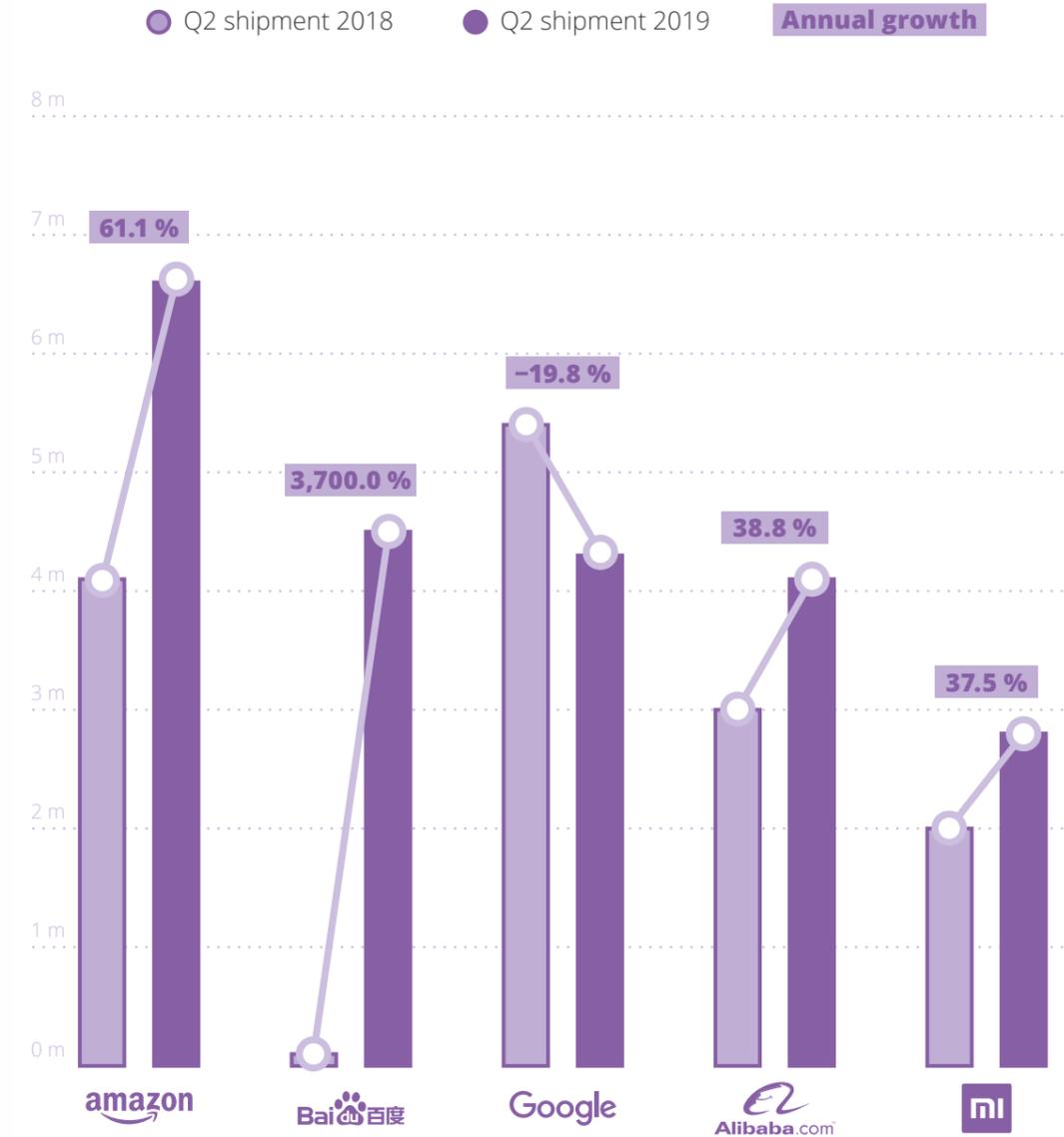
Voice Assistant usage is set to grow by 320 % by 2023.

// While not yet as widespread as embedded voice assistant devices, stand-alone DVA devices are used more often and users are more satisfied.



Digital Voice Assistants will become even more pervasive, as device prices fall \$ 30.

// Worldwide smart speaker shipments and annual growth



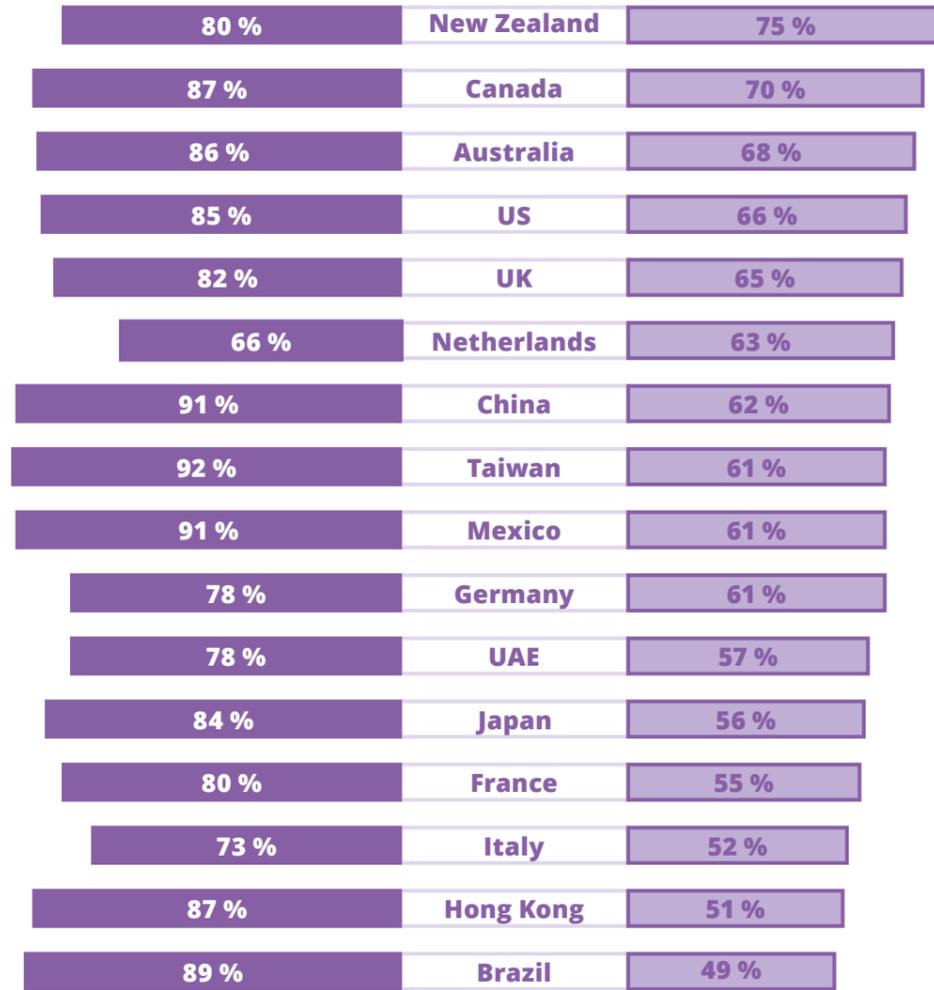
speaker market, rapid growth in the segment has made it more than challenging for Amazon to defend its market share from competitors. Especially Chinese competitor, Baidu, has gained ground significantly. Despite serving the Chinese market only, the company replaced Google to become the world's second-largest smart speaker vendor in 2019.

The global smart speaker market grew by 55.4 % in Q2 2019, reaching 26.1 million units. Amazon maintained the worldwide lead by shipping 6.6 million units of Echo smart speakers.



// Concern about online privacy, by country

- I am concerned about my privacy
- I accept certain risk to my online privacy to make my life more convenient



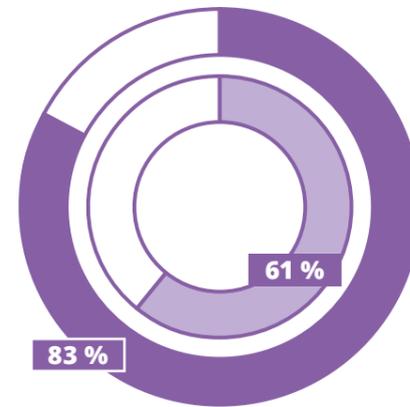
60 %

of consumers in the United States are now using voice to ask the internet questions.

Consumers are concerned about privacy. Companies must adopt ethics in AI to win customers' loyalty and trust.

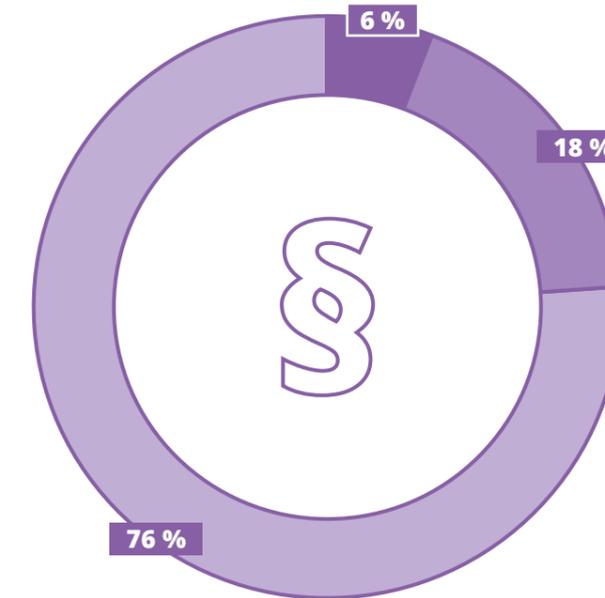
Voice has become an increasingly popular interface for answering search queries or interacting with smart devices in our homes and cars. 42 percent of the global online population say they have conducted a voice search within the past month. And while many project that voice will become the interface of the future, there are still some issues that, if unsolved, will keep voice from becoming as dominant as predicted.

// Global concern about online privacy



// Do you think there should be a new law or regulation to regulate the use of AI by organizations?

- Disagree
- Maybe / don't know
- Agree



In September 2018, California signed into law new legislation that demands businesses let consumers know when they are speaking to an AI-run chatbot online.

Social media company Facebook opened five pop-up cafés across the UK in 2019, where visitors could get a privacy checkup and a free cup of coffee.

One main barrier is privacy. Consumers are increasingly open to interacting with smart devices, but are mindful of potential privacy and ethical implications that AI could entail, increasingly demanding ethical behavior from AI systems of companies they interact with.

Organizations need to create ethical systems and practices for the use of AI, if they are to gain customers' trust, loyalty, endorsement, and engagement. A recent Capgemini report found that companies that are seen as using AI and ML (Machine learning) ethically have a 44-point Net Promoter Score (NPS) advantage over those seen as doing the opposite.

Among consumers surveyed,

62 % said they would place higher trust in a company whose AI interactions they perceived as ethical; 61 percent said they would share positive experiences with friends and family.



STATISTA RELEVANCE COMPASS

Evaluation Insights:

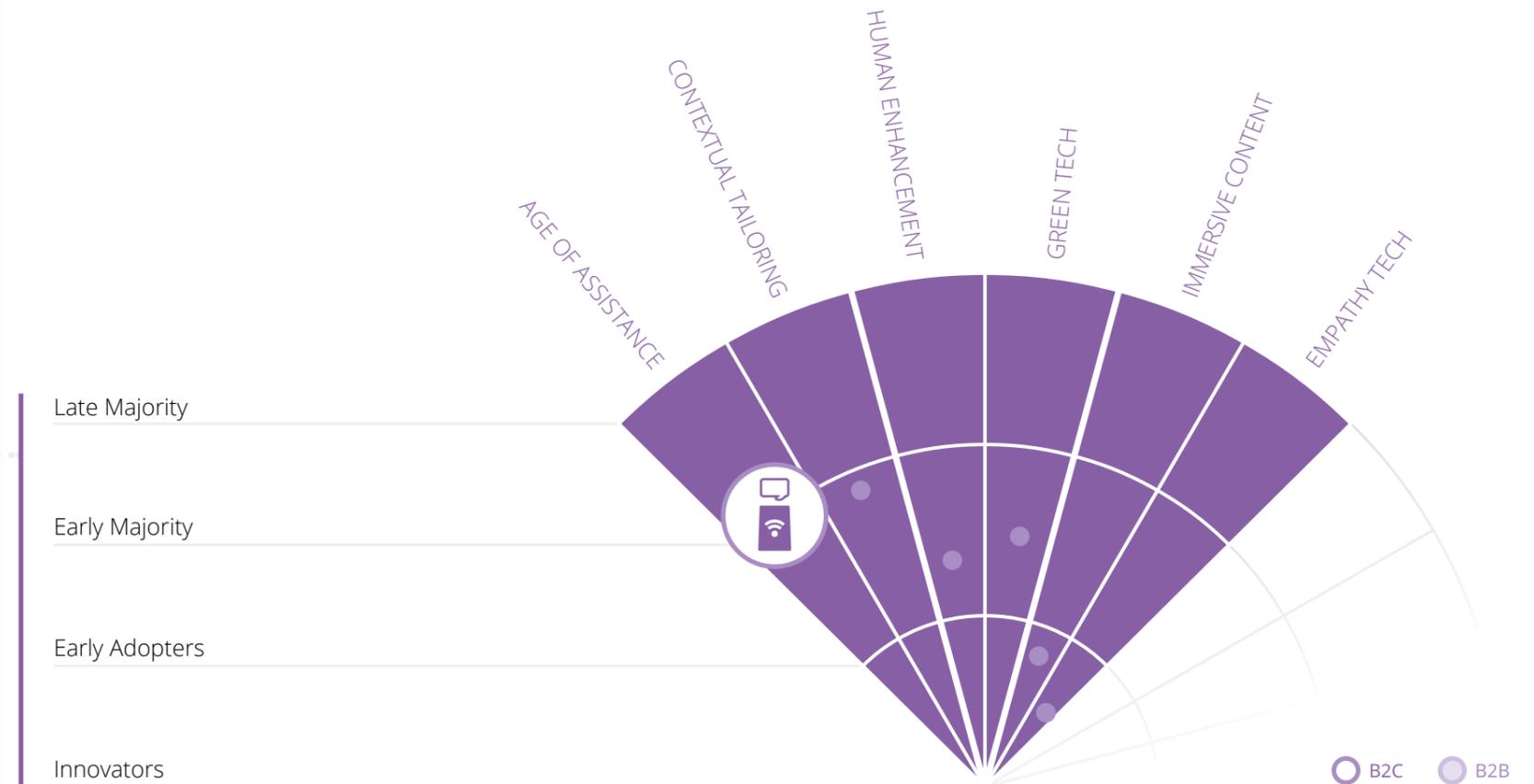
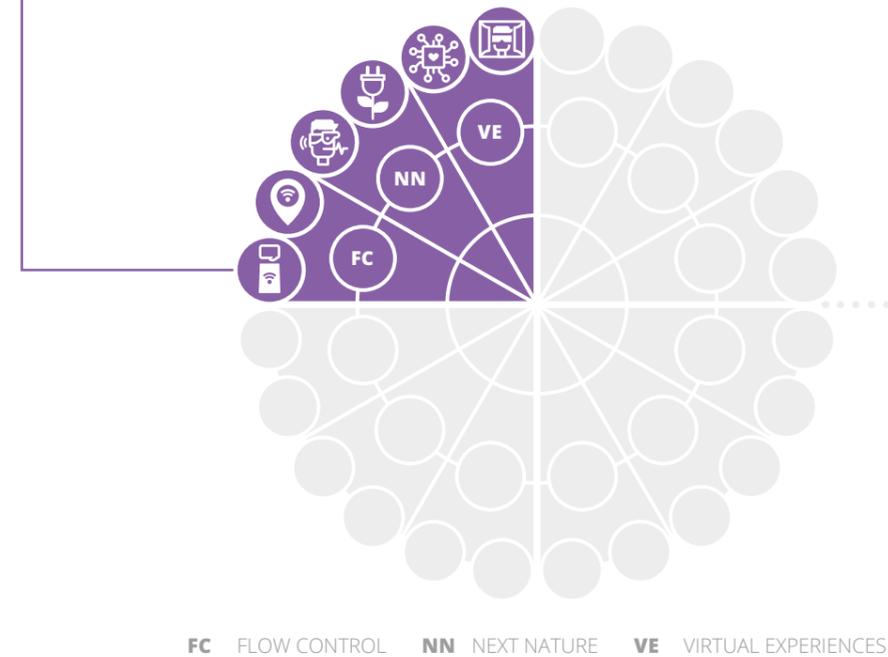
We understand Age of Assistance as being defined predominantly by two sub-segments: Smart Home and Voice Commerce. Smart Home consists of networked devices and related services that enable home automation for private end users (B2C).

Voice Commerce comprises transactions generated via chatbots integrated in stand-alone smart speakers and other consumer electronic devices. We estimate the total market potential for related products and services in both segments for end consumers to reach up to approx. 260 billion U.S. dollars globally by 2025.

Multiple drivers support a continued strong growth in both segments: Among others, increasing matureness of service offerings creating additional value for customers, decreasing equipment costs through scale effects in production, as well as subsidizing hardware through service offerings and the roll-out of 5G. We allocate the microtrend currently at the level of early majority.

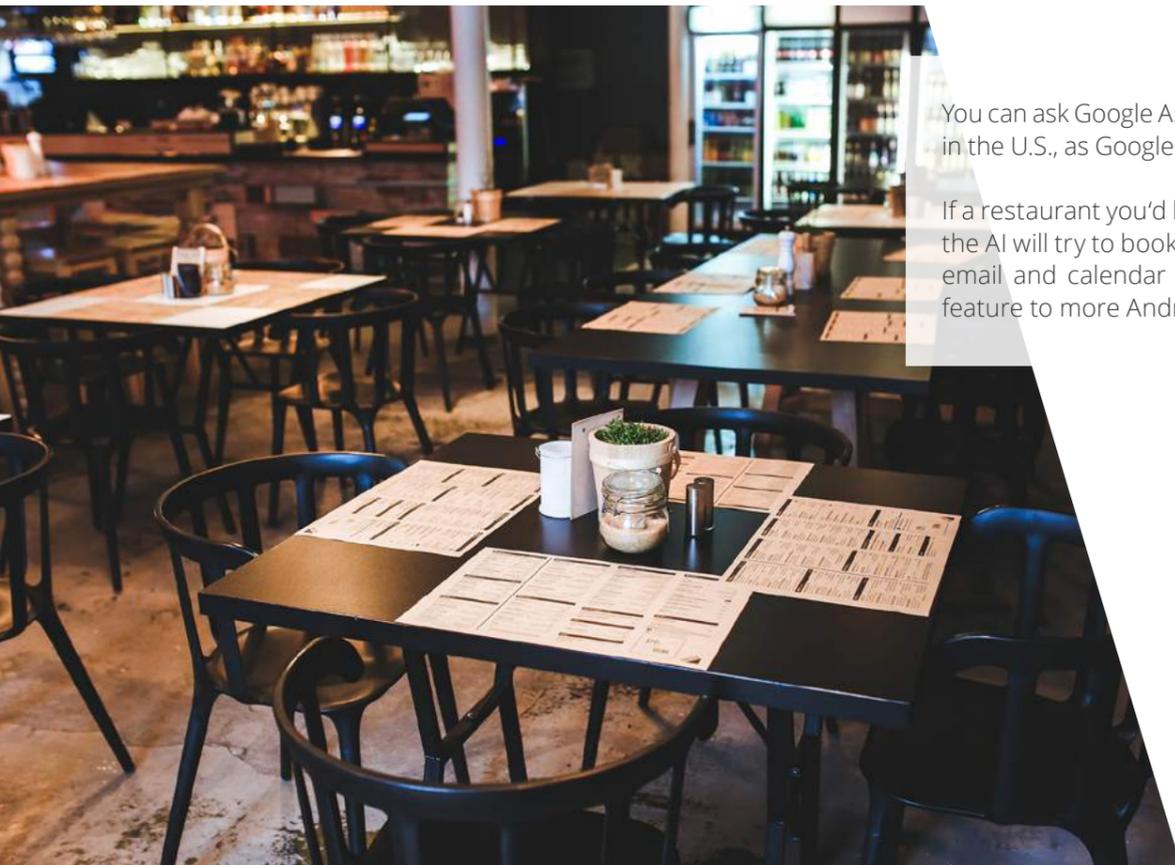
TECHNOLOGICAL CHANGE

/ FLOW CONTROL
1 // AGE OF ASSISTANCE



INNOVATION SNAPSHOT

Google releases its Duplex AI restaurant booking assistant.



You can ask Google Assistant to make a restaurant reservation over the phone for you in 43 states in the U.S., as Google is bringing its Duplex automated voice-calling tech to more Pixel phones.

If a restaurant you'd like to dine at uses an online booking service that's partnered with Google, the AI will try to book a table for you that way. Assistant will then send you a phone notification, email and calendar invite with the details. Google plans to expand the restaurant-booking feature to more Android and iOS devices.

Why this is interesting:

Imagine a future where Google is organizing all your appointments and providing you with personalized recommendations based on your recent activities, your latest ratings or your proximity to a given location and then even messaging you when it's time to start, including traffic updates of course. Imagine Google, Apple, Amazon, and Co. taking over to be the main interface to your life.

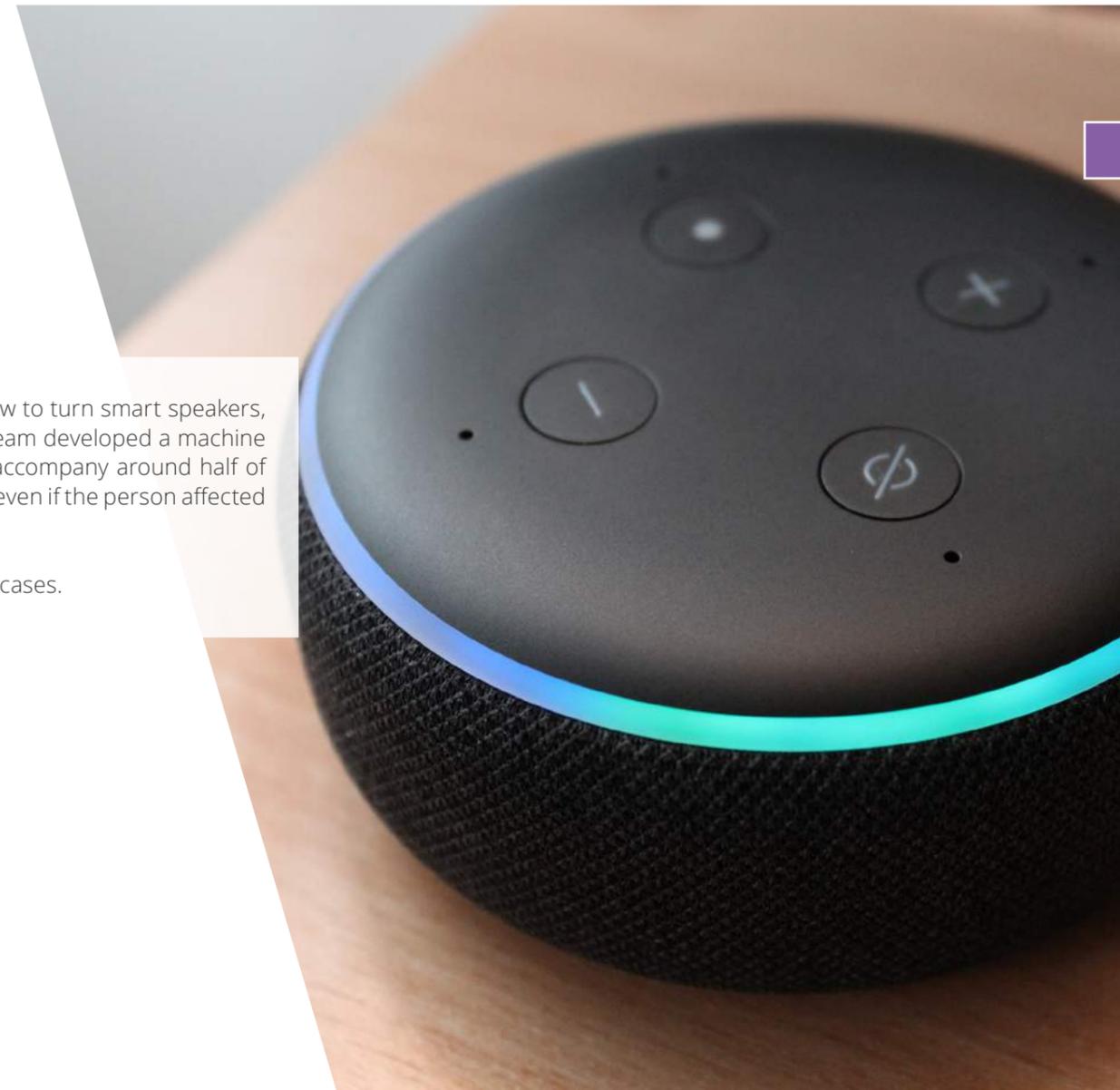
Scientists create cardiac monitoring smart speaker technology.

Researchers from the University of Washington have figured out how to turn smart speakers, like Alexa or Google Home, into a cardiac monitoring system. The team developed a machine learning algorithm that detects irregular breathing sounds, which accompany around half of cardiac arrest events. The smart speaker could then raise the alarm, even if the person affected is incapacitated.

At the current stage the system is correct in 97 percent of all tested cases.

Why this is interesting:

Digital Assistants might become more than simple assistants organizing our everyday lives. They could become life savors by continuously and passively monitoring, detecting, and analyzing irregularities in our living patterns and raising the alarm.



Huawei is launching luxury-fashion smart glasses.



Chinese tech giant Huawei is collaborating with luxury Korean sunglasses and optical glasses brand Gentle Monster to create fashionable smart glasses. The smart glasses are marketed as a type of earbuds replacement. Users will be able to answer phone calls by double-tapping the temple of the glasses, which also hold two microphones and speakers. The battery is easily charged by the eyewear's protector case (similar to Apple's AirPods). Huawei also promises the smart glasses will feature voice assistant access.

The official launch date of the smart glasses was September 6th at IFA 2019, however customers were able to register for a pre-sale in China since August 2019 with prices including 1,999 yuan (284 U.S. dollars) and 2,499 yuan (355 U.S. dollars).

Why this is interesting:

Technology goes fashion: What was once an accessory for nerds and geeks has become a fashion statement, tearing down inhibitions. Smart glasses are going more and more mainstream, becoming accessible and desirable for every consumer. For the majority, today's main interface is the display of your smartphone. But it won't last for decades. Imagine the new visual interface could be glasses – with no necessity of taking any other device with you.

SUCCESSFUL INDUSTRY PLAYERS



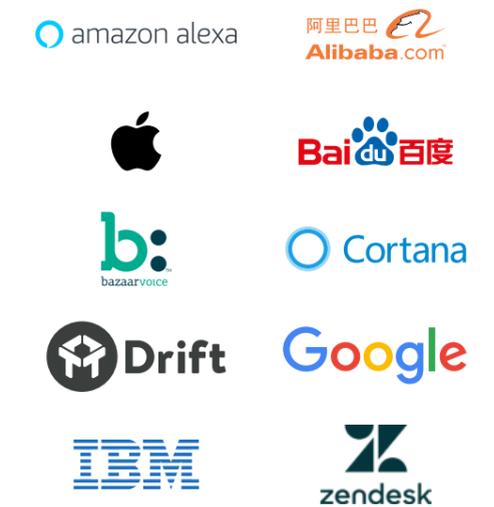
Smart Home systems



Service robots (vacuum/lawn)



Virtual assistants





Microtrend #2

CONTEXTUAL TAILORING

We are constantly mobile. And as our personal circumstances and surroundings are changing steadily, we are looking for helpful ways to easily adapt and keep up.

A new type of consumers are here to challenge the way we interact with information and content. Empowered by mobile devices, we can get exactly what we want wherever we want – instantly and effortlessly. We are always on, managing our everyday lives in permanent transit. Today, no matter where we are, we can be supplied with context-specific content.

New technologies on our devices are automatically sending or receiving contextually relevant information. They are enabling us to find adaptable solutions, which are dynamic and flexible, and take our environmental context, personal preferences, social connections, and even our mood into account. Or maybe simply allow us to watch a show begun at home to be seamlessly continued on the go.

Location-based services, using real-time location information, provide us with services such as entertainment, information, or just the nearest ATM. Beacons, widely used in public transit and for marketing, are broadcasting signals and trigger actions based on proximity. Sensors are leveraging a combination of user data, location, time of day, and other related

conditions to automatically deliver relevant information and experiences to people on their mobile devices.

These devices can read characteristics on target groups, such as age and gender. They can detect moods and emotions via voice or face recognition. And they do all this in order to meet our very personal preferences, customizing our surroundings to the max.

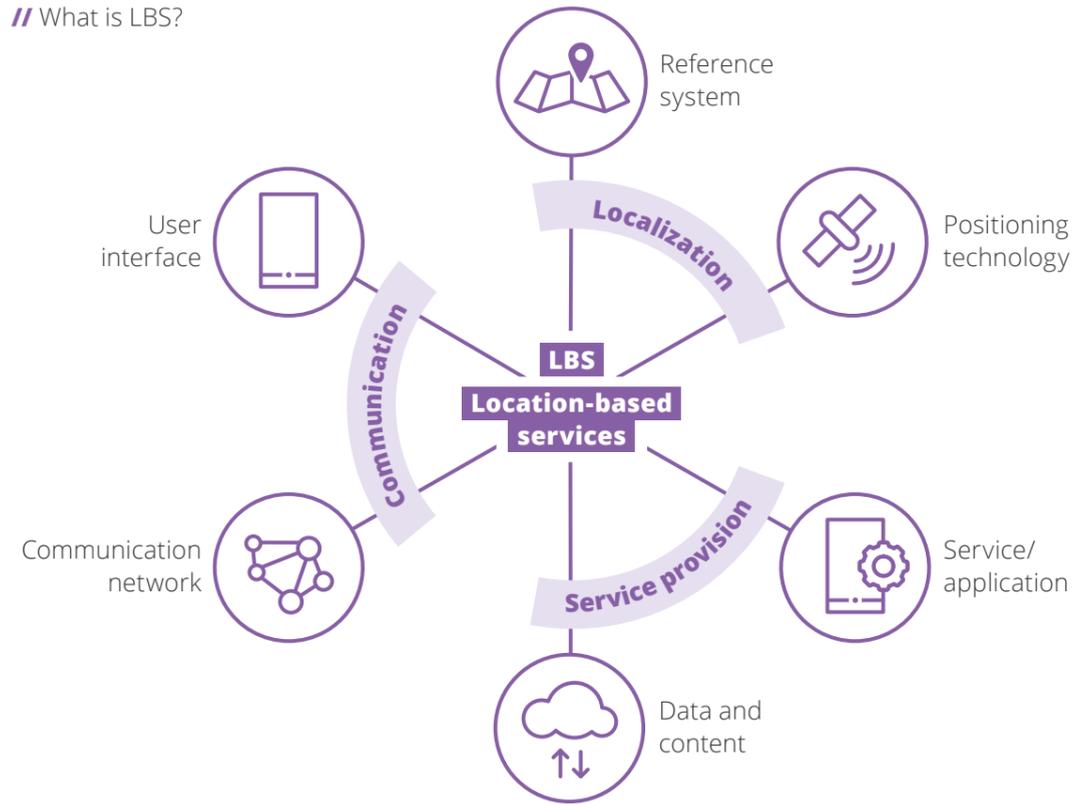
What's in the trend?

- LOCATION-BASED SERVICES // BEACONS // GPS //
- RFID // WEARABLE TECHNOLOGIES //
- GRAVITATIONAL CONTENT DEPLOYMENT //
- SEAMLESS MEDIA STREAMING //
- USER METADATA PROFILING //
- ARTIFICIAL INTELLIGENCE // SMART SENSORS //
- RECOGNITION TECHNOLOGIES



SUPPORTING FACTS

// What is LBS?



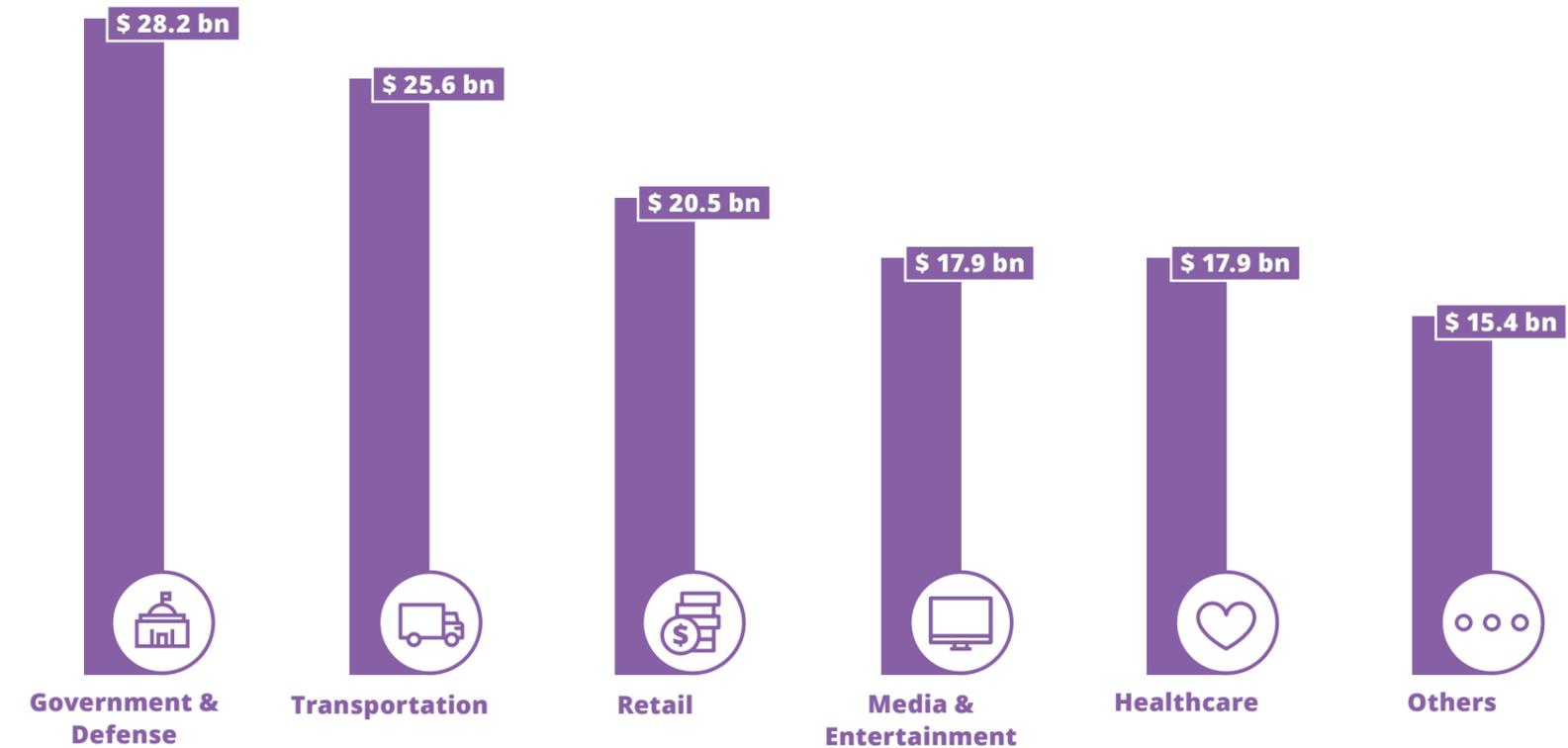
With mobile consumption growing, due to the explosion of smart devices and the rapid mobile broadband uptake, location data has become more relevant for consumers.

Location data has become a vital part of mobile experiences – making them more dynamic, convenient, and relevant for users. Think of navigation, geo-social networking, retail searches, or mobile marketing and advertising, location-based services (LBS) give users access not only to relevant, but also ultimately up-to-date information about their surroundings. Over the past years, Google has seen a dramatic growth in “near me” and other local intent mobile searches. “Near me” has become a new location name.

The location-based services market is observing a huge growth due to increasing analytical or business intelligence tools. Especially the increasing importance of global targeted marketing has led to a high focus on marketing efforts and will further stimulate the growth of the market over the next year.



// Location-based services are addressing diverse markets. These are the most relevant ones:



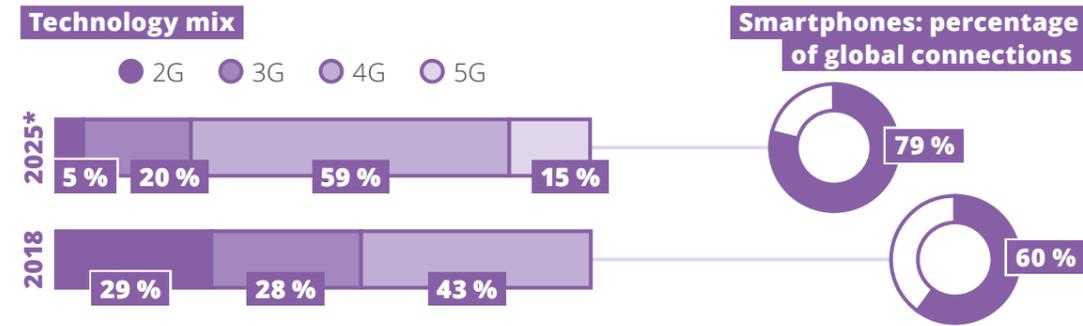
The increasing number of smart devices is a major driver for the location-based services market.

The market for global location-based services is driven by the increasing number of mobile phones and the availability of easily accessible GPS technology via LTE or faster technology. New generations of smart phones with features like GPS and advanced A-GPS – which are used for location-based services – are further fueling the market.

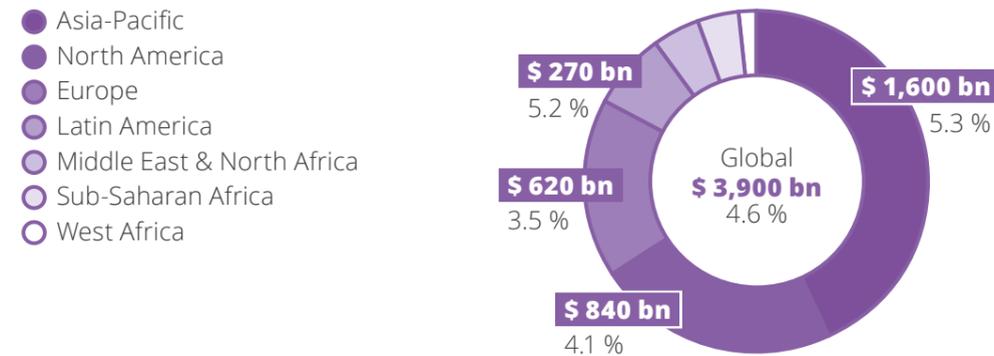
Location-based services use real-time location information of users with the help of their mobile devices to provide services nearby, such as information, entertainment, and other services – from finding the nearest ATM to tracking the location of the delayed UPS delivery vehicle.

At the same time, the variety of devices that come with GPS features, like tablets, navigation devices, smart cars, and portable desktops, are also on the rise.

// The mobile market in numbers 2019



// Contribution of the mobile industry to GDP in 2018, by region



* Forecast



The mobile overtake has completely changed our lives. And as data from GSMA shows, it has had the same effect on the global economy. Last year, 4.6 percent of global GDP came from the mobile industry – equating to 3.9 trillion U.S. dollars.

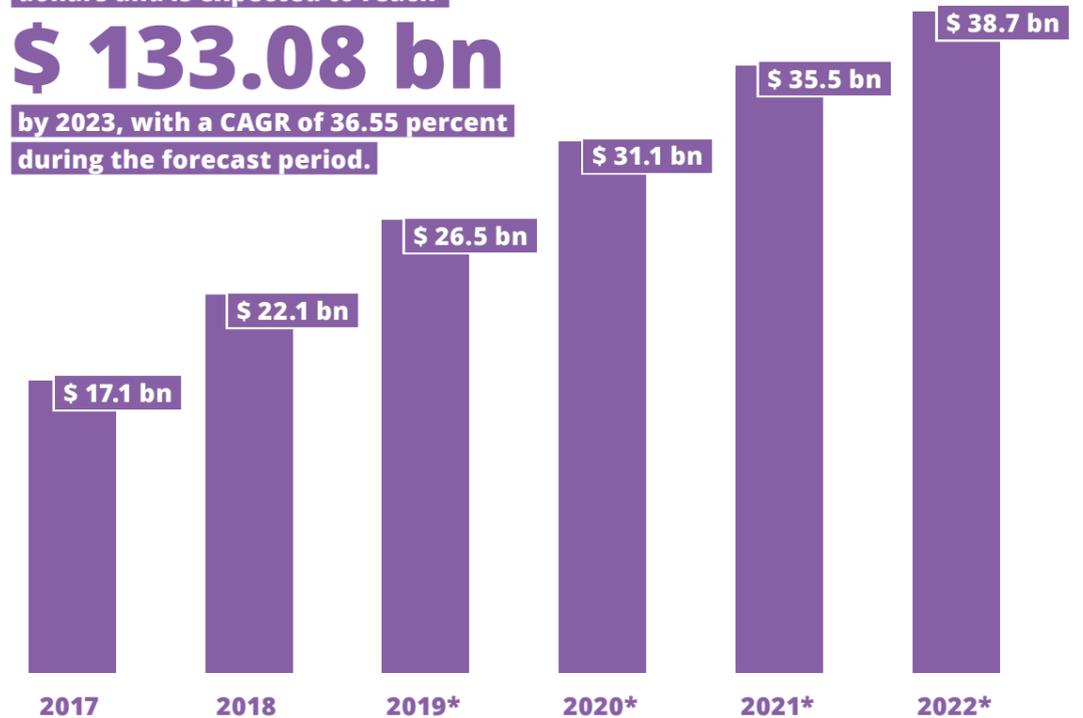


Over 150% growth in mobile searches for “near me now”.*

// U.S. mobile location-targeted ad spending

The global location-based services market was valued at 20.53 billion U.S. dollars and is expected to reach

\$ 133.08 bn
by 2023, with a CAGR of 36.55 percent during the forecast period.



* U. S. January – June 2015 vs January – June 2017

Location-based marketing is heavily changing the way consumers interact with brands around them. So let's have a look at the technologies that power the location-based market:

Proximity marketing is defined as a more granular form of location-based advertising. Few of the most common technologies that are leveraged for proximity marketing include RFID (Radio Frequency Identification), NFC (Near Field Communication) and Beacons.

The RFID and NFC segments are expected to emerge as the fastest growing technology segments, expanding at a CAGR of 42.1 percent over the forecast period from 2014 –2025.

Global RFID technology market revenue is expected to grow to \$ 40.5 bn by 2025.

- Track and trace inventory management**
Locate items within a space
- Loss prevention**
Alerts stolen goods
- Access control**
- Race timing**
Provides a seamless race-day experience
- Attendee tracking**
Eliminates registration lines
- Pet/livestock identification**



The global near field communication (NFC) market is expected to reach \$ 21.5 bn by 2024, at a CAGR of 17 % between 2018 and 2024.

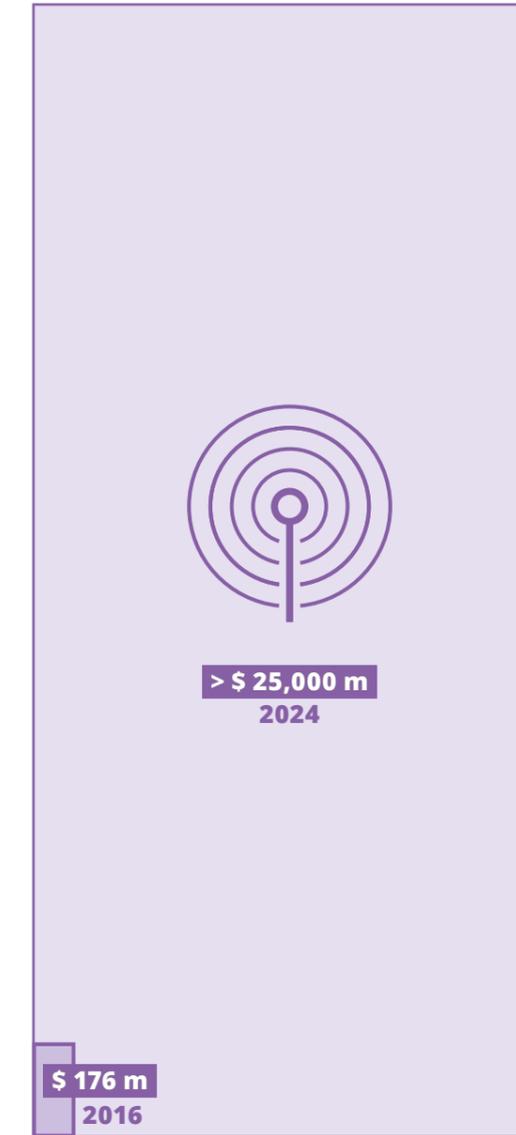
- Content channel**
Embedded experiences
Exclusive content
1:1 messaging
Product gamification
- Customer acquisition across sales channels**
Product registration
Store check-in
- Product authentication/ Brand protection**
Protect your brand
- Mobile payments**
Upsell experience
Resell experience

The global beacon market is expected to register significant growth in the near future, due to the increase in investment in proximity marketing.

Beacon technology has come a long and bumpy way since being first introduced by Apple in 2013, and is finally expected to gain momentum. According to a recent report by Global Market Insight, the beacon technology market is expected to exceed 25 billion U.S. dollars in 2024, revolutionizing the way consumers interact with brands.

Essentially, beacons are small, wireless devices that send out signals over a short distance, facilitating communication between smart devices nearby. Beacons seamlessly connect and transmit information to smart phones and mobile devices, allowing for personalized location-based interaction. For example, a customer strolling through a mall and walking past a store may receive a note with a targeted ad or special offer. As a result, beacon technology is said to increase customer engagement and facilitate an improved customer experience.

// The beacon technology market size



Proximity beacons are anticipated to emerge as the fastest growing product segment, exhibiting a CAGR of 48 % over the forecast period. Rising use of proximity beacons for marketing and advertising purposes by retailers worldwide is escalating the growth of the segment.



STATISTA RELEVANCE COMPASS

Evaluation Insights:

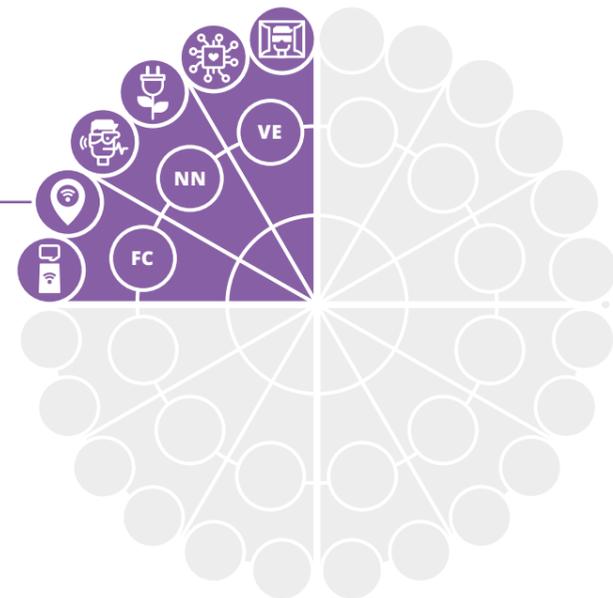
We see location-based services (LBS) as the most visible impact from the underlying micro-trend Contextual Tailoring. LBS – or even better location- and time-based services (LTBS) – is also a very important trigger dimension for Contextual Tailoring – built upon the ability to achieve a higher relevance of products and services for customers through providing and analyzing real-time geo-data.

The most important areas of application will be in entertainment, local services, and social networking. We expect a revenue potential for LBS of up to approx. 95 billion U.S. dollars globally by 2025 (excluding advertising revenues).

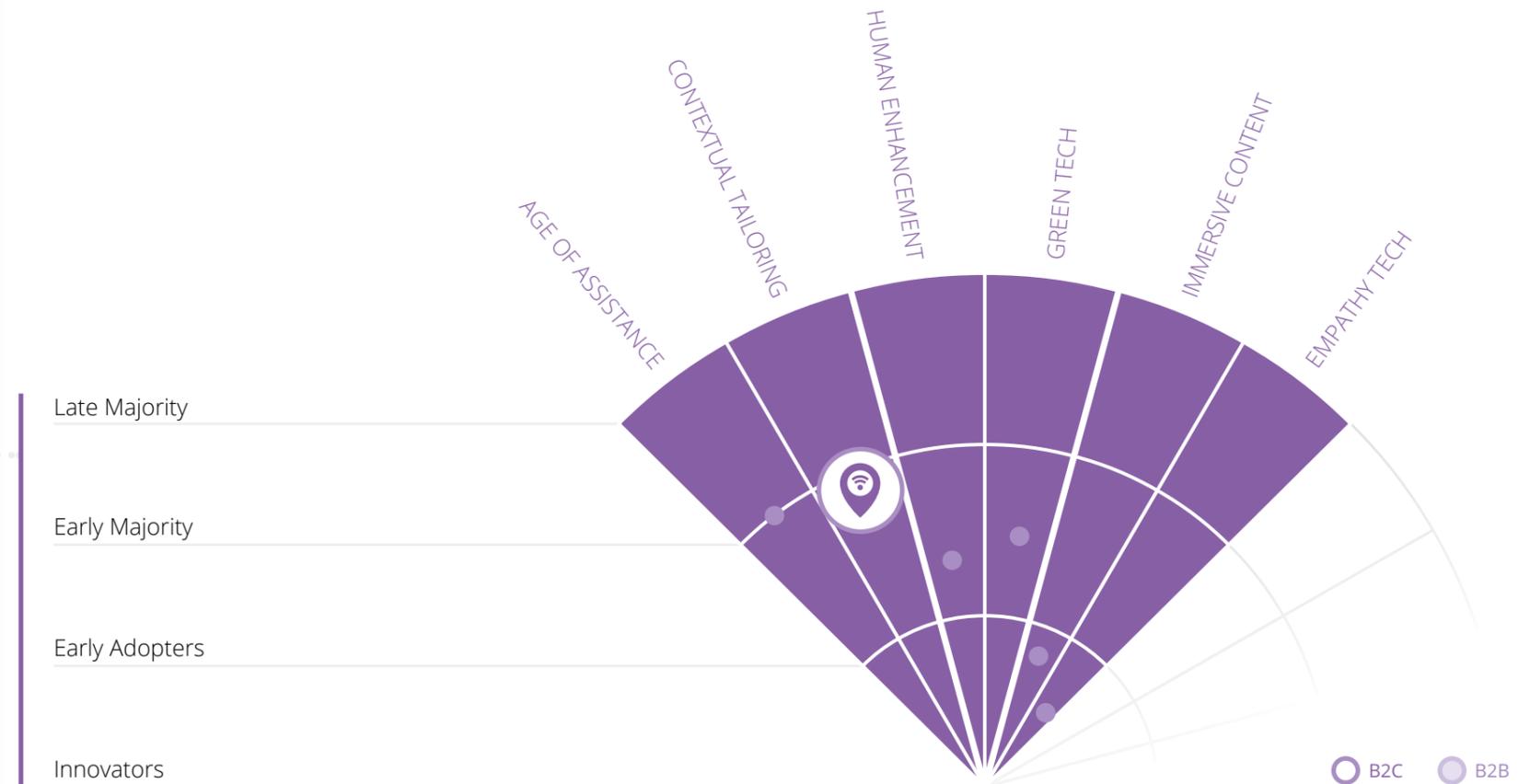
The further proliferation of LBS infrastructure and business intelligence solutions on the B2B side will enable a continued expansion of geo-tailored service offerings and products for end consumers. This will push this micro-trend from currently being close to early majority status to mass market status.

TECHNOLOGICAL CHANGE

/ FLOW CONTROL
2 // CONTEXTUAL TAILORING



FC FLOW CONTROL NN NEXT NATURE VE VIRTUAL EXPERIENCES



INNOVATION SNAPSHOT

Volkswagen created interactive, location-based audiobooks for children.



In order to make car rides more entertaining for children, Volkswagen created the Snelweg Sprookjes (Highway Tales) app, telling personalized interactive stories based on what kids can see out of the back window. The app, which is featuring 11 interactive stories written by some of the best children's book authors in the Netherlands, works on all highways in the Netherlands. It automatically adapts to the route being traveled, detecting ordinary objects such as tunnels, bridges, windmills, or gas stations, transforming these in real-time into story elements. Additionally, it includes local weather conditions, supplemented with traffic and time data.

Why this is interesting:

Locations and conditions are elevated to become more than simply a landmark, a place, or a situation. Enriched with data, they provide additional information that can be adapted to different targets and circumstances. Imagine travelling and commuting becoming more insightful – whether it's simply about finding the next gas station or learning about a foreign area.

Visual Data is used to make real-time adaptive advertising.

Piccadilly Lights, one of the UK's most iconic landmarks and a globally recognized advertising space, got a makeover and was re-launched in October 2017. Landsec, the owner of Piccadilly Lights, has replaced the original patchwork of screens with a single state-of-the-art 4K LED digital screen and live technology hub, which allows the screen to react to certain external factors, such as the weather, the color of cars passing, the gender of passers-by or other real-time information. Equipped with cameras and by using algorithms, the billboard comes alive delivering targeted and context-relevant information and advertising.

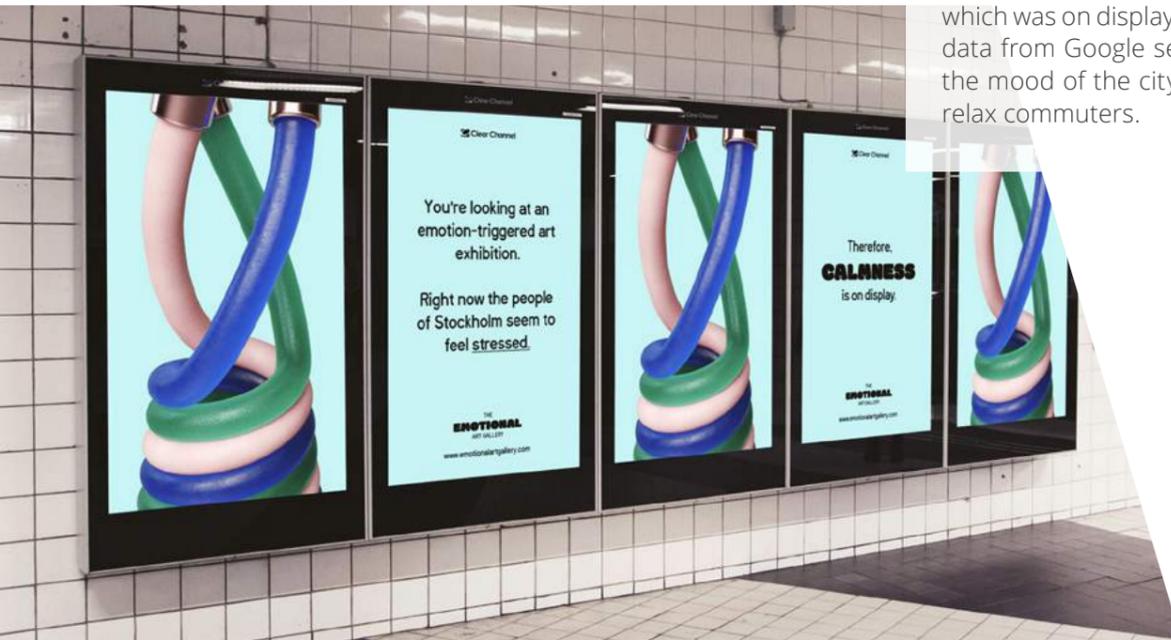
Why this is interesting:

Collecting real-time data on nearby people offers a big opportunity for marketers to serve highly relevant and personalized ads. Moreover, research has shown that interactive video ads are 32 percent more memorable than non-interactive ads and also have a 9x higher impact on consumers' purchase intent. So integrating an element of interactivity will enhance the physical experience and bolster out-of-home efforts.*



Stockholm's Metro transformed into emotion-triggered art exhibition.

Outdoor media company Clear Channel, who owns the network of digital billboards in the Stockholm Metro, launched an initiative aiming to help combat commuters' stress by displaying soothing artwork. By replacing ad content from 250 digital billboards with digital art, the company turned Stockholm's Metro into an Emotional Art Gallery. The Emotional Art Gallery, which was on display in Stockholm on March 7-24, 2019, synthesized real-time, publicly available data from Google searches, social media, news articles, and traffic information to determine the mood of the city. The system then used the data to select and display artwork meant to relax commuters.



Why this is interesting:

Collecting and analyzing personal data in order to specifically target people is nothing new. It is interesting to see, however, what happens if all this personal data is analyzed as a whole. What is the mood, speed, health of a city or a country? And what additional knowledge can we generate from those insights?

SUCCESSFUL INDUSTRY PLAYERS



Location-based services, predictive analytics



GPS / location hardware / technology



Real-time pricing



Macrotrend #2

NEXT NATURE



Bridges between technology and nature: with the synthesis between molecular and biotechnology, our perception of naturalness is undergoing a transformation process.

We have reached the Anthropocene: The age of humans. Humanities impact on earth is now so profound, that experts declared a new geological epoch in which the global connections that all living things rely upon are crumbling. We are living longer than ever, our population is growing, climate change can no longer be denied, while biodiversity is dramatically shrinking.

No wonder biology has become one of the most important technology platforms of the 21st century, as we are seeking solutions to make our planet and ourselves thrive again. Modern molecular biotechnology, or the implementation of our knowledge of the genome to engineer organisms, offers new solutions to today's challenges. New solutions for us humans in **Human Enhancement** (Microtrend #3) or for nature meaning advancements in **Green Tech** (Microtrend #4).

During the past years, the synthesis between molecular- and biotechnology has given rise to a new perception of nature. Constant technological developments and new findings in micro and macro biology prove that the

limitations of nature no longer appear to be absolute. Nature is shaped by human hands.

July 2019

Elon Musk announced he has tested his brain microchip on monkeys, and it enabled one to control a computer with its brain.

Technological innovations no longer represent a prosthesis but are becoming an important part of our life, extending our sphere of activity. Modern molecular biotechnology and nanotechnology, neurosciences, and medical engineering provide profound solutions to today's challenges. Even the creation of new life is no longer just a grand thought but reality. CRISPR/Cas* technology for example is a method by which the genomer of living organisms can be edited.

* CRISPR – Clustered regularly interspaced short palindromic repeats; Cas – CRISPR associated protein 9

DRIVERS

WHAT ENABLES THIS MACROTREND?

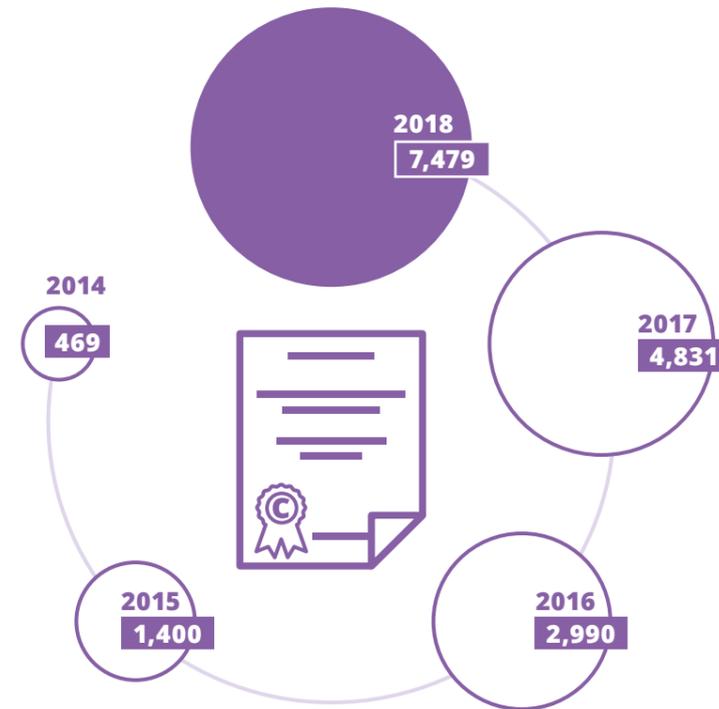
Technological advances and connectivity as well as breakthroughs in biotechnology have provided a new way to perceive and modify.

KEY MOTIF

WHY ARE WE KEEN ON SUCH OPPORTUNITIES?

We are trying to enhance and enrich nature in order to meet today's challenges when it comes to ageing, diseases, pollution, and resource scarcity. People want to enhance their bodies to increase performance or overcome their own restrictions.

// Total number of CRISPR patent applications worldwide



MANIFESTATIONS

Microtrend #3

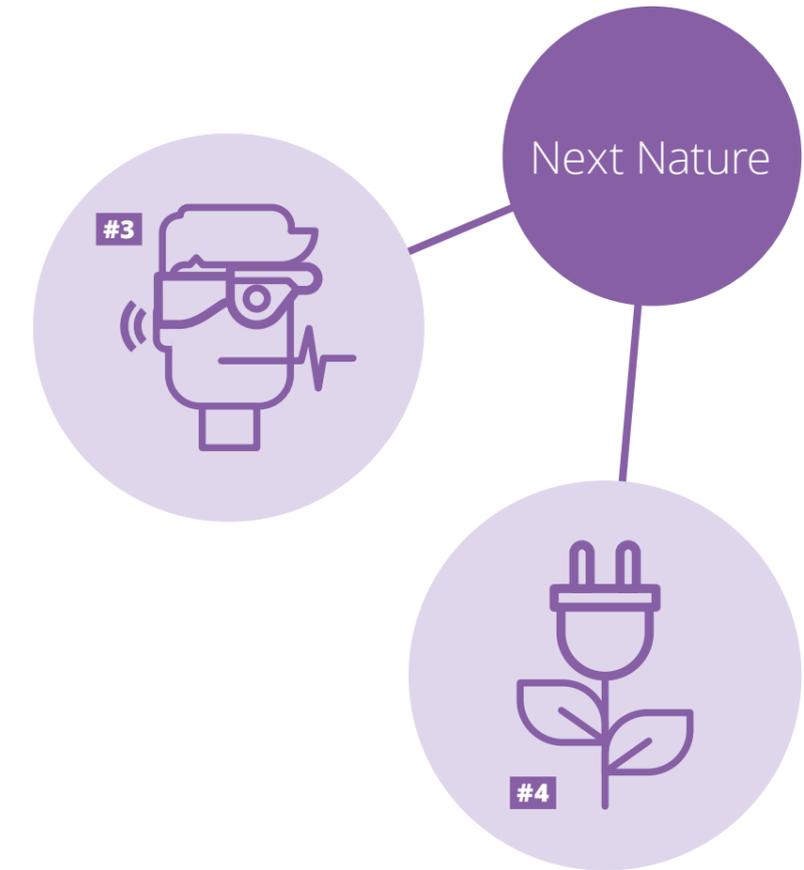
HUMAN ENHANCEMENT

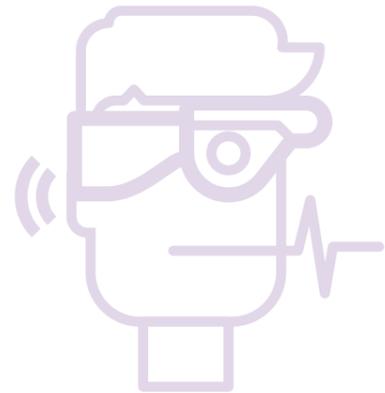
Technological progress offers a symbiosis of devices and biomatter, turning devices into extensions of the wearer's body. Technological innovations no longer represent a prosthesis but are literally becoming a part of our lives and bodies – extending our reach.

Microtrend #4

GREEN TECH

To counteract main global challenges like hunger and pollution, researchers are poring over biotechnological solutions that help save our existence. Biotechnology has expanded to include new and diverse sciences and techniques to create products that help counteract the damage we've caused to the planet, and find solutions to our increasingly growing population figures.





Microtrend #3

HUMAN ENHANCEMENT

Advances in technology are marrying devices and materials with biological powers, turning them into extensions of the wearer's body.

Throughout history, the development of new technologies has offered dramatic improvements in our quality of life. Today, technological innovations no longer represent a prosthesis but are literally becoming an important part of our lives and bodies. Human enhancement, however, does not mean erasing possible limitations of our bodies alone. It means optimizing our bodies and minds to perform better – regardless of any medical implications.

It's no longer about self-optimization via wearables alone. The fact that genome sequencing is becoming more affordable opens up many possibilities. Advancements in genome editing via CRISPR/Cas will potentially help us to live healthier, longer lives.

Technology inserted in or applied to our bodies, the implementation of tiny nanobot nurses and DNA-bots in our veins – or even custom-crafted microbes –, the use of high-tech prosthetic devices helps us overcome the current limitations of our bodies through natural or artificial means. Temporarily or permanently.

Even if the legal status quo as well as unforeseen long-term consequences are nebulous, wearables like health trackers and smart tattoos are proof that the majority of people is willing to let technology get up close and personal today.

What's in the trend?

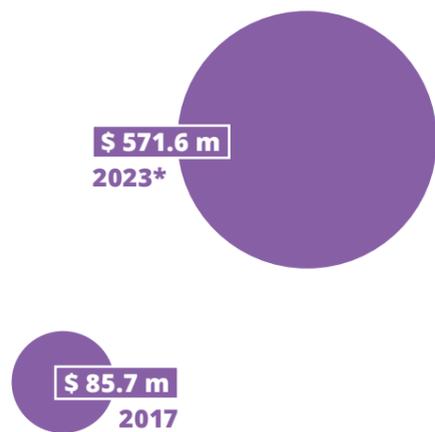
- WEARABLE TECHNOLOGIES // TATTOOABLES //**
- THINKABLES // SMART MATERIALS //**
- SMART PROSTHETICS // BIOCYBERNETICS //**
- BRAIN-COMPUTER INTERFACES //**
- COGNITIVE COMPUTING // NANOBOTS //**
- BIOELECTRONICS // NEURO AND MATERIALS SCIENCES //**
- MEDICAL ENGINEERING**



SUPPORTING FACTS

BODY

// Size of the medical exoskeleton market worldwide



The Amputee Coalition of America estimates that the amputee population will more than double by the year 2050 to

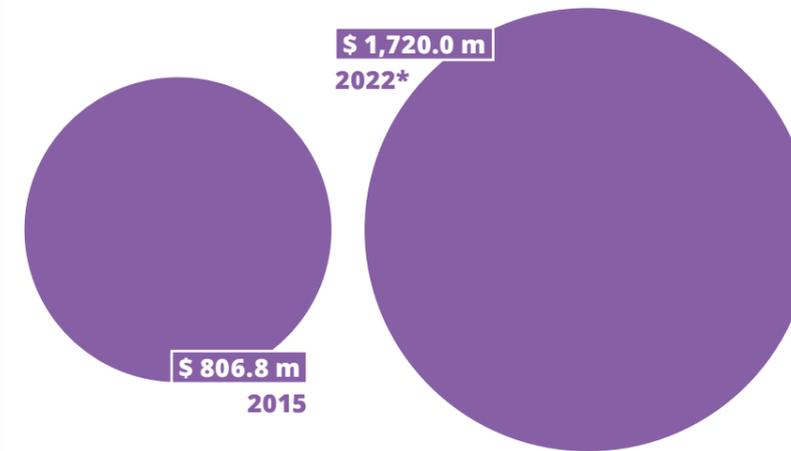
3.6 m.

The size of the global wearable robotic exoskeleton market worldwide was valued at some \$ 127.4 m in 2017 and is projected to increase to over

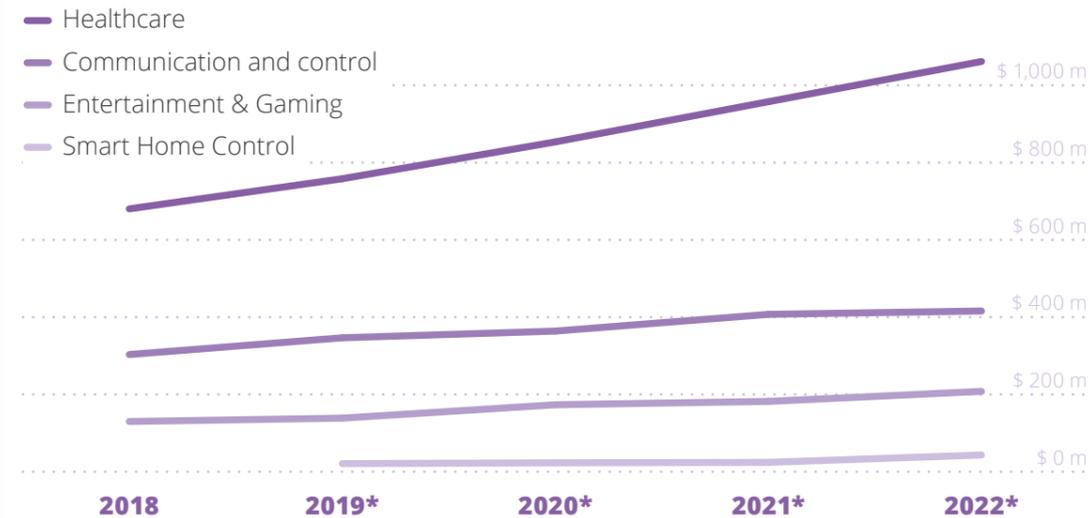
\$ 5,438 m
by 2028.

BRAIN

// Brain computer Interface (BCI) market revenue forecast worldwide



// Brain computer interface market size – worldwide



Human Enhancement is at least as old as humanity itself.

Every day, we try to enhance ourselves by exercising our muscles with workouts or our brains with meditation and lots of coffee.

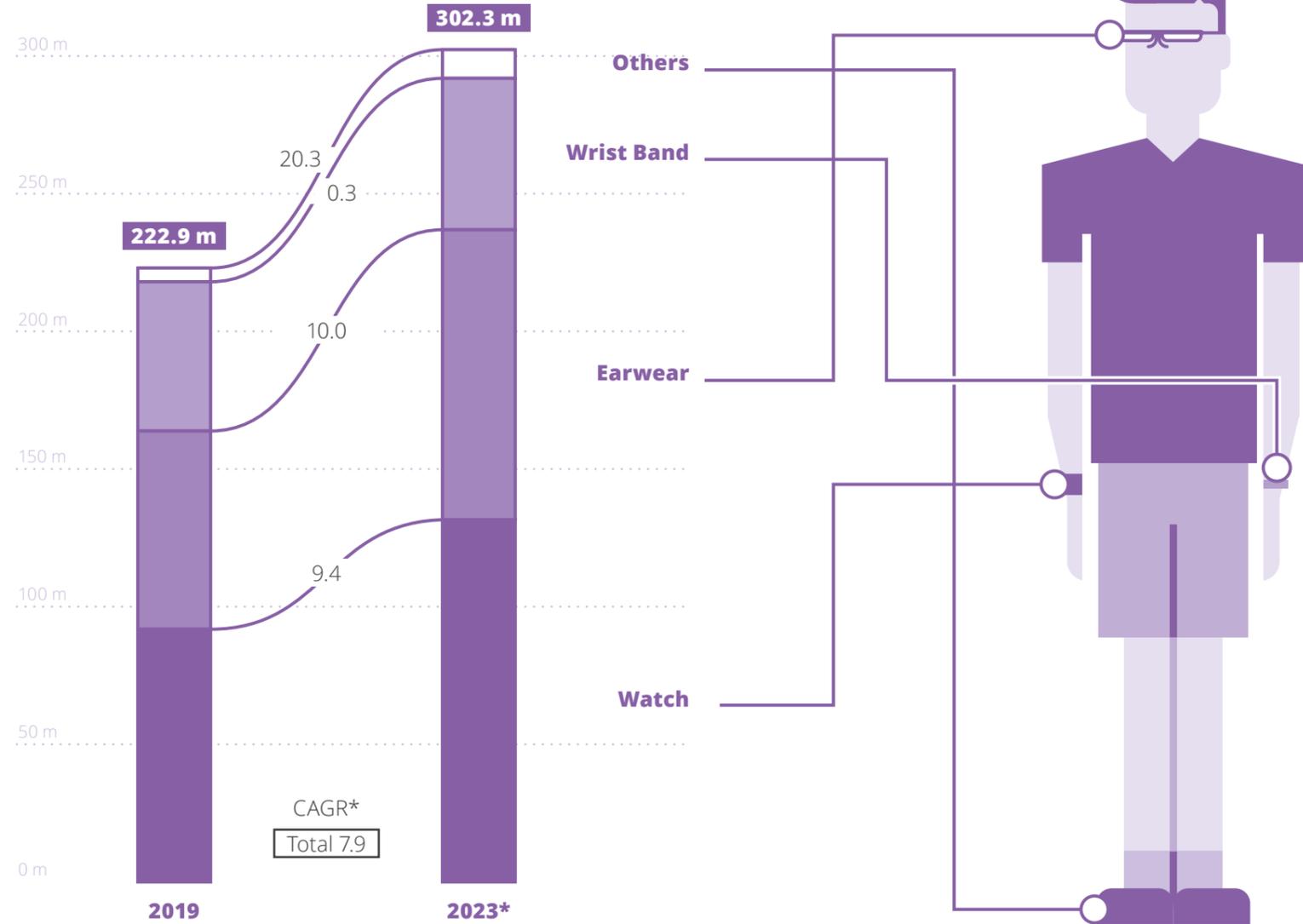
Advancements in human enhancement technologies, however, are finally opening up huge new possibilities: These technologies are mainly separated into upgrading or restoring physical and psychological abilities – be it for medical purposes or for improved performances.

Human enhancement technologies today are mainly used for restorative reasons following a congenital defect at birth, an accident, or illnesses. Key drivers of the market include a rising global geriatric population base and an increasing prevalence of neuroprosthetic conditions.

In the future, the use of this technology in virtual gaming, as well as in home control and security systems, will further fuel the growth of the market. While opening your car simply by swiping your finger might sound far-fetched for a mass-market, we definitely see that market catching fire.



// Worldwide wearables forecast by product category, shipments



* Forecast



While Human Enhancement is mainly attributed to medical purposes, we see a new wave of non-medical enhancers gaining ground: Think of adaptive apparel and wearables.

Adaptive apparel for example – a growing but still underserved global market.

Adaptive apparel encompasses clothing and footwear designed to support consumers with health conditions or disabilities. Both the global market for adaptive apparel and smart shoes will continue to grow steadily over the next years.

The segment of smart shoes is an innovative entry in the market, offering physical performance or navigation trackers. But the segment is evolving in terms of its key features. An increasing number of manufacturers is focusing on innovations that cater to performance-enhancing requirements. In partnership with Puma, the MIT Design Lab is developing biologically active smart shoes that sense how the wearer feels and then adapt to it. Apple is designing smart shoes that could

prevent damage to feet, helping users to avoid an injury.

And finally there are wearables that help us enhance our performances. Smart watches, smart wristbands, and smart earwear are not only monitoring our health conditions but also enhancing our personal fitness or biometrics. Worldwide shipments of wearable devices have topped 222.9 million in 2019, according to the IDC. And the Future Today Institute predicts that global sales of consumer wearables (non-medical) should generate revenue of 38 billion U.S. dollars in 2020.

The global smart shoe market is forecast to grow in value from \$ 115.3 m in 2018 to

\$ 223.4 m by 2026.

The global market for adaptive apparel is estimated to grow to

\$ 349.9 bn in 2023.

STATISTA RELEVANCE COMPASS

Evaluation Insights:

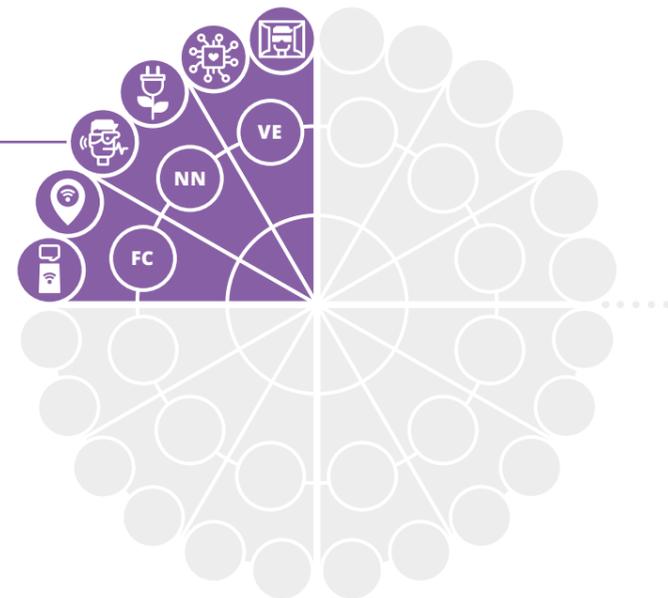
We define the market for Human Enhancement along two core angles. The first being: Are the products and services necessary from a medical point of view (like a Bluetooth-enabled pacemaker) or originating from the wish to achieve a biological performance (like exoskeletons enhancing physical strength)? The second angle refers to the localization of products: Is it outside the body (like wearables) or implanted, like BCI (brain computer interface) solutions, for example?

We expect the market for end consumer-oriented Human Enhancement products and services to reach a volume of up to approx. 110 billion U.S. dollars globally by 2025.

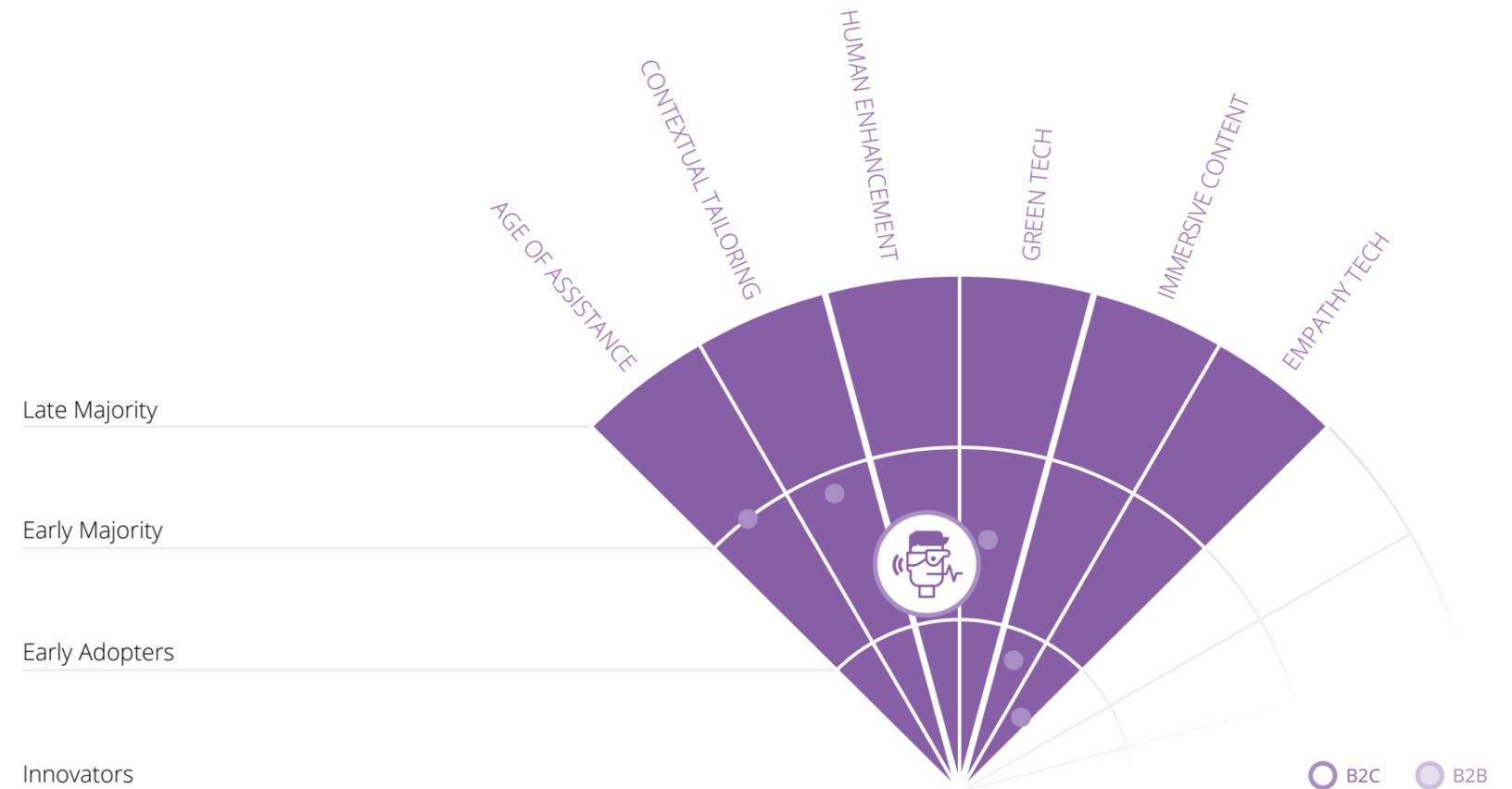
Scientific and technical progress will enable higher added value and customer acceptance of respective products and services. As many of these offerings are still at an early stage, we locate this microtrend currently slightly beyond early adopter level but expect a strong push in market readiness and proliferation.

TECHNOLOGICAL CHANGE

3 / NEXT NATURE
// HUMAN ENHANCEMENT

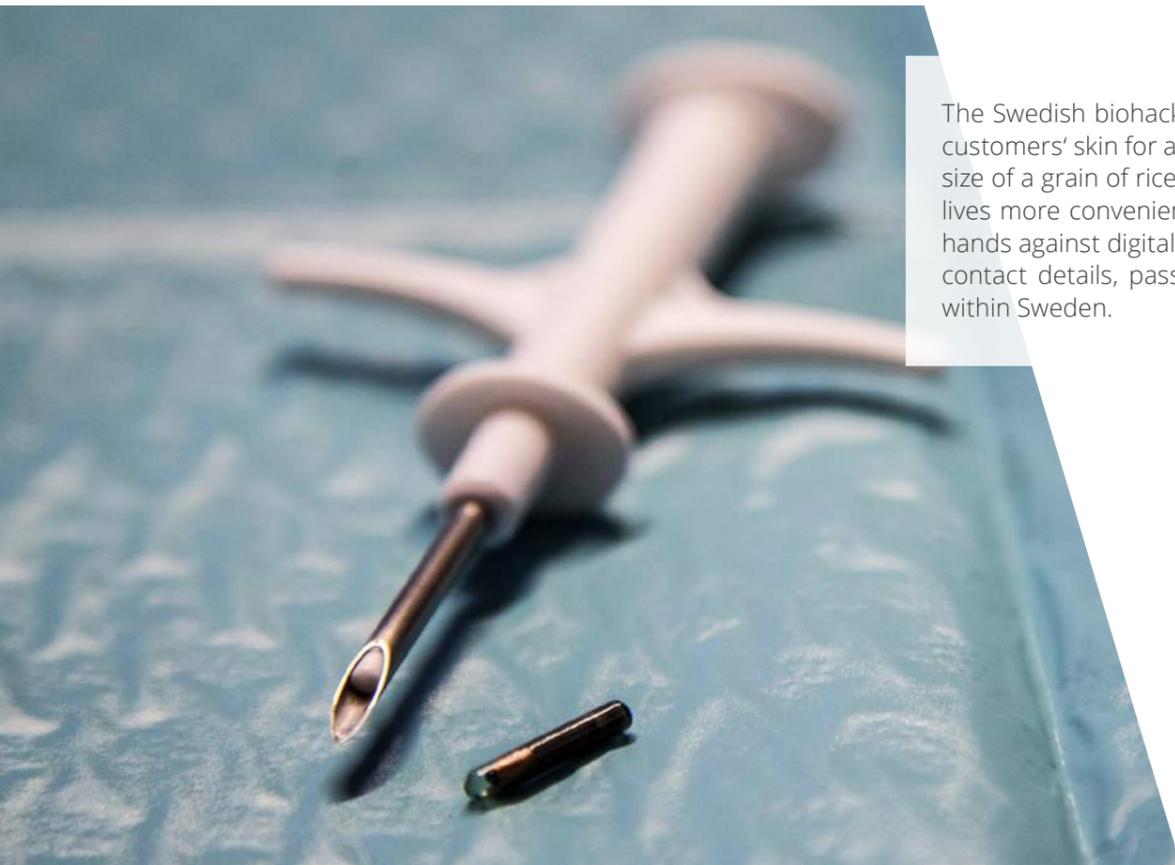


FC FLOW CONTROL NN NEXT NATURE VE VIRTUAL EXPERIENCES



INNOVATION SNAPSHOT

Insertable microchips to unlock the future.



The Swedish biohacking startup Biohax International is successfully injecting microchips into customers' skin for about 180 U.S. dollars (with over 4,000 implanted chips so far). Around the size of a grain of rice, the chips are designed to speed up users' daily routines and make their lives more convenient – accessing their homes, offices, and gyms is as easy as swiping their hands against digital readers. The same embedded chip also can be used to store emergency contact details, password data, social media profiles, or e-tickets for events and rail travel within Sweden.

Why this is interesting:

Current use cases only hint at the extraordinary potential for microchip implants – in Sweden and around the globe. In the not-so-far-away future, skin-embedded microchips will transform how we share data, how we protect our finances, how we access places and services. Imagine, for example, you could not only unlock doors or transfer money by waving your hand, but also safely store critical information about your health status to ensure the correct medical treatment in case of an emergency.

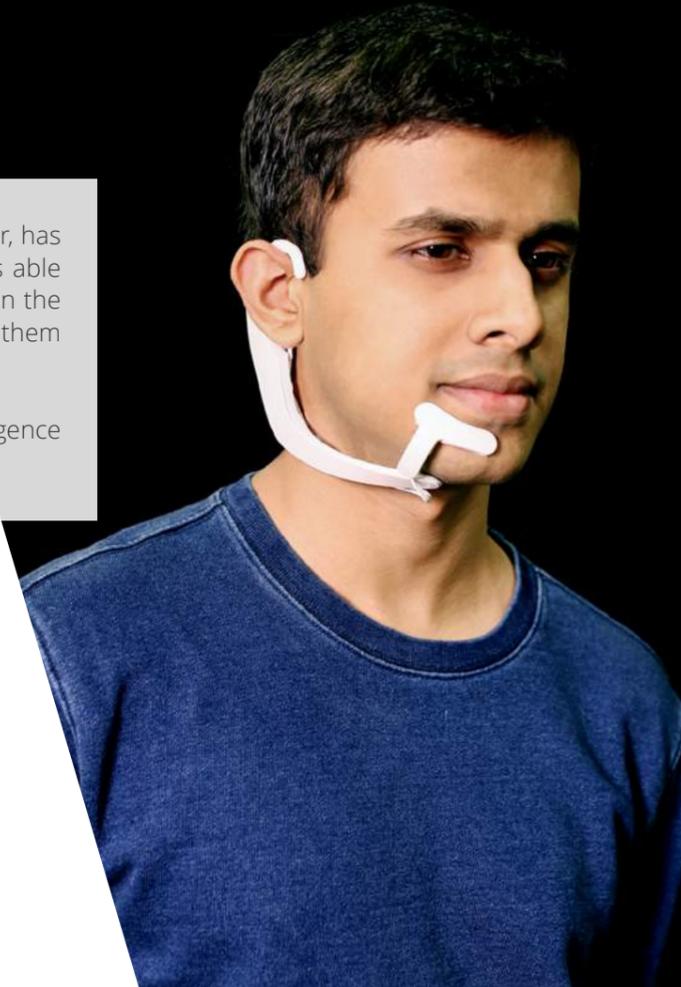
A device translating silent thoughts into speech.

AlterEgo is an AI-enabled headset device that Arnav Kapur, an MIT Media Lab researcher, has been developing for the past several years. Via powerful sensors, the small headset is able to detect the signals the brain sends to internal speech mechanisms. It then picks up on the internal vibrations and transmits them to an AI embedded in the device, which translates them into language.

AlterEgo allows humans to converse in natural speech with machines, artificial intelligence assistants, services, and other people without a voice.

Why this is interesting:

Imagine you could never forget anything. This device will give you the perfect memory, making silent notes that can be recorded and read back whenever you need it. AlterEgo is all but the smarter version of yourself inside yourself.



Striving to shape human potential.



Seismic, a California-based startup, is taking on the wearables market with their “Powered Clothing”: apparel that enables wearers to overcome limitations and achieve full physical potential. “Powered Clothing” integrates discreet robotics, designed to help move better by working in collaboration with the body to give strength, stability, and power.

Seismic has also entered into an agreement with one of the largest construction organizations in Japan, Obayashi Corporation, to begin co-developing next-generation industrial “Powered Clothing”. The industry-specific clothing will support workers’ core muscles to help augment strength when lifting, carrying, or standing for long periods of time.

Why this is interesting:

Imagine a future where you have more strength, more power, and more endurance just because you are wearing your clothes. Clothing will become more than fashion, it will support you in your daily life, giving you assistance (see Age of Assistance) and enabling you to perform better.

SUCCESSFUL INDUSTRY PLAYERS



**Wearable technologies /
exoskeletons**



**Medical implants /
nanomedicine & gene therapy**



Mental enhancements





Microtrend #4

GREEN TECH

Biotechnology has expanded to include new and diverse sciences and techniques to create tangible products to counteract the damage we've caused to the planet, and catch up with our increasing growth in the world's population.

Throughout history, the development of new technologies has offered huge improvements in our quality of life. For thousands of years, humankind has used biotechnology in agriculture, medicine, and food production.

Today, biotechnology has expanded to include diverse new sciences and techniques to create solutions to counteract the damage we've caused to the planet, and to catch up with the increase of the world's population. In order for traditional agriculture to meet the global demand for food, researchers are trying to make farming resemble modern manufacturing.

New kinds of smart in- and outdoor plant factories and micro-farms are endeavoring to see whether produce and grains can be grown in spite of climate change. Advancements in agricultural drones will soon assist with planting, harvesting, and pest control. Genetically modified crops help fight germs and viruses. Synthetically produced food is surpassing factory farming, as scientists are getting closer to largely culturing meats in labs or researching 3D-printed foods.



And thinking big: large-scale technological and scientific interventions like geo-engineering and terraforming are looking for new approaches to cope with global climate change and find alternatives for our future.

What's in the trend?

- BIOENGINEERING // LAB AGRICULTURE //**
- GENOMIC EDITING // BIOINTERFACES //**
- AGRICULTURAL TECHNOLOGIES // MICROFARMS //**
- AUTOMATED FARMING // ROBOTIC HARVESTING //**
- CRISPR // NANO-ENGINEERING // GEOENGINEERING //**
- TERRAFORMING**

SUPPORTING FACTS

In order to mitigate the effects of climate change while at the same time providing enough food for our ever-growing population, researchers are fiercely working on sustainable solutions that help save our existence.

According to the United Nations, our earth will be home to over 9.8 billion people by 2050. In order to substantially feed this growing population, the UN's Food and Agriculture Organization stated that the global agricultural production must rise by 70 percent to meet the projected demand. Current farms, however, will not meet this 70 percent mark without getting smarter and more efficient, in order to counteract both the challenges of producing more foods and the impact of a reduced amount of harvested crops due to pollution effects at the same time.

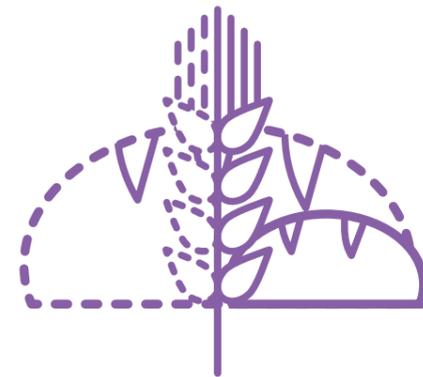
That's why researchers and engineers all over the world are working on new opportunities to transform food and land use systems. A recent report from the Food and Land Use Coalition stated that our current food and land use systems cause up to 30 percent of total

According to the latest U.N. estimates, we're going to need to produce

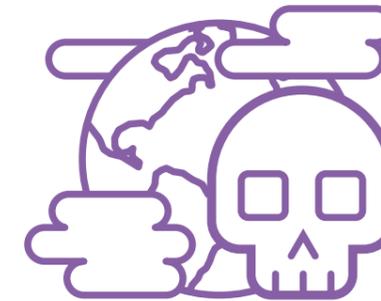
70 % **more food by 2050 to meet global nutrition needs.**

The revenue in the Food & Beverages segment amounts to globally

\$ 65.5 bn
in 2019.



FOOD SCARCITY



POLLUTION

Global temperature is up
1.9°F **since 1980.**

Global carbon emissions in 2018 are
set to hit an all-time high of
37.1 bn t.

7 **of the world's 10 most**
polluted cities are in India.

greenhouse gas emissions driving climate change.

New agricultural systems that are both productive and regenerative, and which will combine traditional techniques, such as crop rotation, with modern technologies, such as advanced precision farming, will allow for a more sustainable and reasonable use of our resources.

Moreover, alternative food sources will little by little make up for the growing demand for food, while at the same time being more resource-effective and climate-friendly.



Plant-based meat alternatives are no longer a small niche for vegetarians but are becoming more and more mainstream.

In the past two years, we have seen plant-based meat alternatives sales – like sales of plant-based dairy alternatives – gain momentum, outpacing the sales of traditional meat. Sales of plant-based meat alternatives grew by 23 percent in 2018 alone, and even more growth is expected for the next years. In just 20 years, says management firm AT Kearney, the majority of meat products will no longer come from slaughtered animals. Instead it will be sourced from cultured meat or plant-based alternatives.

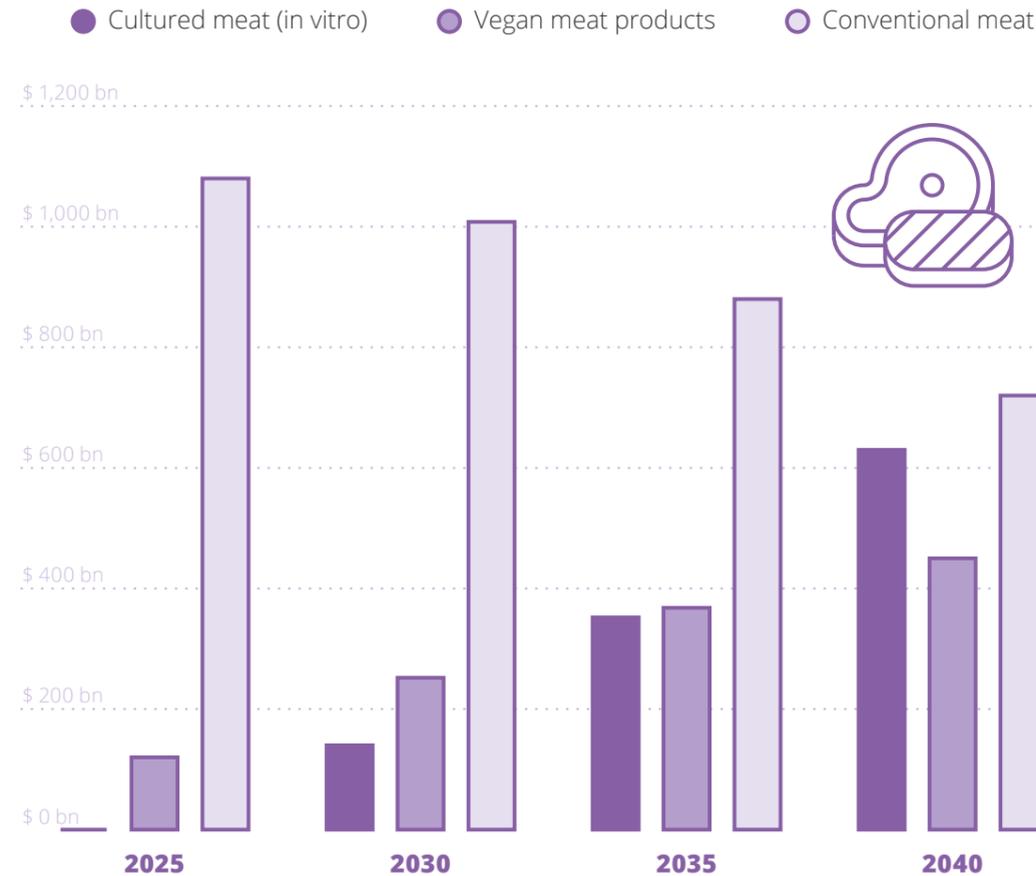
The huge success of the meat alternatives is driven by the extraordinary evolution of the products – in terms of pricing as well as in terms of look, taste, and mouth-feel. In 2013, the University of Maastricht introduced the world to the first lab-grown hamburger patty, and back then it cost 330,000 U.S. dollars to create.

Fast forward to 2020, these modern meat substitutes no longer bear relation to former too-much-effort veggie burgers, and they do no longer target a marginal group of eaters. About 30 percent of Americans (and Americans are known for eating quite a lot of meat), say that they're reducing their meat consumption, and 32 percent consider themselves flexitarian. This is not just a U.S. phenomenon, it increasingly becomes a global trend, as research shows.

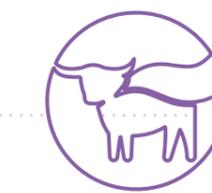
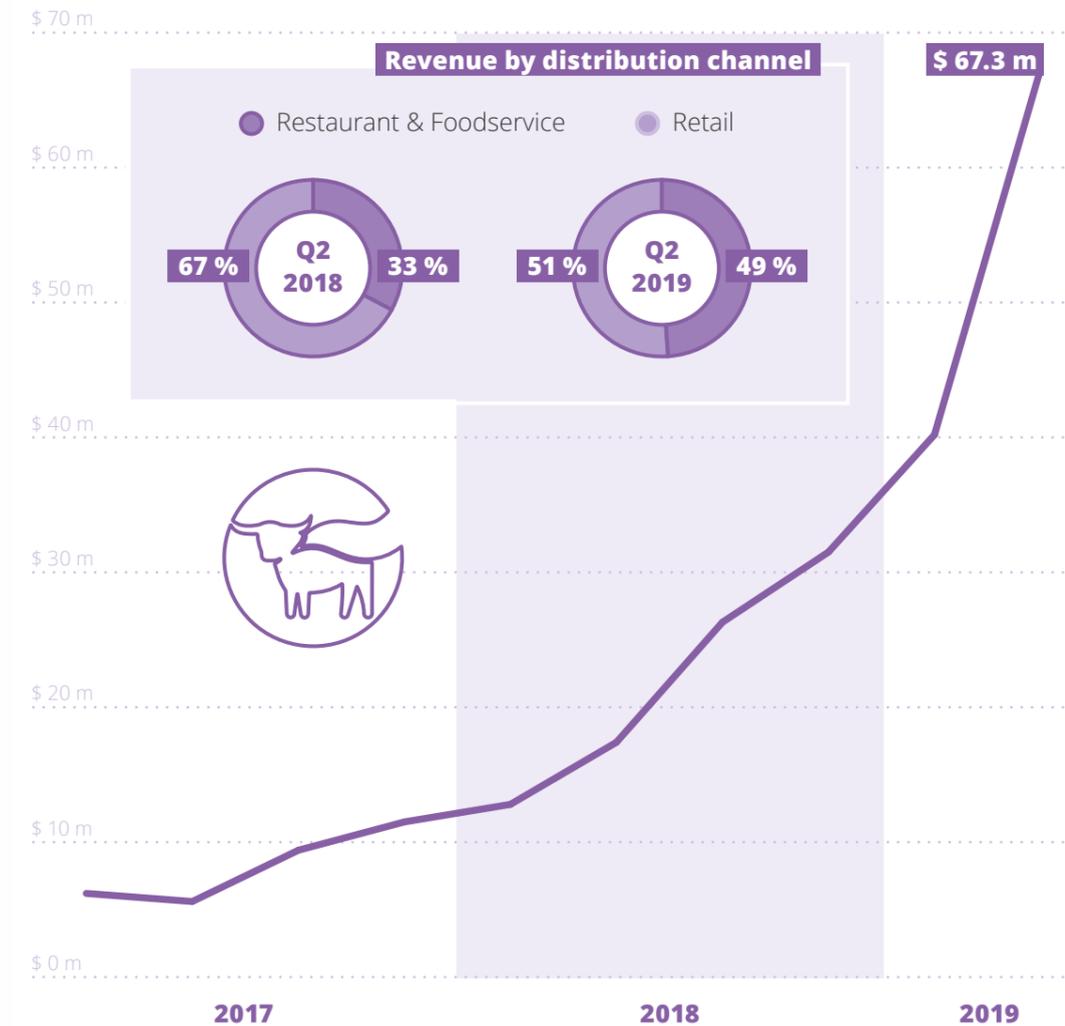
Slaughter-free is the future:

By 2040, 60 % of meat products will be cultured or plant-based.

// Forecast sales of meat market with meat substitutes and meat alternatives worldwide



// Global quarterly revenue of Beyond Meat since Q1 2017



Since 2008, the menu penetration

of the term vegan on menus in the U.S. has grown by 490 %.

The total venture investment in Impossible Foods is at more than

3/4 of a billion dollars.



IoT solutions and precision agriculture are focused on helping farmers to close the supply-demand gap, by ensuring high yields, protection of the environment, and profitability.

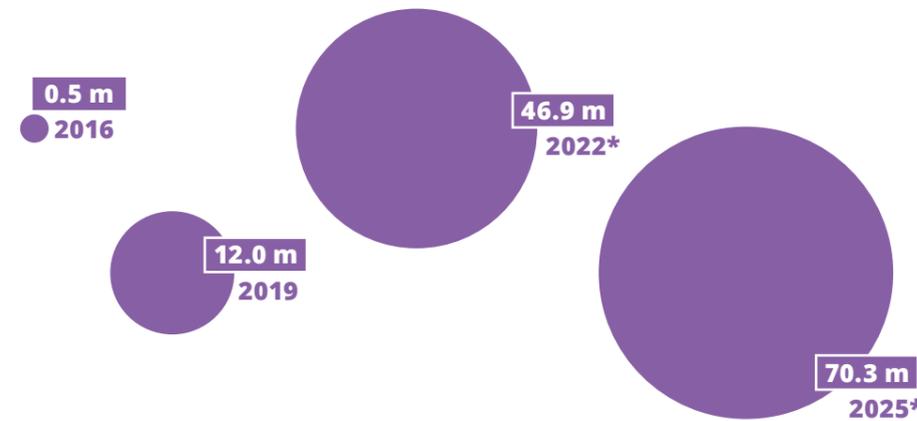
An exponential growth of the world population, shrinking agricultural lands, pollution issues, and shrinking resources have accelerated the need to enhance traditional farming with modern techniques. Another imminent challenge for the farming industry is globally declining agricultural labor, which has made the need for more efficient farming even more necessary.

In order to catch up with the escalating demand for food from limited resources and labor, the farming industry is innovating new solutions – especially with technological means. The approach of using precision agriculture, for example, ensures an optimal application of resources in order to achieve high crop yields while reducing operational costs at the same time.

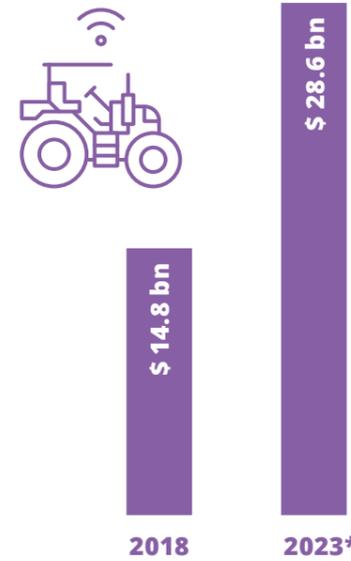
We have seen precision agriculture expanding to various regions, including North America,

Europe, South America, Asia-Pacific, and the Middle East & Africa. In 2018, North America dominated the global precision agriculture market growing at a CAGR of 37.3 percent in the period between 2018–2025. Precision agriculture in Asia-Pacific however is anticipated to grow at the fastest rate in coming years – due to the rising population and food demand in developing economies such as India and China.

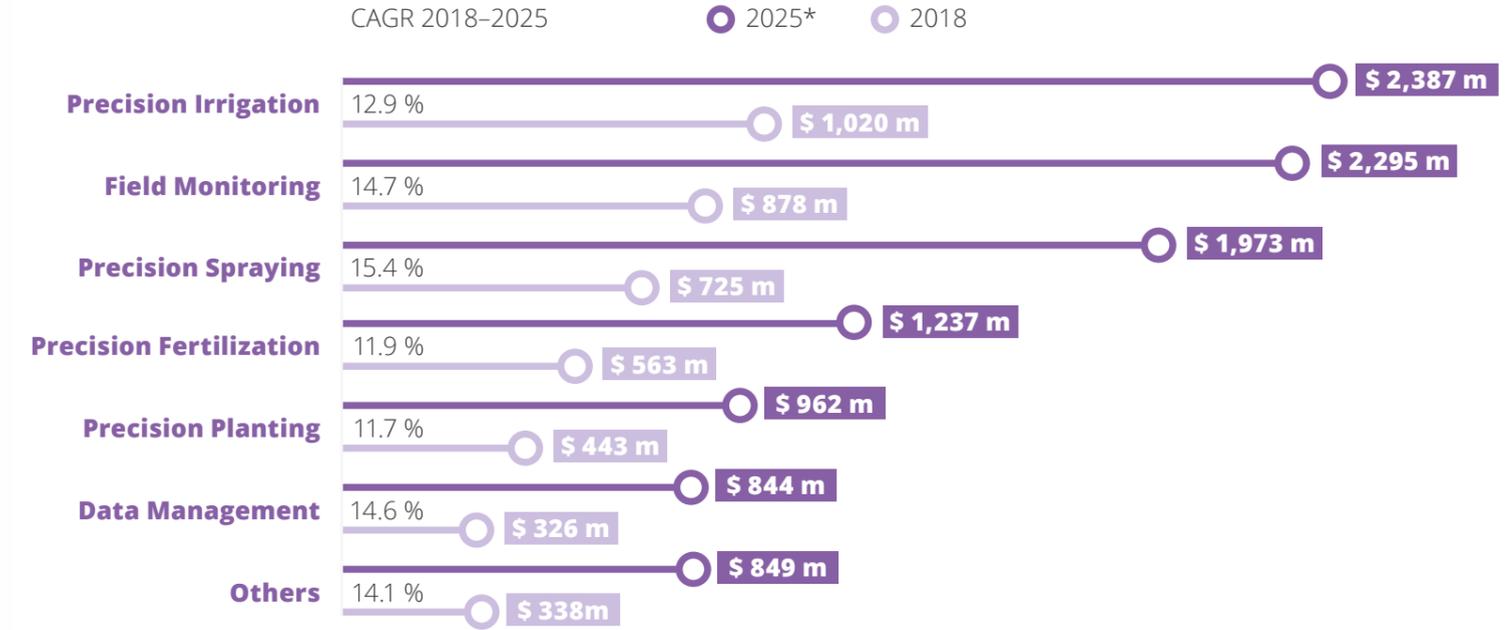
// Number of Internet of Things (IoT) active connections in agriculture in the European Union*



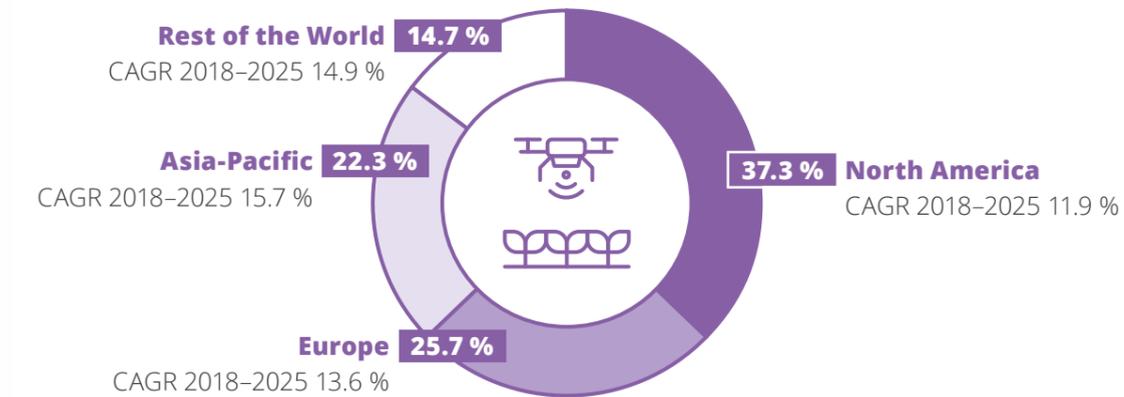
// Global agricultural IoT market size



// Global precision agriculture market by application



// Global precision agriculture market by region



The global precision agriculture market is projected to grow from \$ 4.84 bn in 2018 to

\$ 14.1 bn by 2026.



STATISTA RELEVANCE COMPASS

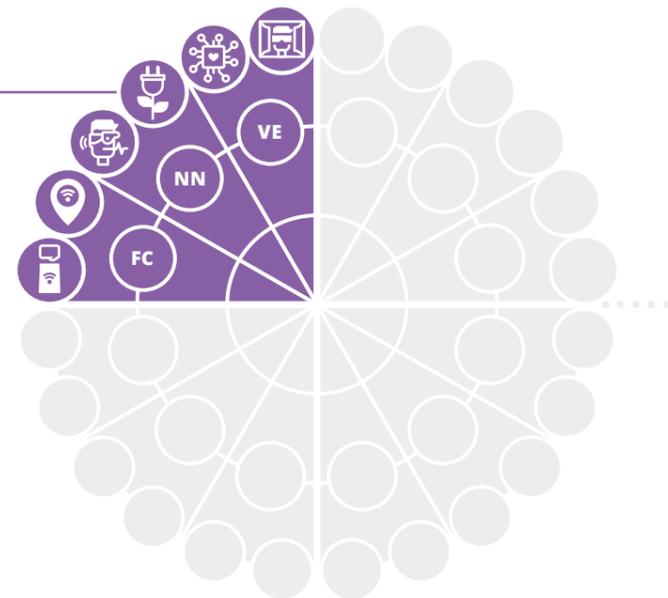
Evaluation Insights:

“Tech” seems to be deeply interwoven in almost every aspect of modern agriculture – from genetically modified seed development to precision farming and connected livestock. To quantify the end consumer market potential of Green Tech, we referred to the massively emerging market segment of meat substitutes. While the overall market for meat products is expected to grow to 1.2 trillion U.S. dollars by 2025, we expect the market for meat substitutes to grow up to approx. 135 billion U.S. dollars by 2025. Of course, there are also several other end products for consumers enabled or at least affected by Green Tech. These are not included in these numbers.

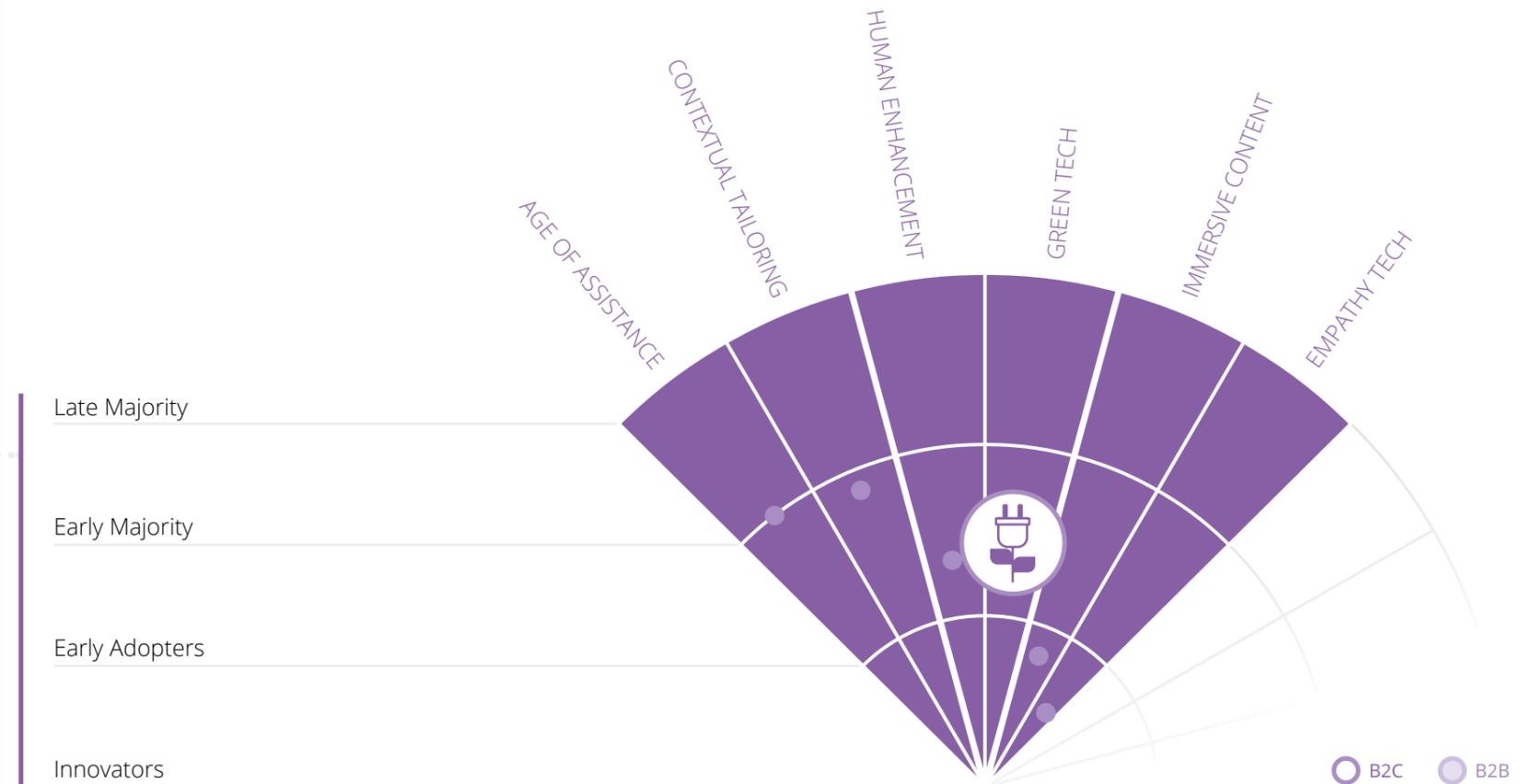
Though still currently located at post-early adopter level, we expect a strong increase in consumer base and consumption until 2025. Main drivers are strong investments in meat substitute startups on the one hand, and increased customer awareness fueled by discussions around climate change and personal health on the other.

TECHNOLOGICAL CHANGE

4 / NEXT NATURE
// GREEN TECH

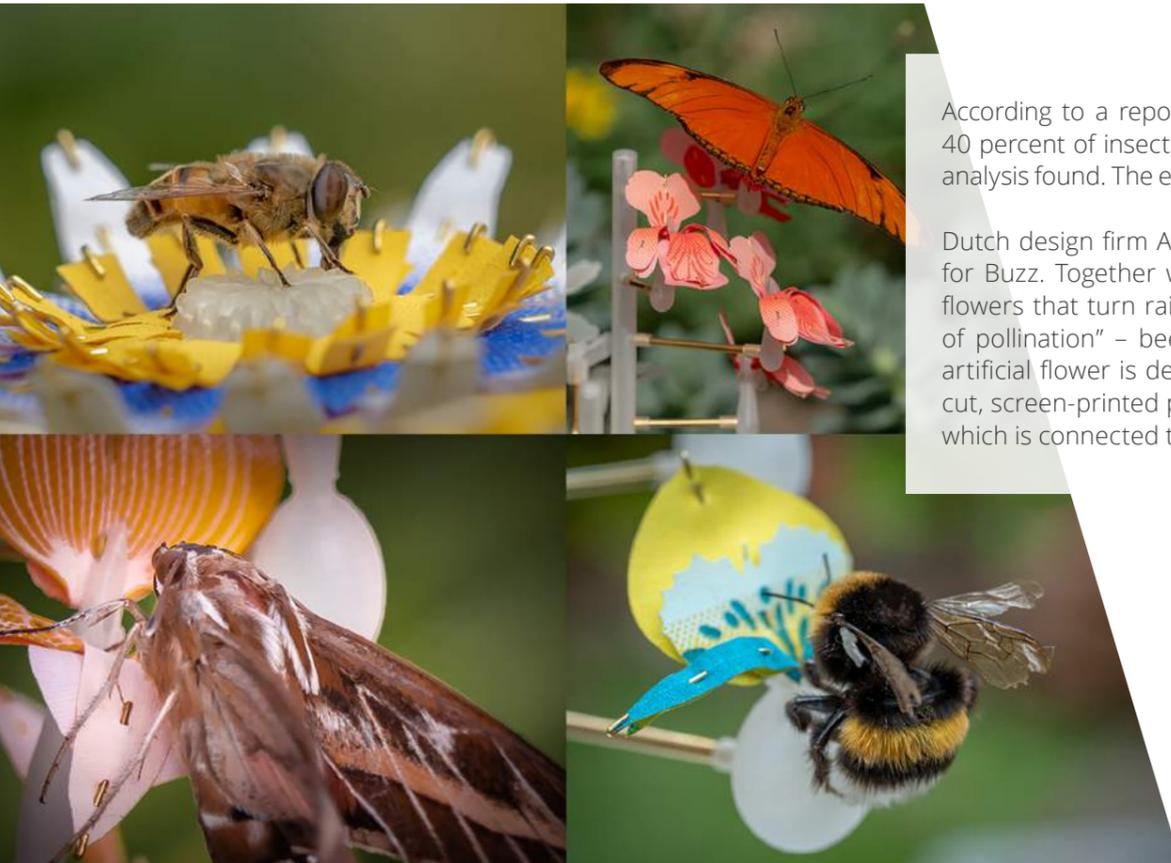


FC FLOW CONTROL NN NEXT NATURE VE VIRTUAL EXPERIENCES



INNOVATION SNAPSHOT

Food for Buzz is making urban environments flower again.



According to a report, published in the journal “Biological Conservation”, in April, more than 40 percent of insect species are declining in numbers and one third are endangered, a recent analysis found. The extinction rate is eight times higher than that of mammals, reptiles, and birds.

Dutch design firm Atelier Boelhouwer is working against that fact with a project called Food for Buzz. Together with engineers and scientists, Boelhouwer designed a series of artificial flowers that turn rain into sugar water, to serve as emergency food sources for the “big five of pollination” – bees, bumblebees, hoverflies, butterflies, and moths. Each self-sustaining artificial flower is designed to cater to the taste of a specific insect and is made up of laser-cut, screen-printed polyester petals, with a small 3D-printed container attached at the center, which is connected to a hollow 3D-printed stem.

Why this is interesting:

Biodiversity has become a major issue in urban city planning. By making our cities greener, we encourage animals living in the wild, such as bees, for example, to reconquer urban space. As pollinators, bees play a very important role, especially in terms of food production for humans, and many foods we regularly enjoy would not exist without bees.

Burger King is rolling out the Impossible Whopper nationwide.

In April 2019, Burger King started running a regional test of the Impossible Whopper – the plant-based alternative to the beefy burger. It took only 4 month before the fast-food chain had made the faux-meat burger available nationwide in all of its 7,200 restaurants starting in August 2019.

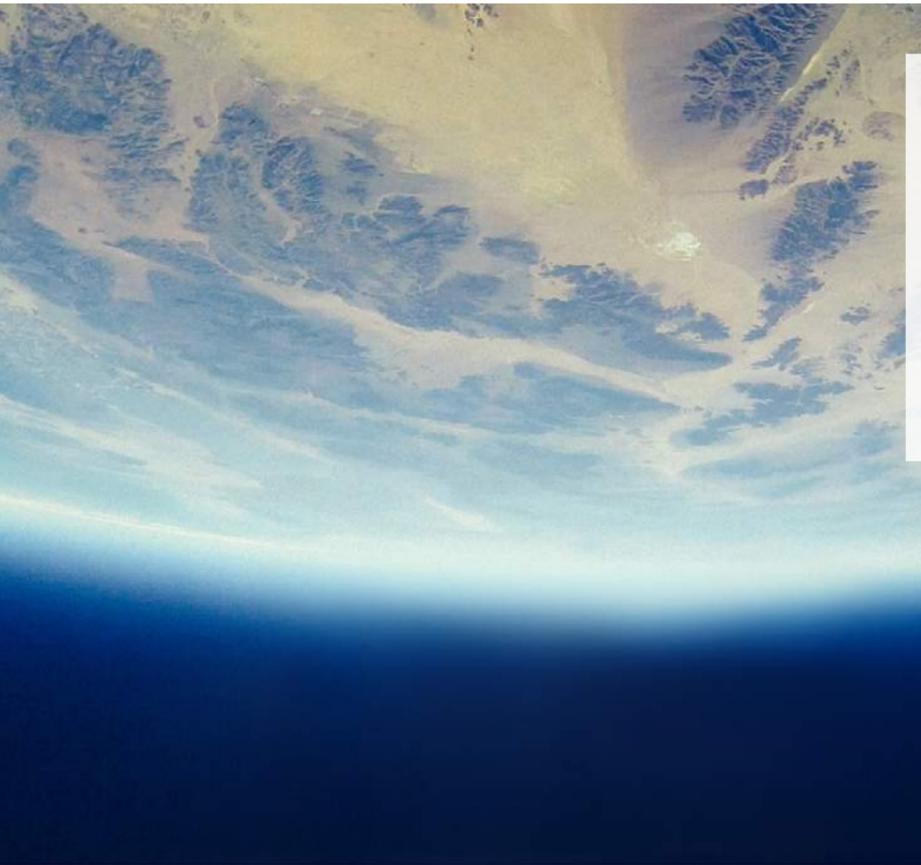
The nationwide availability of the Impossible Whopper does much to assuage concerns that plant-based patties are a fad. And Burger King’s bet on faux meat is paying off, as the Impossible Whopper is boosting sales and bringing in new customers, according to an analysis by Cowen.

Why this is interesting:

If the burger can gain traction at the chain, and if the same thing happens at other fast-food restaurants that serve it or other plant-based alternatives, like the Beyond Burger, faux-meat burgers could make a real difference for the environment.



Solar geo-engineering might be closer than we thought.



Researchers and scientists are increasingly exploring geo-engineering, a strategy that might help avert global warming through the intentional, large-scale modification of the climate. The UN Environment Assembly considered a proposal in March 2019 to research solar geo-engineering. Solar engineering is a method to cool the earth by blanketing the sky with aerosol chemicals. By reflecting a small amount of sunlight back into space, the average global temperature could be lowered.

So far, this measure has not been successful – not because countries were restrained to further investigate geo-engineering, but because some, like the U.S. for example, feared the plan would limit research while not addressing the issues of climate change.

Why this is interesting:

The Earth's temperature is already 1°C beyond pre-industrial levels, and global warming is accelerating faster than ever before. By 2040, we're going to breach the 1.5 degree of warming mark, according to the UN. Floods and extreme heat will become more common. Geo-engineering is an ambitious set of experiments to help mitigate these effects, manipulating the environment yet not replacing the necessary measures to reduce emissions.

SUCCESSFUL INDUSTRY PLAYERS



Agricultural drones and robots



Agricultural biotechnology



Genome editing



Animal data



Macrotrend #3

VIRTUAL EXPERIENCES



The experience economy is linking entertainment with sensual stimulation and personal information. Digital technologies are creating immersive and interactive experiences that inspire new levels of engagement.

Trendwatchers have been talking about the experience economy forever. But now commercially available tech is adding a whole new level to it. Now experiences worth remembering are no longer limited to the real world. Innovative virtual immersions are becoming increasingly accessible for millions of connected consumers. Blurring offline and online, real and imagined worlds, these experiences enable new possibilities that fuel inspiration and stimulation.

Technology has evolved from facilitating communication to enabling multi-dimensional interactions and collective experiences: from online gaming, to online dating, and to online education, from digital medical consultation to social networking. **Immersive Content** (Microtrend #5) is more than a buzz.

Augmented and virtual reality (AR and VR) or mixed formats in mixed reality (MR) have evolved to fascinate billions of consumers in artificial worlds. The global augmented and virtual reality market amounted to an estimated 20.4 billion U.S. dollars in 2019 and is expected to expand drastically in

the coming years, with forecasts for 2022 eclipsing 192 billion U.S. dollars.

In 2019, the global augmented and virtual reality market is forecast to reach

\$ 20.4 bn.

New immersive worlds are opening up via smartphones and VR helmets, or smart glasses, like Oculus Quest and Microsoft HoloLens. Users can easily interact with virtual objects via click, voice, or gesture control. Enriched with haptic and olfactory elements, these digital simulations feel almost authentic and life-like, adding a whole new level to experiencing interactions online. **Empathy Tech** (Microtrend #6) is opening up new emotional territories by trying to decipher moods and feelings.

DRIVERS

WHAT ENABLES THIS MACROTREND?

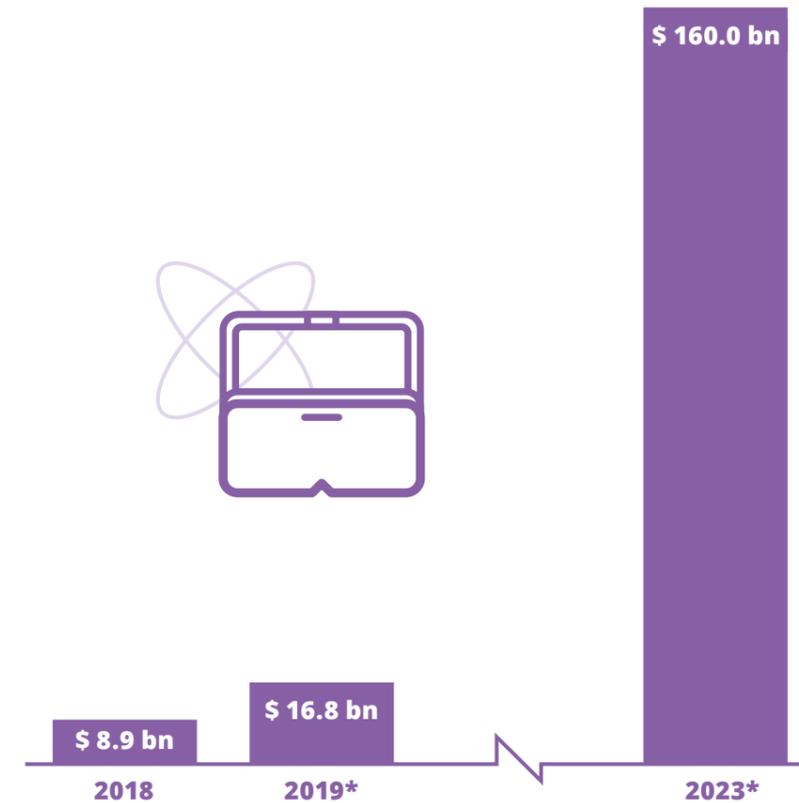
Virtual reality and augmented reality have a profoundly transformative effect on the way we live and work in the future. Solutions which are allowing humans to explore fully immersive computer-generated worlds and overlay computer graphics onto our real world view are increasingly being adopted in both entertainment and industry.

KEY MOTIF

WHY ARE WE KEEN ON SUCH OPPORTUNITIES?

People are longing for new forms and formats of experience that are no longer restricted to reality.

// Forecast augmented and virtual reality market size worldwide



* Forecast

MANIFESTATIONS

Microtrend #5

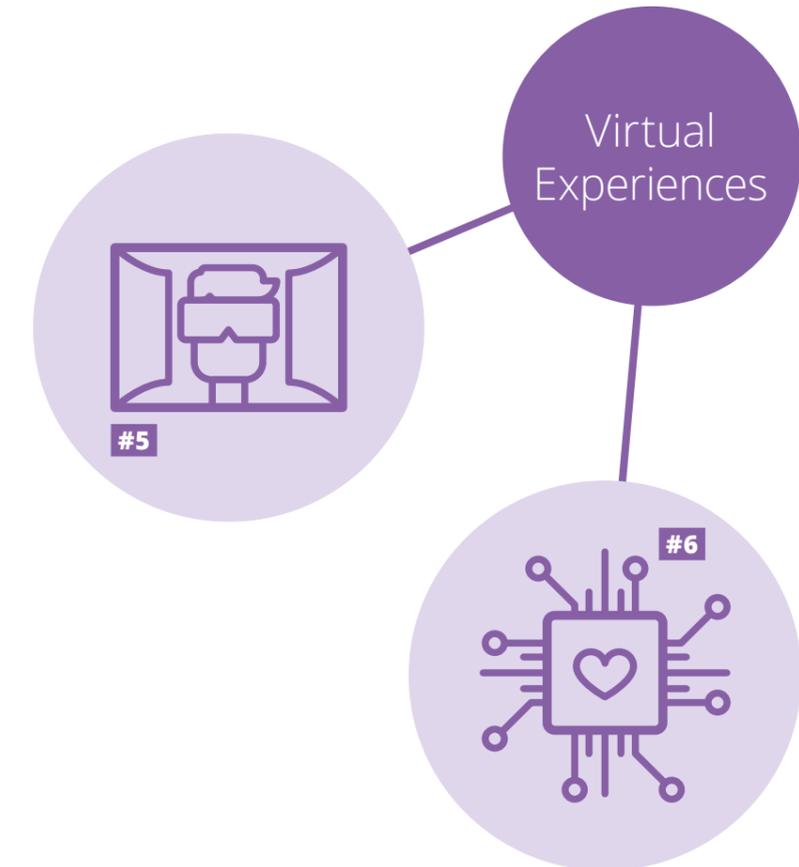
IMMERSIVE CONTENT

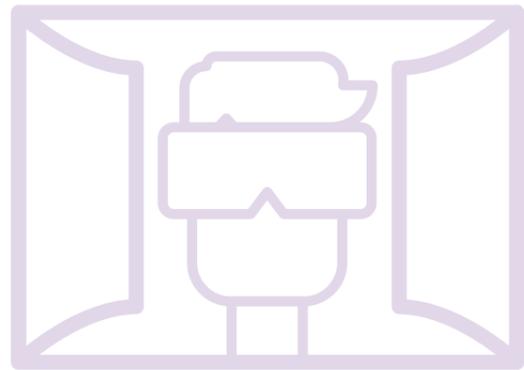
Combining virtual, augmented, and mixed reality, a new category of immersive, interactive content is emerging that enables us to experience new digital worlds and escape our daily lives' routines.

Microtrend #6

EMPATHY TECH

Our increasingly digitized and virtualized lifestyles make us long for sensual experiences and perceptions. We are searching for technological support that doesn't feel alien but human.





Microtrend #5

IMMERSIVE CONTENT

Combining virtual, augmented, and mixed reality, a new category of immersive, interactive content is emerging that enables us to experience new digital worlds and escape our daily lives and routines.

This microtrend is sponsored by augmented (AR) and virtual reality (VR) technologies, both of which let consumers immerse themselves in new digitally-enabled creative worlds. Simulated environments (these are heavily adopted in the industries sector), e-sports, and immersive gaming technologies will continue to explode in popularity across the world, pushing VR and AR forward. And while there is quite a controversy over the prospective size of both these markets, at the same time there is a clear agreement: both will grow exponentially.

We witnessed high-performance AR-enabled devices go mainstream in 2019, setting new expectations around virtual experiences and the possibilities that come with it. Possibilities to imagine, escape, explore, create, and connect. In the future, haptic gloves and full-body suits enable virtual objects not only to be seen, but also to be felt via vibration, temperature, and pressure. Air circulation, light design, and aroma will transform VR and AR experiences into real memories. So don't forget to keep an eye on the next microtrend, too: Empathy Tech.

The microtrend Immersive Content is mainly driven by three technologies:

// Virtual Reality (VR)

Virtual reality works in a computer-simulated setting, creating a new environment and it is experienced wearing a pair of goggles.

// Augmented Reality (AR)

Augmented reality doesn't simulate a new environment, but overlays content right onto your personal field of vision. All you need is a lens and screen (mobile phone for example).

// Mixed Reality (MR)

Mixed reality combines a number of technologies such as AR, VR, 360-degree video and holograms. It refers to the merging of virtual and real environments where both worlds can exist together.

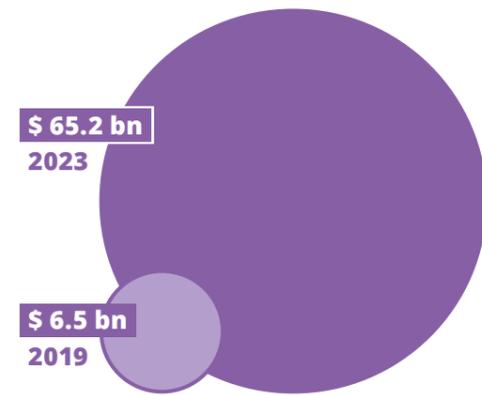
What's in the trend?

VIRTUAL REALITY // AUGMENTED REALITY //
MIXED REALITY // AUGMENTED RETAILING //
HYBRID GAMING // E-SPORTS // VIRTUAL SPACES //
INTERACTIVE CONTENT // VIRTUAL WORLDS

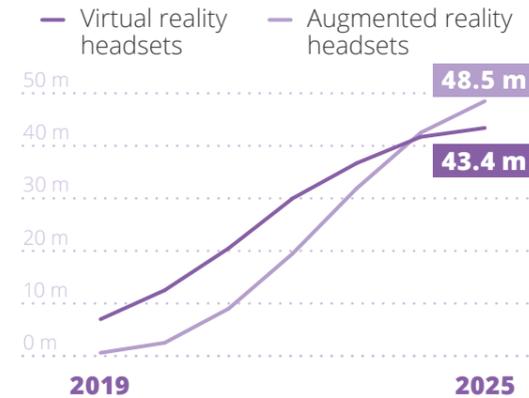


SUPPORTING FACTS

// Augmented and virtual reality spending in China*



// Unit shipments of augmented and virtual reality headsets*

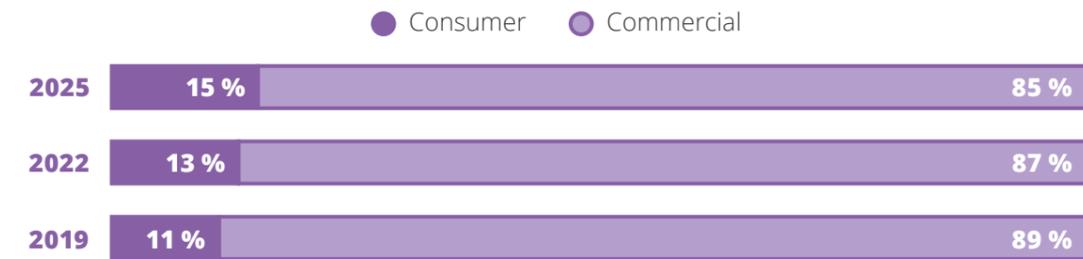


Technological advancements are finally pushing virtual reality into the mainstream, fundamentally altering the way we will interact with each other and our environments. New forms of immersive content will emerge and captivate audiences, making them the center of events.

Virtual reality (VR) has been thought of as the next new thing for some years now. However, bulky headsets and the absence of appealing content have so far hindered the final breakthrough of VR. But commercial and consumer markets for augmented reality (AR) and virtual reality are finally catching fire. AR/VR headset growth is expected to continue as global shipments climb to 68.6 million in 2023 with a compound annual growth rate (CAGR) of 66.7 percent over the 2019–2023 forecast period.

Especially commercial applications for VR and AR are flourishing. A growing number of companies are turning to VR as a way to drive training, design, sales, collaboration, and numerous other use cases, such as reducing the time required for product development cycles.

// Augmented reality headset commercial/consumer segment market share worldwide*



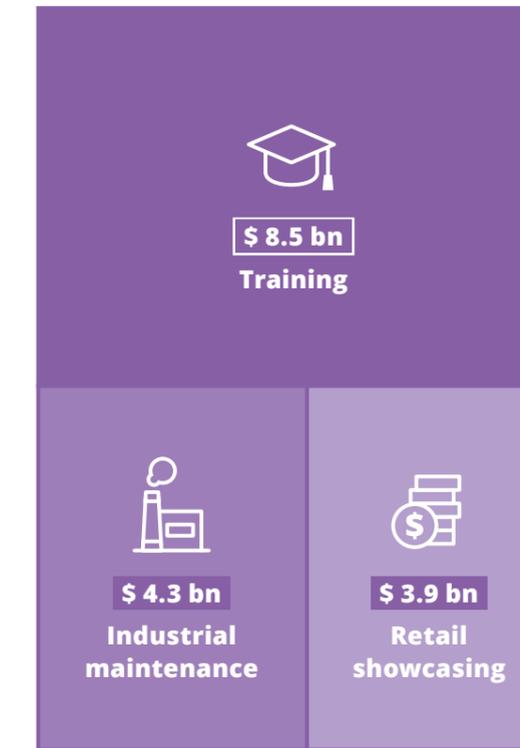
* Forecast



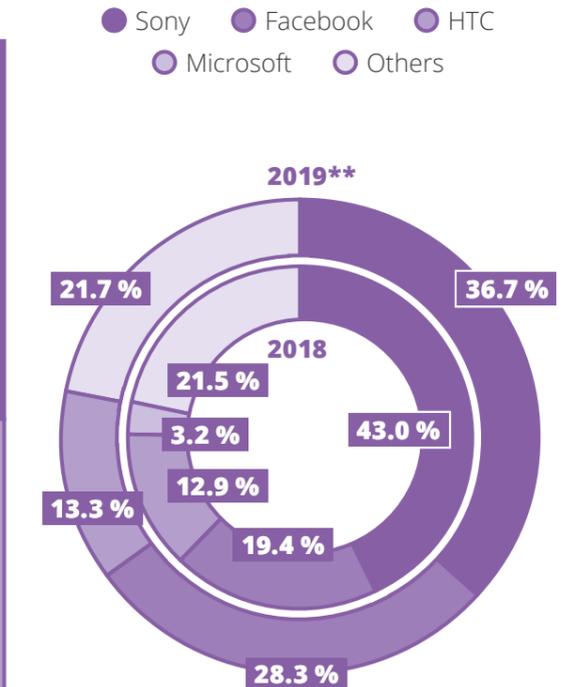
AR, on the other hand, is used by a growing number of companies to radically change existing business processes, bringing new skills to first-line workers who require a hands-free technology.

The global market for AR and VR is expected to rise to \$ 160 bn in 2023.

// The commercial use cases that are forecast to receive the largest investments in 2023 are:



// The strongest spending growth over the 2019–2023 forecast period will come from**:



** 2019 numbers are estimated shipment figures calculated by Statista

Globally, immersive gaming technologies and gaming platforms continue to explode in popularity.

All over the world, consumers are in gaming mode, spending more money than ever. In 2018, the World Health Organization (WHO) started classifying gaming disorder as a mental health condition – adding the disorder to the International Classification of Diseases, or the ICD-11, the organization’s official diagnostic manual.

According to Newzoo, there are now more than 2.5 billion gamers across the world and combined, they will spend 152.1 billion U.S. dollars on games in 2019. This is an increase of +9.6 percent year on year.

Especially E-sports are surging in popularity, reaching a global audience of 453.8 million in 2019. Data from the Global Web Index shows that nearly 3 in every 10 internet users now watch live streams of other people playing video games, equating to a global audience of close to 1.25 billion people, and management consulting firm PwC believes that e-sports have greater growth potential than the NFL.

Why dedicating two entire pages to e-sports? Because, when millions people are following E-sports with similar significance as their favorite real-live sports, this indicates that this enthusiasm could skip over to all kinds of virtual experiences.

The E-sports market will generate

\$ 1.8 bn in 2022.*

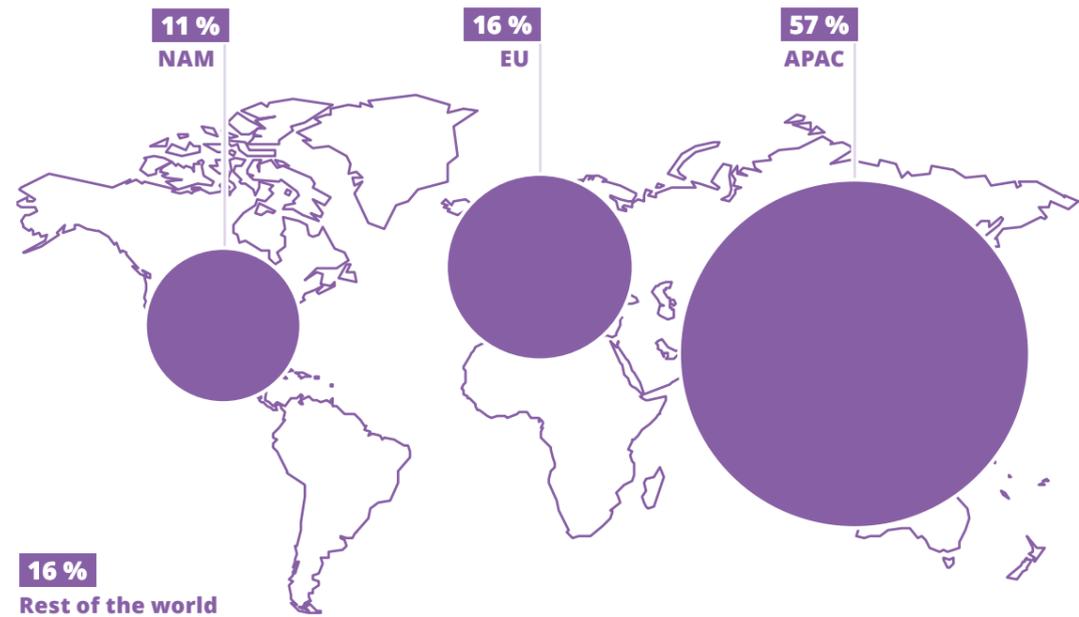
The global E-sports industry is worth

\$ 900 m.

// The total e-sports active audience will grow from:



// Share of e-sports enthusiasts in 2019

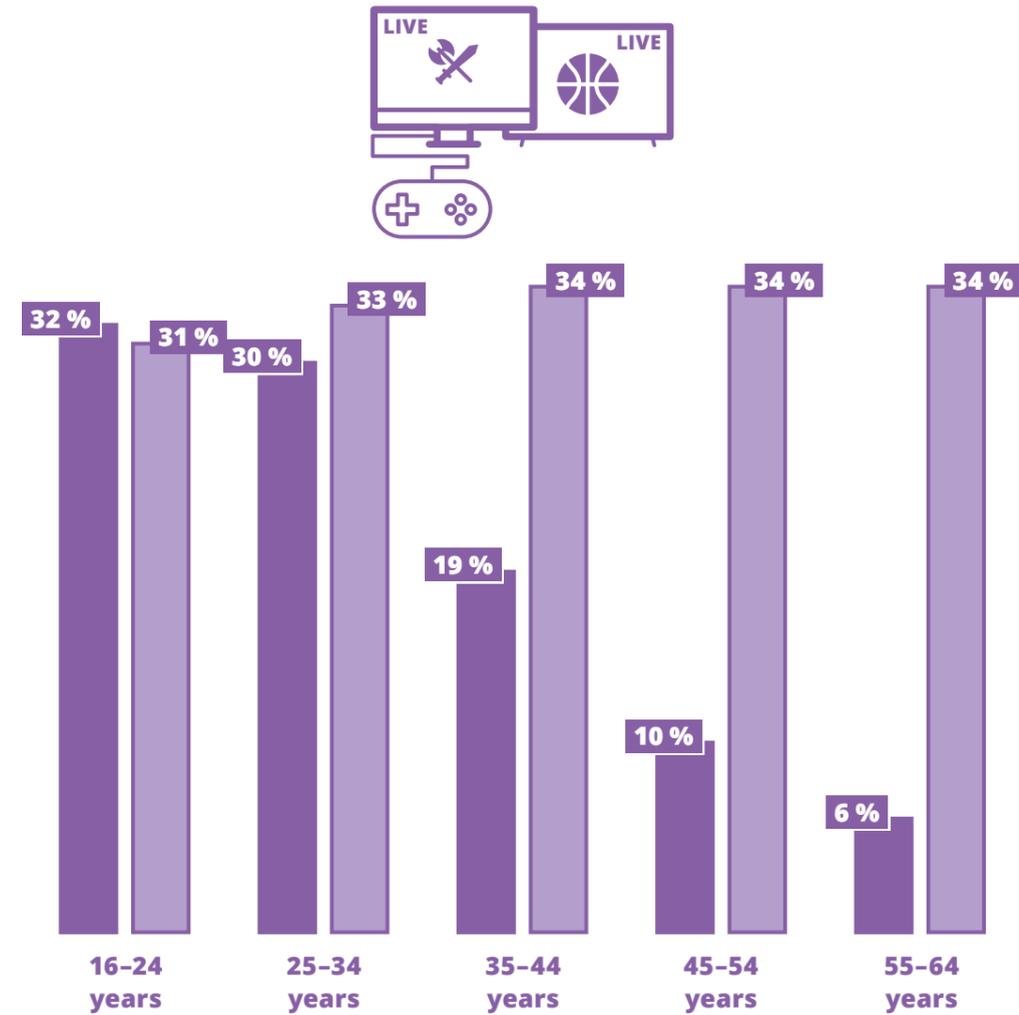


* Forecast



// Percentage of global internet users who say ...

- ... they've recently watched an e-sports tournament
- ... they're interested in watching conventional sports



Twitch alone boasts

140 m

monthly active users, with 15 m people tuning in to watch live game streams every day.

\$ 2 m

is the individual prize number for top players in the e-sports industry.

STATISTA RELEVANCE COMPASS

Evaluation Insights:

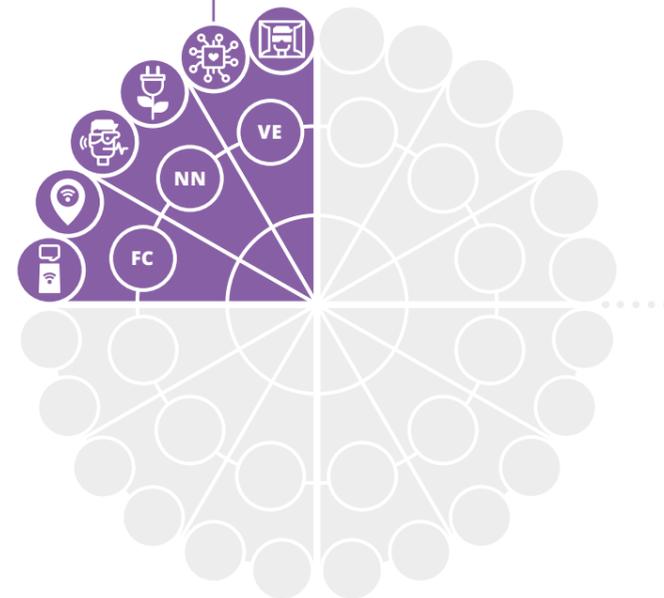
To quantify the future market potential of Immersive Content, we refer to products and services enabling experiences in VR and AR. Although former expectations regarding the market-readiness of consumer products and services in this segment seem to have been somewhat overhyped in retrospective, we expect a significant growth up to approx. 50 billion U.S. dollars globally by 2025. These figures combine consumer spending for hardware and software.

As consumer hardware is still expensive and software supply (e.g. games) is still very limited, we position this microtrend currently between innovators and early adopters.

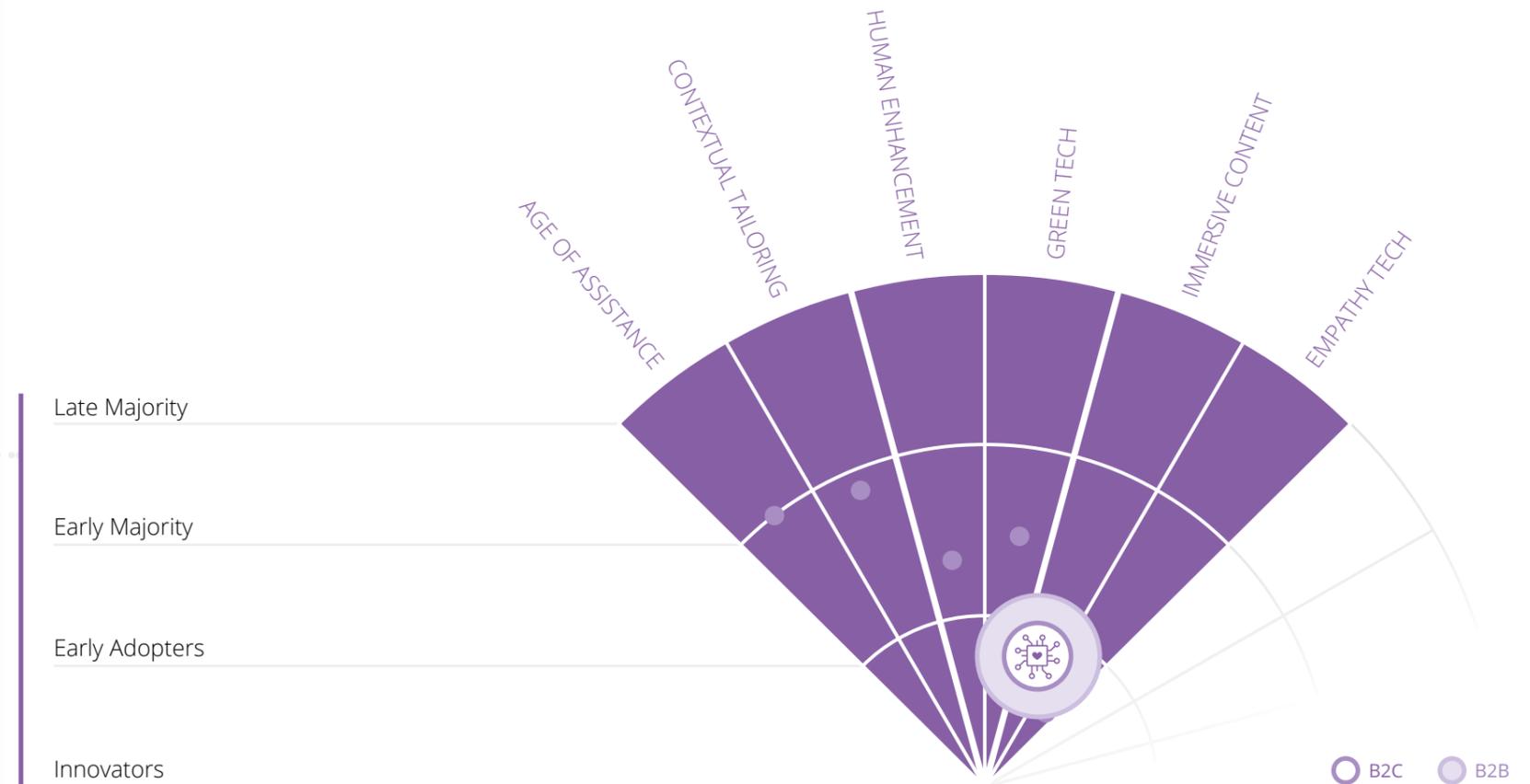
In addition to the B2C segment, the product and service offerings for B2B customers create an even bigger market segment – up to six times bigger than the respective B2C market.

TECHNOLOGICAL CHANGE

5 / VIRTUAL EXPERIENCES
// IMMERSIVE CONTENT



FC FLOW CONTROL NN NEXT NATURE VE VIRTUAL EXPERIENCES



INNOVATION SNAPSHOT

British Airways launches VR headset to entertain first class passengers.



British Airways first-class customers will enjoy their own 3D cinema on board as the airline exclusively tries out a new virtual reality headset. From August 2019 until the end of the year, customers travelling on selected flights in first class from London to New York will be able to try out VR headsets.

Content available includes 2D, 3D, and 360-degree movies, documentaries, TV shows, as well as therapeutic programs such as guided meditation for those passengers with a fear of flying.

Why this is interesting:

British Airways is the first UK airline to try the technology and it proves that virtual reality has matured from being a fancy gadget for geeks and gamers to something that has aspirational value for a bigger audience.

Asos' Virtual Catwalk is a new way to see products in real life.

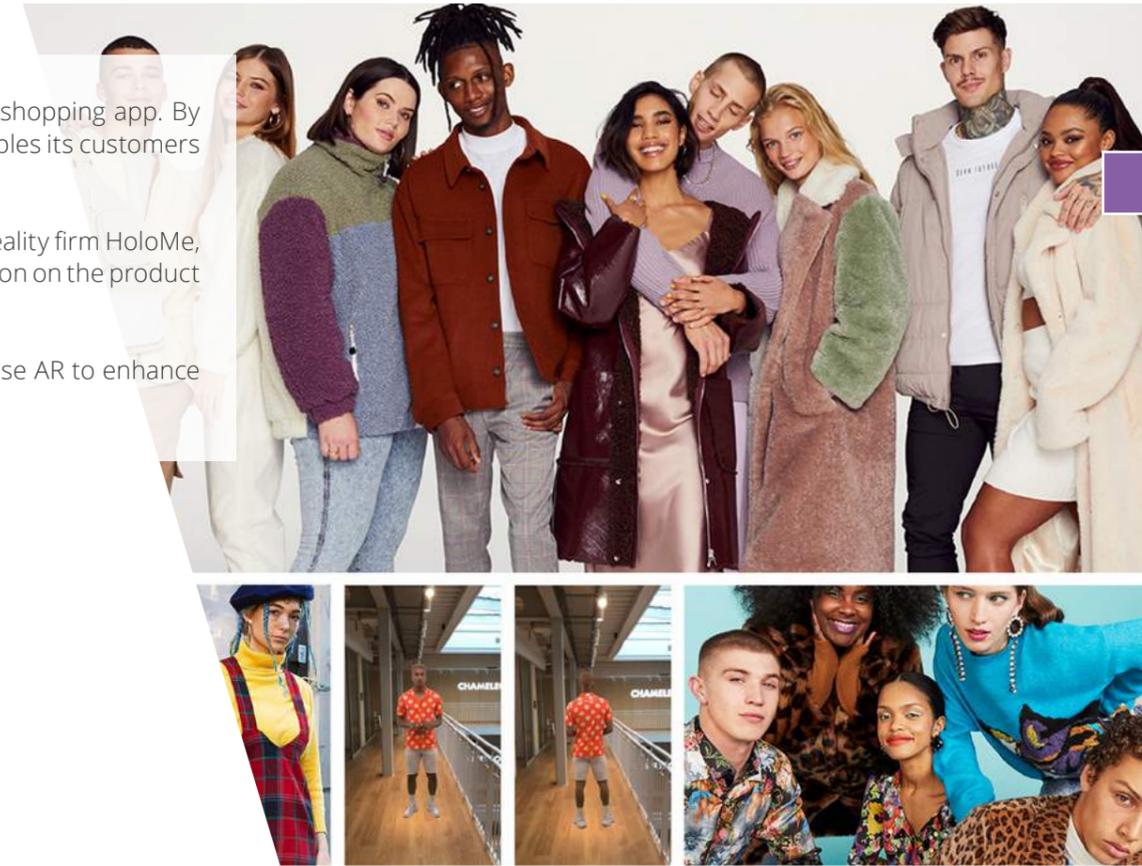
In June 2019, retail giant Asos incorporated augmented reality (AR) into its shopping app. By launching a virtual catwalk for 100 of its new Asos Design products, Asos enables its customers to view items of clothing in AR before making a purchase.

Customers can use the technology, created in partnership with augmented reality firm HoloMe, by pointing their smartphone camera at a flat surface and clicking the 'AR' button on the product page. Models will then appear "in front of them" wearing the product.

With the virtual catwalk experience Asos is showing how e-commerce can use AR to enhance the shopping experience and improve the try-before-you-buy experience.

Why this is interesting:

Since the explosion of online shopping, the fashion industry is struggling with unsustainable returns. The usage of technologies like AR and AI may help customers find the right product right away, seeing it in "real life" and thus avoiding the need to return items.



Artist gives live concert inside video game.



An estimated 10.7 million gamers attended a live virtual concert inside online video game Fortnite in February 2019. Gamers were transported to an in-game location featuring a neon-lit stage, where they could watch popular U.S. DJ Marshmello play a 10-minute live set.

Weapons were disabled during the event, and gamers were able to dance and soar above the stage. The concert had been heavily promoted inside Fortnite and was even featured on Marshmello's tour schedule.

Why this is interesting:

For ages, concerts have been a popular, however offline, experience. The Marshmello Fortnite concert with millions of people in attendance might give us a glimpse of the future and show how we approach virtual reality experiences. Imagine VR entering political will formation. You could have political rallies with millions of people interacting across the globe.

SUCCESSFUL INDUSTRY PLAYERS



Immersive gaming



Immersive retail & advertising

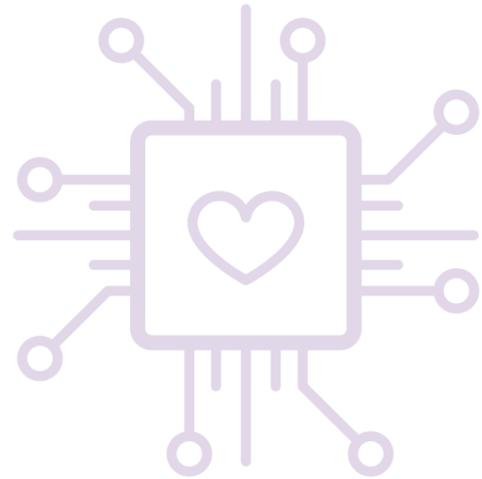


Healthcare & education



AR/VR tech





Microtrend #6

EMPATHY TECH

Our increasingly digitized and virtualized lives make us long for sensual experiences and perceptions. We are searching for technological support that doesn't feel alien but human or at least more natural.

Living in a knowledge society, we are predominantly dealing with digital data and immaterial value formats, rather than performing hard manual labor. Still, we want all our senses to be involved and technologically stimulated to broaden our areas of perception. In times of high-tech, society is longing for high-touch.

Today, technology does not only try to mimic nature with soft designs and sensual surfaces, but also becomes more able to understand our emotions and even trigger them. More and more products provide emotional experiences.

Technology is becoming ever more empathic, learning to track and interpret our emotions and moods, and to dynamically adapt to them. Smart algorithms are analyzing changes in people's tone and voice, offering their tips to call center agents. Advanced sensors in smartphones, digital assistants (DA's), and smart home systems permit an even more precise tracking of behavior and character. Gartner predicts that by 2022, personal devices will know more about an individual's emotional state than his or her own family.

Amazon recently rolled out new developers tools for Alexa to make the software sound more emotional – more human. The new update offers a range of options that take Alexas voice from excitement to disappointment.

Interfaces are becoming more intuitive, replacing traditional ones like mouse and keyboard with touchless interfaces via gesture, voice, and object recognition. Less technology, more humanity is the new mantra. And tech devices are increasingly trying to feel as natural and human as possible in order to smoothly blend into our daily lives.

What's in the trend?

MID-AIR HAPTICS // AFFECTIVE COMPUTING //

HUMANIZING TECH // EMOTIONAL DESIGN //

EMPATHY INTERFACES // RECOGNITION TECHNOLOGIES //

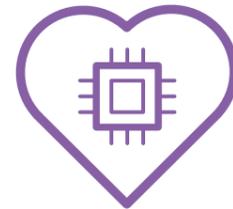
BIOMETRIC SENSORS // ANTHROPOMORPHIC INTERFACES //

INTUITIVE TECHNOLOGIES // NATURAL USER INTERFACES //

HYPER-STIMULATION

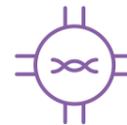


SUPPORTING FACTS



Reading emotions

Today, algorithms can detect human emotions from facial expressions, body language, and vocal cues. Understanding emotions holds growing importance during the interaction between humans and machines.



Emotional designs

Our lives are increasingly dominated by tech which makes us long for sensual experiences and perceptions. Companies that leverage tech are now adapting their images and designs to be more approachable, friendly, and sensual with soft colors, curved designs, and textile coatings.



Evoking emotions

Sensor technologies are becoming more and more advanced, adding a new layer to virtual experiences: Touch. This could impact everything from online shopping to medical use cases, like physical rehabilitation.



The global emotion detection and recognition market is estimated to report

a CAGR of **32.7 %** over the forecast period (2018–2023),
driving the market to reach **24.7 bn** by 2020.



NEUROAESTHETICS

is a scientific field of study that explores the impact of aesthetic experiences on human biology.



HUMAN-CENTERED

design means creating products that deeply resonate with customers, building empathy and intuitive user-product interactions.

The global haptic technology market accounted for \$ 9.5 bn in 2017

and is expected to reach **\$ 42.4 bn**
by 2026, at a **18.1 % CAGR** during the forecast period.

By 2022, it is estimated that

10 %

of personal devices will have emotion AI capabilities.

Emotion artificial intelligence systems are starting to help machines recognize our moods. Gartner predicts that by 2022, emotion-tracking AI is becoming so sophisticated that personal devices will know more about an individual's emotional state than his or her own family. This argument might sound a little far-fetched to some of us – but more and more products demonstrate that this prediction might come true.

Emotion AI systems and affective computing are changing the way we will interact with personal technologies. Everyday objects, charged with emotion-detecting technologies, will start to detect, analyze, process, and respond to our very personal emotional states and moods. The emotion detection and

recognition market was valued at 12.4 billion U.S. dollars in 2018 and is expected to reach a value of 91.67 billion U.S. dollars by 2024, at a CAGR of 40.46 percent over the forecast period from 2019–2024.

Key drivers of the emotion detection and recognition market are the rising need for better customer experience and understanding emotions, as well as the rising need for human touch in digital communications – imagine chatbots, for example. From tech giants to small startups, from healthcare to FMCG, and from telco to retail and media & entertainment, companies all over the globe have been investing in emotion AI. All of these companies are using emotion detection and recognition to understand consumer needs and expectations.

+ 43.0 %

growth in terms of revenue for the affective computing market size rising to 1.71 bn U.S. dollars by 2024.

The global sentiment analytics market is anticipated to grow at a CAGR of 14 percent over the forecast period of 2017-2024 and reach

\$ 6 bn in 2024.

In 2019, the emotional recognition market is valued at

\$ 20 bn.

Sensor technologies are becoming more and more advanced, adding a new layer to virtual experiences: Touch.

In recent years, virtual and augmented reality technologies have become a lot better at mimicking reality. VR and AR are fooling our brains into believing that virtual objects and personas are right in front of us. However, so far, we could not touch these objects.

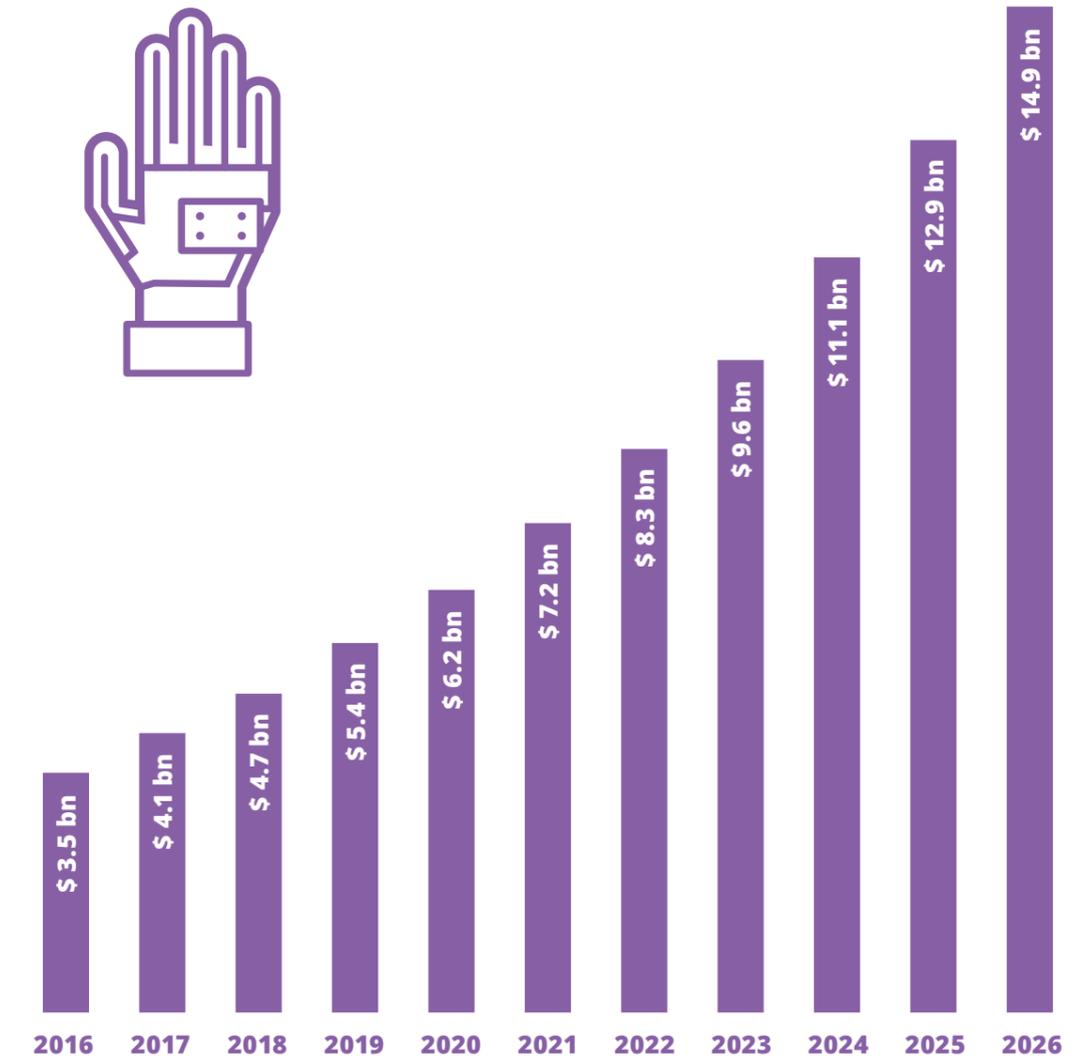
With recent advancements in haptic technologies however, this could rapidly change, as haptic technologies provide a way of recreating the sense of touch. By applying forces like vibrations and motions, the person using the haptic technology is enabled to receive a sensual response from virtual environments – be it in a game, in virtual reality, or in a car.

Bringing the sense of touch to VR experiences could impact everything from online shopping to medical use cases, like physical rehabilitation.

In September 2019, Facebook acquired neural interface startup CTRL-Labs for its mind-reading wristband. The deal is reportedly worth between

\$ 500 m and \$ 1 bn.

// Haptic technology market value in Asia-Pacific*



* Estimates



STATISTA RELEVANCE COMPASS

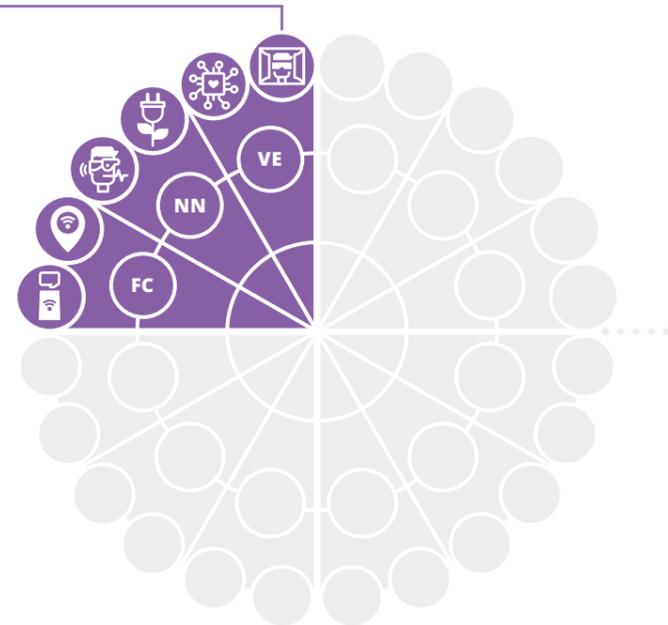
Evaluation Insights:

As technology is ever more present in almost all aspects of our lives, there is a tendency to make this technology appear more and more human. Besides this general tendency, a dedicated market for affective computing products and services is evolving at an early stage but gaining momentum and comprised of devices and services that can identify, understand, and stimulate human affects. The future application fields are numerous across many industries, from advertising to entertainment, communication, and life sciences based on e.g. emotional expression recognition in face, skin, and voice.

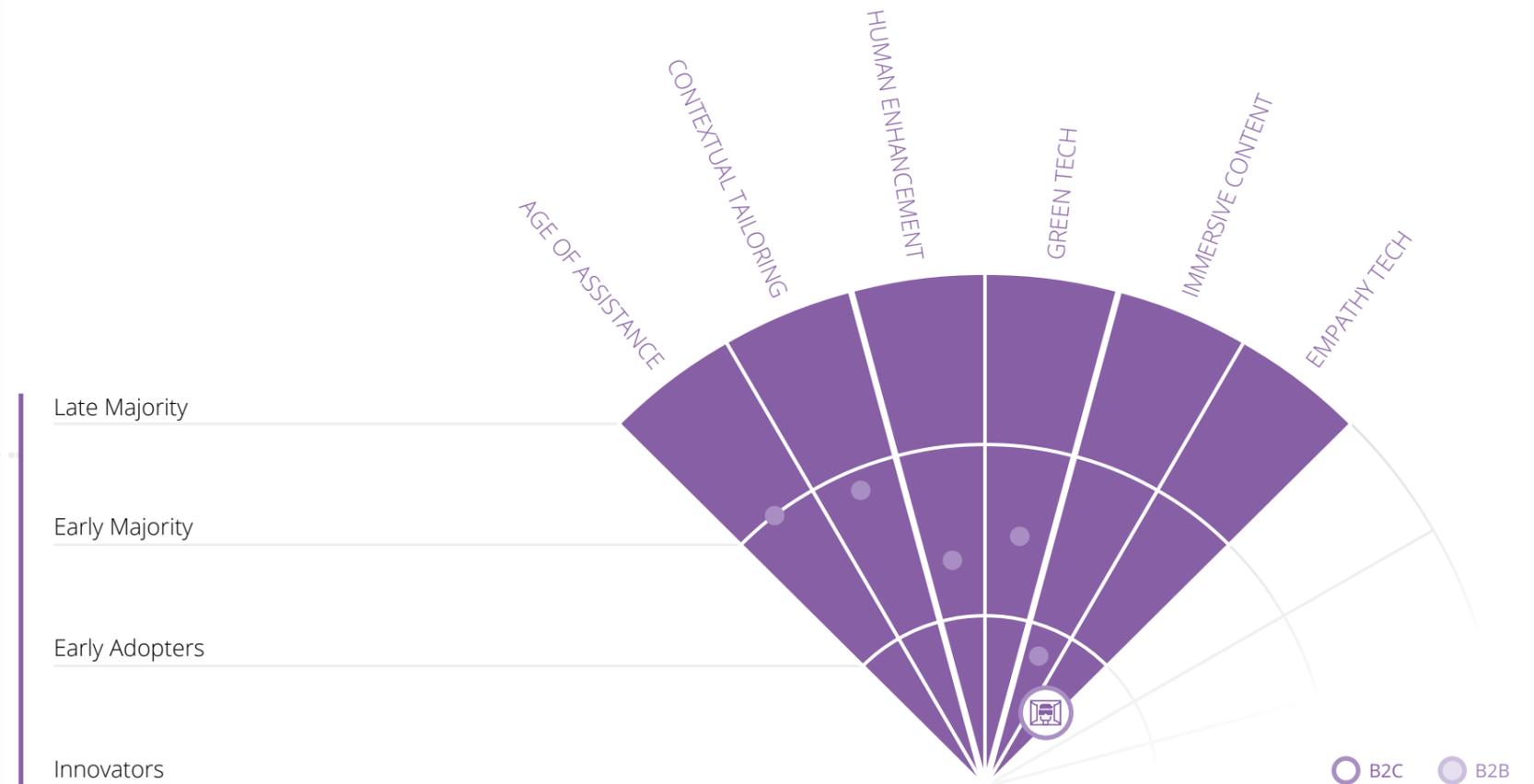
We estimate this market to achieve a volume of approx. 5 billion U.S. dollars by 2025 in end consumer spending. As these product solutions are still at a very early stage, we see this microtrend among innovators but expect a true mass-market adoption over the next decade.

TECHNOLOGICAL CHANGE

6 / VIRTUAL EXPERIENCES
// EMPATHY TECH



FC FLOW CONTROL NN NEXT NATURE VE VIRTUAL EXPERIENCES



Late Majority
Early Majority
Early Adopters
Innovators

B2C B2B

INNOVATION SNAPSHOT

Kia aims to tailor vehicle interiors to passengers' emotions.



In collaboration with MIT Media Lab, South Korean automotive company Kia is working to ease drivers' stress levels with their real-time emotion adaptive driving (short R.E.A.D.) system. The system, which Kia previewed at CES in January 2019, analyzes the driver's emotions in real-time using bio-signal recognition technology. The AI-based system monitors facial expressions, heart rate, and electrodermal activity to determine the emotional state in order to then change the car's interior – such as temperature, music, lighting, or even seat-vibration – to improve the driver's state of mind.

Why this is interesting:

Consumers already know that their vehicles are equipped with cameras and sensors to monitor and adapt their driving performance. As facial and emotion technology matures however, consumers will expect smart cars that can truly respond to customers' needs.

A fingernail-mounted haptic interface generates organic touch sensations.

FULU is a fingernail-mounted haptic interface for augmented reality environments. The device, applied on the nail side, retaining physical touch on the finger pad, enables users to touch textures far away or in the digital world. The tiny device can easily be connected to Bluetooth devices, such as smartphones and laptops, to enjoy real-time touch experiences anytime, anywhere.

The tiny device creates a virtual feeling of touch on the top side of the nail, whilst your soft finger pad is free to touch physical objects. With the FULU interface, you can receive and send touch with your friends and family who are far away.

Why this is interesting:

Currently, digital communication is highly audio-visually focused, neglecting other human sensory experiences. With touch as the most important sensory system to create trust and empathy, the options to engage with consumers and build almost real relationships seem endless.



Google goes for comforting aesthetics.



We all agree that an aesthetically pleasing surrounding can affect us positively. Thanks to a collaboration between Google and Johns Hopkins University, there finally is data to prove it: A Space for Being is a multiroom installation unveiled during Salone del Mobile 2019, which is informed by the principles of neuroaesthetics. Building upon the last exhibition, 'Softwear', which focused on intuitive design, the 2019 installation is set to show how physiological changes in the body respond to design. Visitors were fitted with wristbands to capture bio-data, like heart rate, temperature, and breathing when exposed to certain design stimuli.

The word human is integral to Google's approach to designing hardware, increasingly opting for comforting curved forms such as Google's Pixel Buds and pebble-shaped Home Mini speaker, which have soft rounded shapes, and woven textile covers and cables.

Why this is interesting:

Smart technology is here to stay, so tech companies are starting to design it in a way that allows it to seamlessly fit into our lives, considering its cozy extensions of our environment.

SUCCESSFUL INDUSTRY PLAYERS



Biometric sensors / recognition technology



Affective computing



Hyper-simulation & haptics



5 experts on
**TECHNOLOGICAL
 CHANGE**



Kevin Kelly

Founding executive editor of Wired magazine

“The greatest benefit of the arrival of artificial intelligence is that AIs will help define humanity. We need AIs to tell us who we are.”



Tim Cook

Apple CEO

“A significant portion of the population of developed countries, and eventually all countries, will have AR experiences every day, almost like eating three meals a day. It will become that much a part of you.”



Ray Kurzweil

Futurist and author

“We won’t experience 100 years of progress in the 21st century — it will be more like 20,000 years of progress (at today’s rate).”



Sherry Turkle

Abby Rockefeller Mauzé Professor of the Social Studies of Science and Technology at MIT

“Every technology asks us to confront human values. This is a good thing, because it causes us to reaffirm what they are.”



Sundar Pichai

Google CEO

“AI is one of the most important things that humanity is working on. It’s more profound than, I don’t know, electricity or fire.”

02

ECONO MICAL CHANGE

ECONOMICAL CHANGE

The world is changing faster than ever before. Technological advancements like artificial intelligence (AI), machine learning (ML), and the exponential growth in processing power are transforming industries at a rapid pace, affecting economic growth rates and capital markets in ways that seem difficult to foresee.

For the most part in the history of business, the world's leading companies have been industrially-focused, investing massive amounts of capital to build physical factories. Today's business reality, however, is very different from those days: We now live in a world of data, where everything surrounding us is captured digitally and linked to information. It is the data era.

For the first time in history, technology and commerce have clashed in a way that caused digital companies to become more valuable than traditional blue chip companies. Google, Apple, and Amazon are leading the new wave of successful companies.

The digital revolution in economies all over the world is leveraging connectivity, network effects, and infinite scale to create global platforms that seem impossible to compete with. Today, billions of people are connected with each other in a matchless global network. This global connectivity not only allows for an almost frictionless spread of new ideas and innovations, it also happens instantaneously and with unrivaled speed. Think of for instan-

ce artificial intelligence (AI) and 3D printing. These technologies will have major impacts on what and where we produce and additionally how we do it.

In the post-digital world, every moment will represent a potential new market of one. Businesses of the future are increasingly being confronted with dynamically changing commercial environments. Demand will be communicated instantly while immediate gratification is expected at the same time. And both, demand and offer, will be constantly changing, creating a never-ending stream of new opportunities with innovations arising at the interfaces of formerly separate sectors.

Collaborative business innovations and cross-sectoral value creation will emerge, as exemplified by the platform economy, for instance.

The technological revolution has already taken over retail and advertising and is now unstoppably entering the manufacturing, finance, and healthcare sectors. While the transformation speed will proceed differently in advanced and developing markets of the

world, it seems like no country or industry will be spared.

Moreover, no worker, no job description will stay untouched by the technological revolution. Whether it is skill requirements, organizational models, work equipment, or workflow profiles – a fundamental change is entering the work environment on all levels. Work is being organized as flexible and agile as the production of goods and services. Traditional silos are being dissolved in favor of more open structures.

So let's have a deeper look at these heavy changing forces that shape our industries of tomorrow.

Trend Drivers

Network Society:

Spread of digitization, virtualization, and networking on various industry levels.

Accelerating technological progress:

The application of big data, new algorithms, and cloud computing will change the nature of work and the structure of the economy.

New age of innovation:

$n=1$ and $r=g$ has become the new formula for successful business modelling.

Global Platform Economy:

Commerce increasingly moves towards digitization. Platforms, aggregators, and marketplaces are set to play an increasingly important role in the economy.

2020 Technology macrotrends to watch:



Macrotrend #4

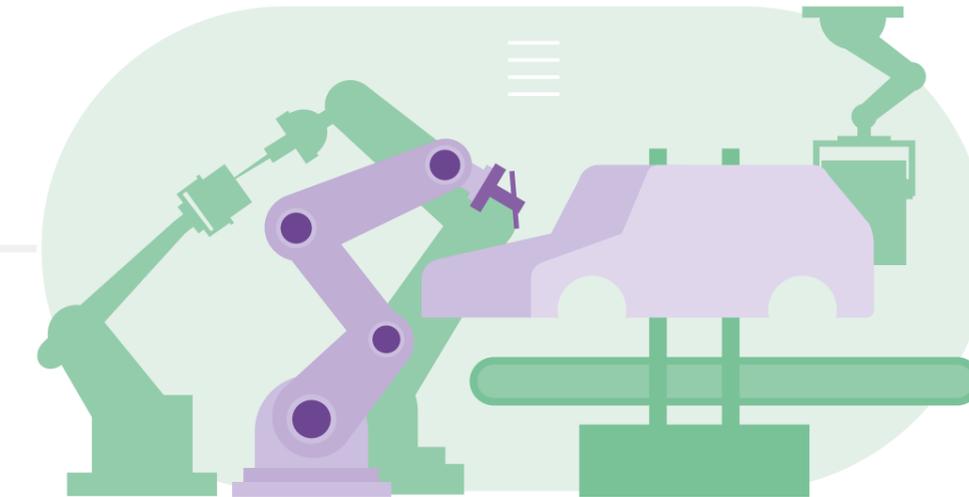
NEW WORK

The world of work is in a state of flux. Technological advancements and employee expectations are enabling and forming a modern workforce that is shaking up the world of work as we know it.

Macrotrend #5

URBAN HUBS

Cities are the manifestation of cultural, economic, and social acceleration. Urban planning and strategic design thinking in the context of rapid urbanization and mobility are crucial to keep cities enjoyable and inhabitable.



Macrotrend #6

INDUSTRY 4.0

Advances in robotics, AI, and machine learning are ushering in a new age of automation, as machines match or outperform human performance in a range of work activities.

Macrotrend #4

NEW WORK



The future of work is in a state of turmoil. Technological advances and employee expectations are reshaping work as we know it. All over the globe, a modern workforce is evolving that fosters a new way of working and living.

Work today is more global, more connected, more mobile and more skill-driven than ever before. And more than ever before do employers need more from their people if they are to stay competitive and relevant. And just as well, employees expect – even demand – more from the corporations they work for.

Today's globalized economy has given birth to an internationally available workforce which works and thrives within a constant rotation of new environments: the **Nomad Workforce** (Microtrend #7). The need for location independence, supported by a remarkable shift in the workplace towards freelancing and remote working, pushes organizations to strike an ever more flexible pose: Remote work, telecommuting, looser organizational designs, modular workspaces, hot-desking, flexible hours, and job-sharing are becoming more common. In the war to recruit talent, we have seen workplace review websites, like Glassdoor, even make flexibility a reputational competitive edge. The traditional nine-to-five job is increasingly losing attractiveness – especially for the younger generations entering the job market.

Coworker brands have been quick to adopt this new opportunity. By the end of 2019, almost 2.2 million people are expected to work in over 22,000 coworking spaces worldwide.

22,000
is the number of coworking spaces globally.

Competition for the right talent has become more fierce than ever, while 'talent' no longer means the same as ten years ago. Skills, roles, job titles, and job expectations have dramatically changed in the past years. Across industries, workers and organizations are trying to adapt to this change.

Moreover, over the last couple of years, becoming an entrepreneur, or "founder", has become a highly attractive alternative to traditional corporate careers. Have a look at our microtrend **Beta-Enterprises** (Microtrend #8) to understand what these new entrepreneurs are aiming at.

DRIVERS

WHAT ENABLES THIS MACROTREND?

The increasing globalization and rising wanderlust are pushing a new culture of flexibility, while rapid advances in technological innovation, like cloud-based services and telecommuting, are enabling it. Technology-supported environments and networked working are becoming a matter of course which leads to greater freedom regarding place and time.

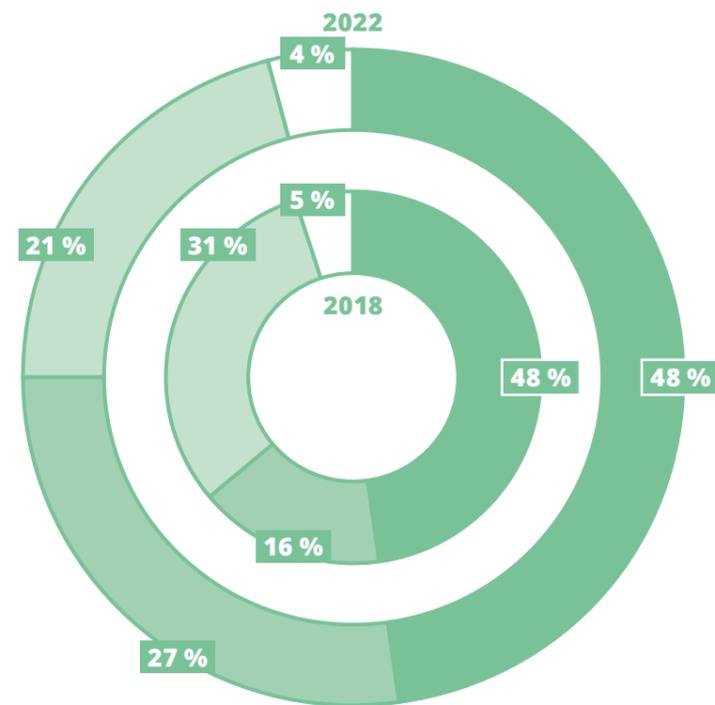
KEY MOTIF

WHY ARE WE KEEN ON SUCH OPPORTUNITIES?

Due to an accelerated speed in everyday life, the dynamization of the working world, and the ongoing flexibilization, the individual bears more responsibility for the success of their own life ("life entrepreneur"). People long for flexibility in every aspect of their lives because the rate and pace of it are changing so fast.

// Share of stable, new, and redundant roles (projected)

● Stable roles ● New roles ● Redundant roles ○ Other



MANIFESTATIONS

Microtrend #7

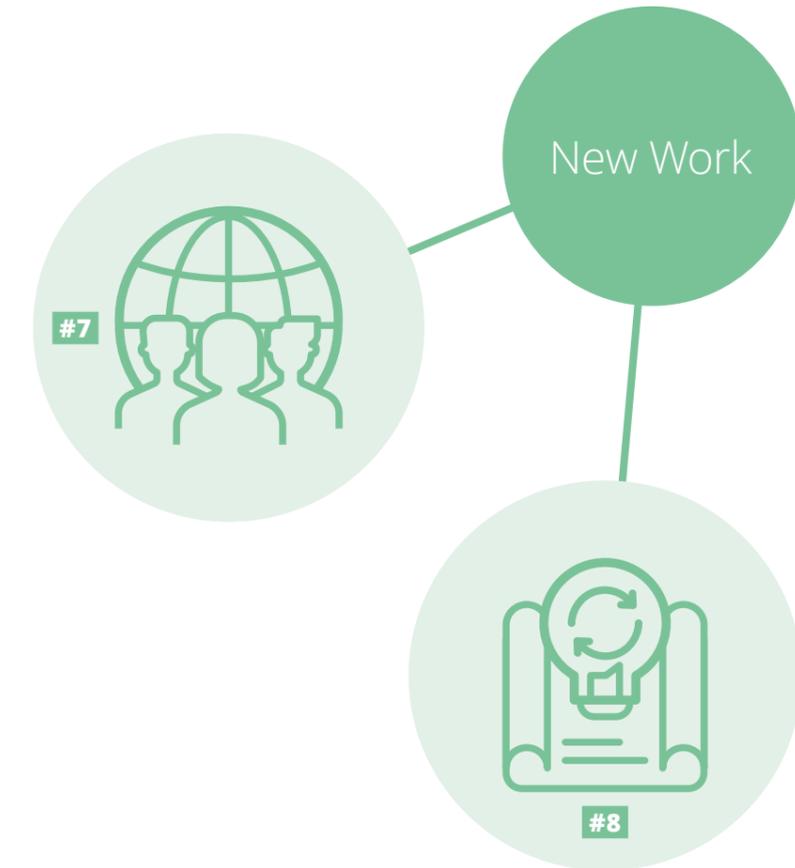
NOMAD WORKFORCE

Constant presence at work during regulated working hours is making way for flexible, location-independent working models and project-based assignments. Digital devices now enable us to work from anywhere in the world, and access information everywhere and at all times.

Microtrend #8

BETA ENTERPRISES

Innovation has become the leading paradigm of business, and a new entrepreneurial mindset is evolving in which a 'beta' mode has become the new 'alpha'.





Microtrend #7

NOMAD WORKFORCE

A growing cross-generational, cross-national tribe of educated professionals is striving to lead an unbound life.

With a connected ecosystem of tools and services that help them live and work, this new workforce dismisses concepts like borders, time-zones, and office spaces. Empowered by mobile technologies, today's professional generation has replaced the old value system of ownership, stability, and increased responsibilities with a new and more flexible value set that relies on freedom and individual fulfillment. The notion of a full-time job will become as outdated as the idea of a one-company-career. Workers will operate in a freelance, part-time, and remote manner. With not much more than a laptop and mobile device, this Nomad Workforce is constantly on the move, travelling across town or the globe, simply logging on to cloud-based solutions that offer seamless access to files, business applications, media, and entertainment, allowing teams to collaborate across time zones.

This shift towards a more distributed workforce, which seems a choice at first, will soon become a necessity, as the economy adjusts to constant revolution on the market. This outside army helps companies scale up dur-

ing peaks without blowing up the permanent headcount. Leading companies (and largest employers) are trying to rapidly transform the way they operate. They are seeking a new set of tools, systems, and new workplace formats from working hour accounts with temporary family-related timeouts, to part-time work to flexible freelancing concepts and looser organizational designs.

In the future, collaboration tools will steadily improve in cost and convenience, allowing for smarter and more agile teams.

What's in the trend?

- FREELANCE CULTURE // GLOBAL WORKFORCE //**
- WORK-LIFE-BLENDING // REMOTE WORKING //**
- VIRTUAL WORKPLACES // CLOUD-BASED SOLUTIONS //**
- GIG-ECONOMY // COLLABORATIVE TELEPRESENCE //**
- AUDIOVISUAL CONFERENCING //**
- WORKFLOW PLATFORMS // TELECOMMUTING //**
- CO-WORKING // SHARED WORKSPACES**



SUPPORTING FACTS

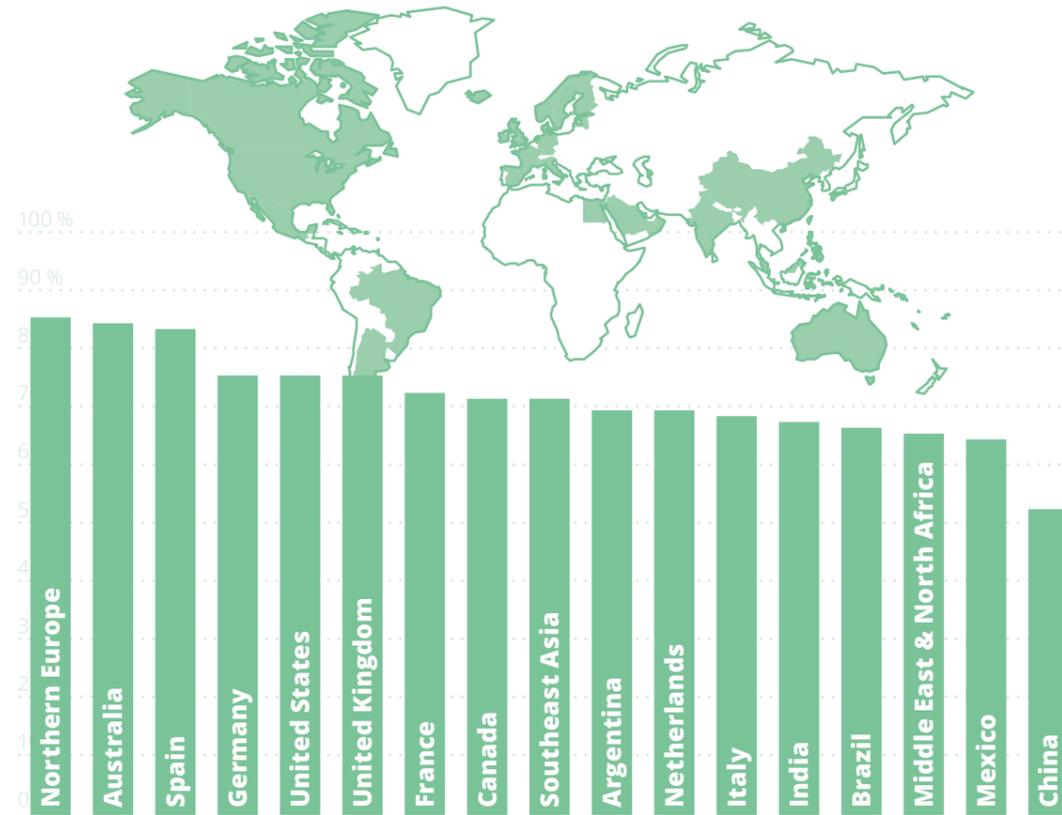
Digital nomads. Freelancers. Remote workers or gig workers. Whatever you name them, many workers are refusing the classical office idea, trading it in for flexibility and freedom in mobile workplaces and self-employment. The traditional workplace is losing attractiveness.

Shifting demographics – Millennials and Gen Z are now flooding the workforce – ever-increasing digitization, and the desire for greater job satisfaction could redesign the landscape of global employment into a freelance-driven model in the coming years.

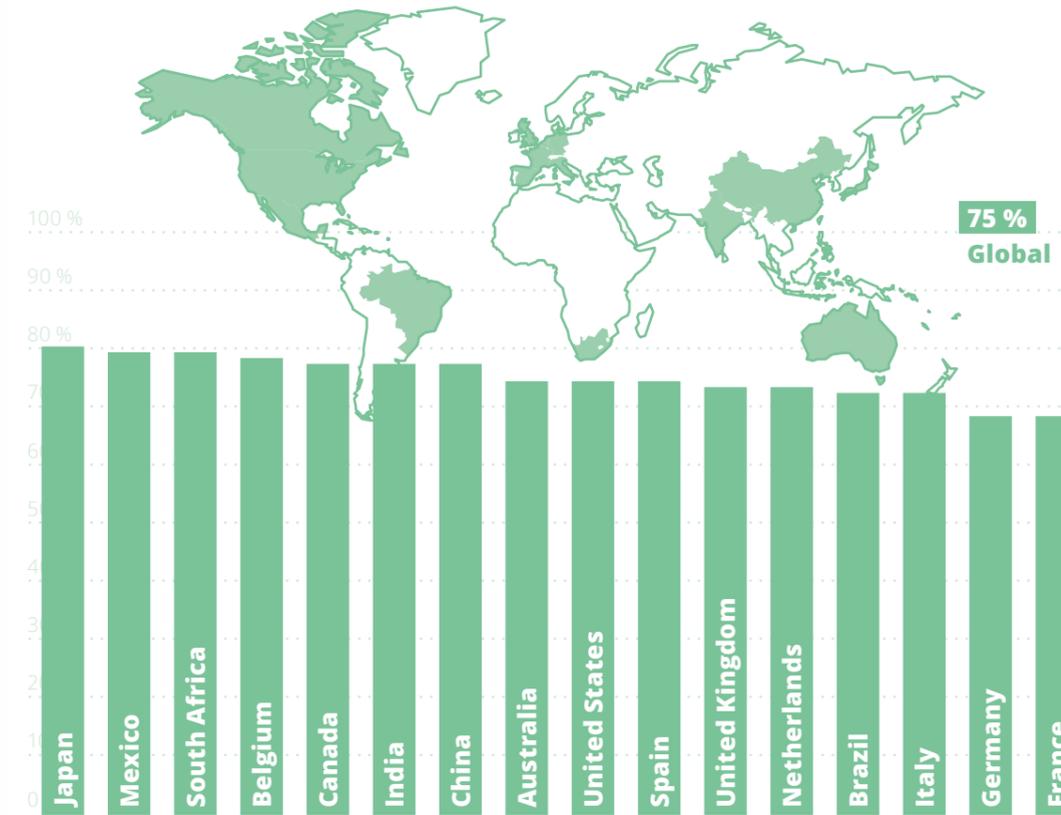
In the United Kingdom, in France, and the Netherlands, freelance growth has outpaced overall employment growth. In the United States, freelance workers could represent more than 50 percent of the U.S. working population by 2027.

This shift from traditional employment to more modern forms of engagements is presenting benefits and challenges to corporations, the staffing industry, and the freelancers them-

// Talent professionals who say work flexibility is very important to the future of recruiting and HR



// Share of people who consider flexible working to be the new normal in 2019, by country



selves. Companies that embrace this flexible entrepreneurial lifestyle have a huge competitive edge. And corporations do respond: there has been a 78-percent increase in job posts mentioning “workplace flexibility” since 2016.

35 %
of British employees would rather have flexible working options than a pay rise.

79 %
of executives expect that contingent and freelance workers will substantially replace full-time employees in the coming years - and predictions vary by industry.



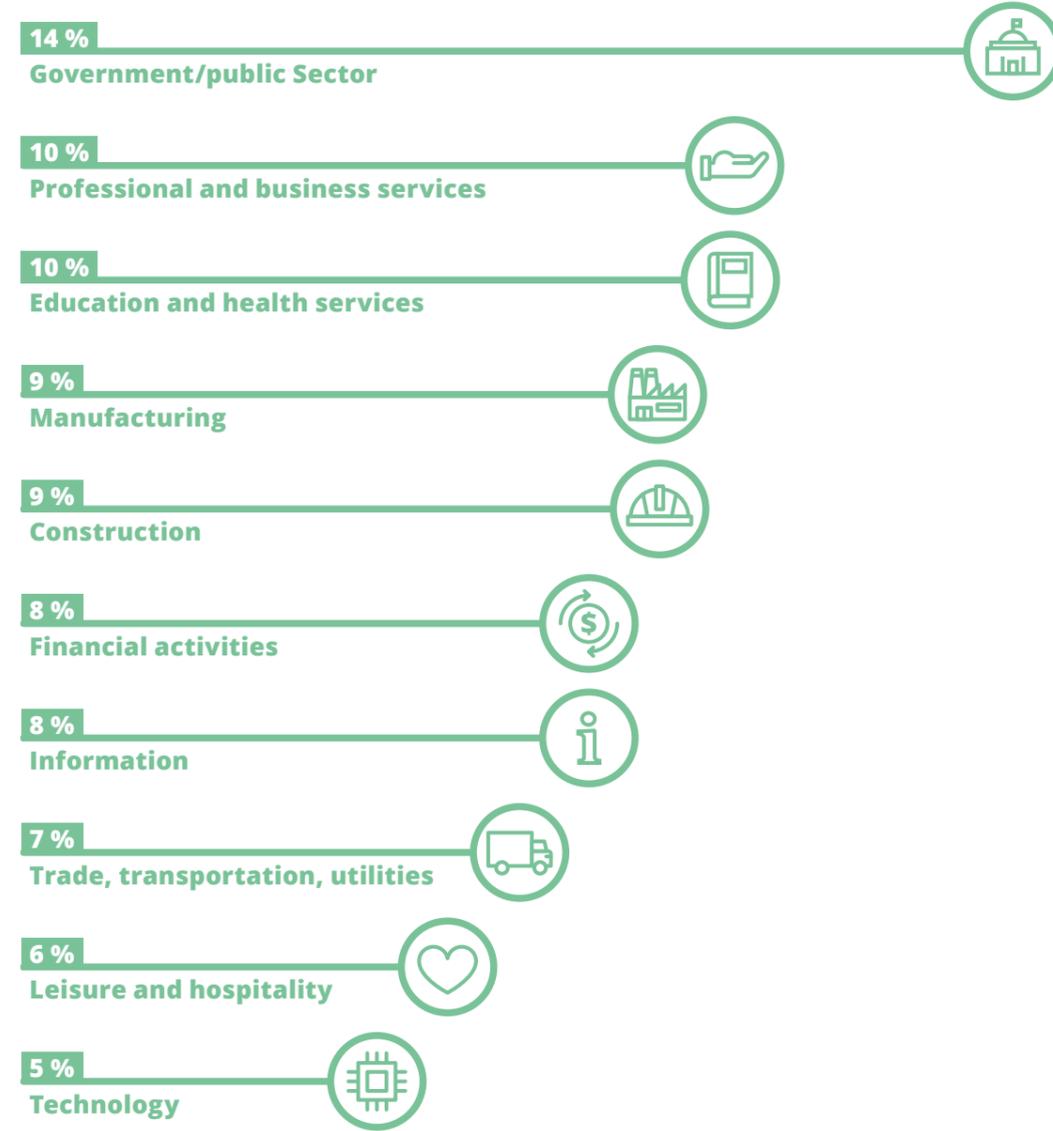
Freelancers predicted to become the U.S. workforce majority by 2027.

Despite an economic boom, which has created a record number of full-time 9-to-5 job openings, Americans are increasingly choosing to freelance. According to a study done by Upwork and Freelancers Union, the U.S. freelance workforce growth is accelerating and has outpaced overall U.S. workforce growth threefold since 2014. In 2018, 56.7 million Americans were freelancers.

Although technology is enabling freelancing, it is not the technology sector that is contracting freelancers. In fact, it is rather the government and the public sector, as well as professional and business service sectors in the U.S. which are hiring freelancers.

The more than 57 m Americans who work freelance jobs contribute nearly \$ 1.4 tn to the economy every year.

// Industries where gig economy workers are currently employed in the U.S. in 2018



Note: United States; August 16 to 19, 2018; 18 years and older; 498 respondents

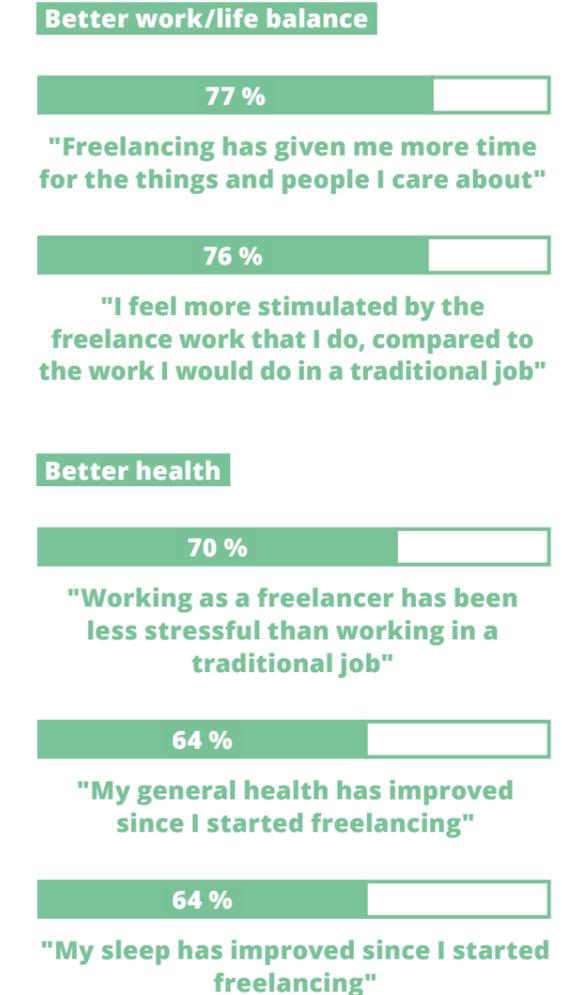
Recent studies have found that employee stress levels rose by nearly 20 percent in the last three decades, and a majority feel that work is having a negative impact on their personal relationships. Today, 8 in 10 Americans are affected by stress.

// Reasons for starting gig work in the U.S. in 2018, by generation



Note: United States; January 5 to February 18, 2017; 18 years and older; 1,491; 514 full-time; 256 part-time traditional employees and 721 gig workers.

// Full-time freelancers report ... (strongly/somewhat agree)



As the number of freelancers and remote workers globally continues to rise, the shift towards co-working and flexible workspaces will continue to gain importance.

Co-working has developed rapidly over the past decade. 2019 has proven that co-working has become a full-grown industry, offering working environments that are supportive to collaboration, productivity, and innovation. All over the globe, the number of co-working spaces and co-working space members are growing at staggering rates. The number of co-working space members will increase to 5.1 million in 2022.

As of 2018, the Asia-Pacific flexible workspace market was the fastest-growing. According to an Instant Group report, the co-working space supply in its key cities increased by over 15 percent. Of the estimated 8,600 co-working centers, Hong Kong is dominating the Asia-Pacific region with more than 340 co-working spaces within the city alone.

Globally, the share of co-working spaces is still relatively low, well below 10 percent in fact. But this does not make this segment less interesting for investors.

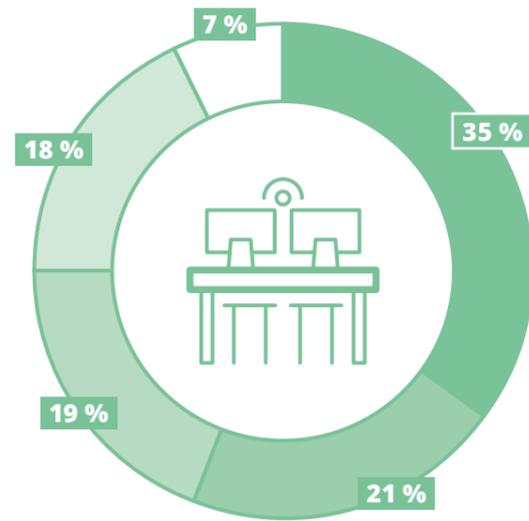
Main drivers of the ongoing success of co-working spaces will be the growing demand from large companies for more flexibility, the growing number of startups, and the further increasing number of self-employed workers.

In 2019, the global market value of flexible workspaces is estimated at approximately

\$ 26 bn.

// Share of coworking spaces worldwide in 2019, by region

- APAC
- EMEA*
- United States
- United Kingdom
- Rest of the World

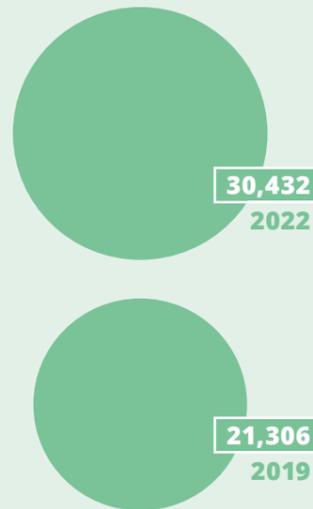


There are an estimated

35,000

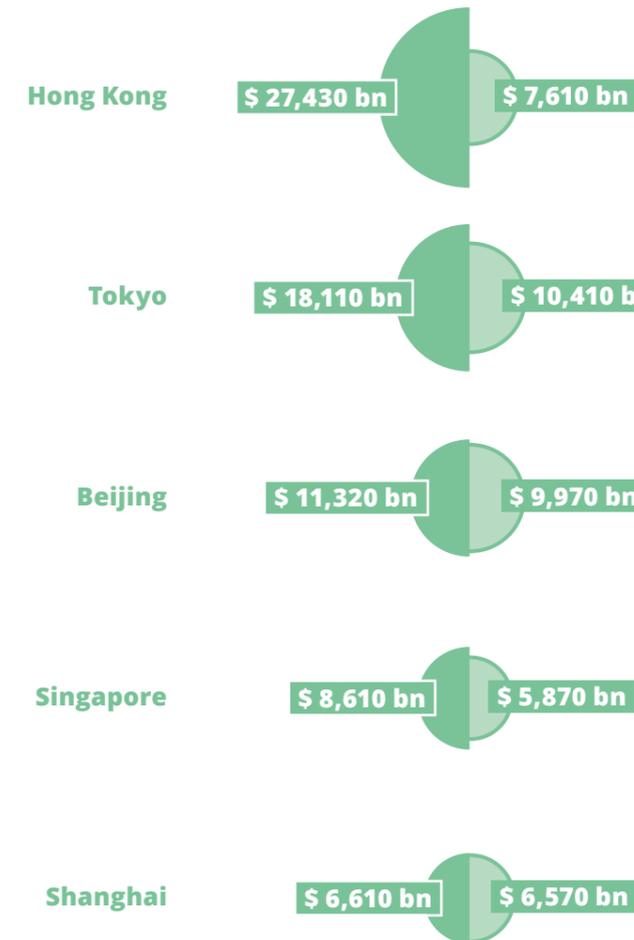
flexible workspaces in the world today.

Global Number of Coworking Spaces



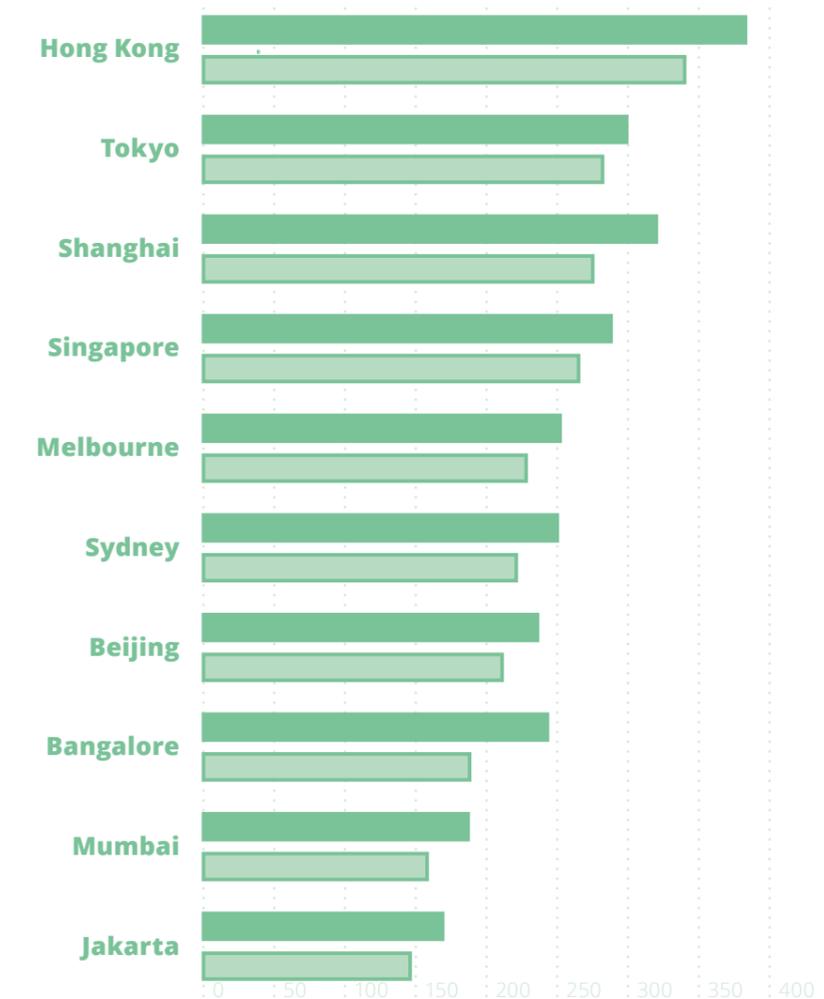
// Annual cost of flexible and conventional office renting in the Asia-Pacific region in 2018, by city

- Conventional workstation rate
- Flexible workstation rate



// Leading cities providing flexible office spaces across the Asia-Pacific region in 2017 with a forecast for 2018, by number of centers

- 2018
- 2017



* Figure doesn't include the United Kingdom.

STATISTA RELEVANCE COMPASS

Evaluation Insights:

The increasing flexibility of employment types is one of the most visible aspects of what is currently subsumed under the term New Work. We quantify the microtrend Nomad Workforce based on the expected number of digitally enabled freelancers and the income they generate with their job activities. This amounts to a total economic value of up to approx. 375 billion U.S. dollars globally by 2025.

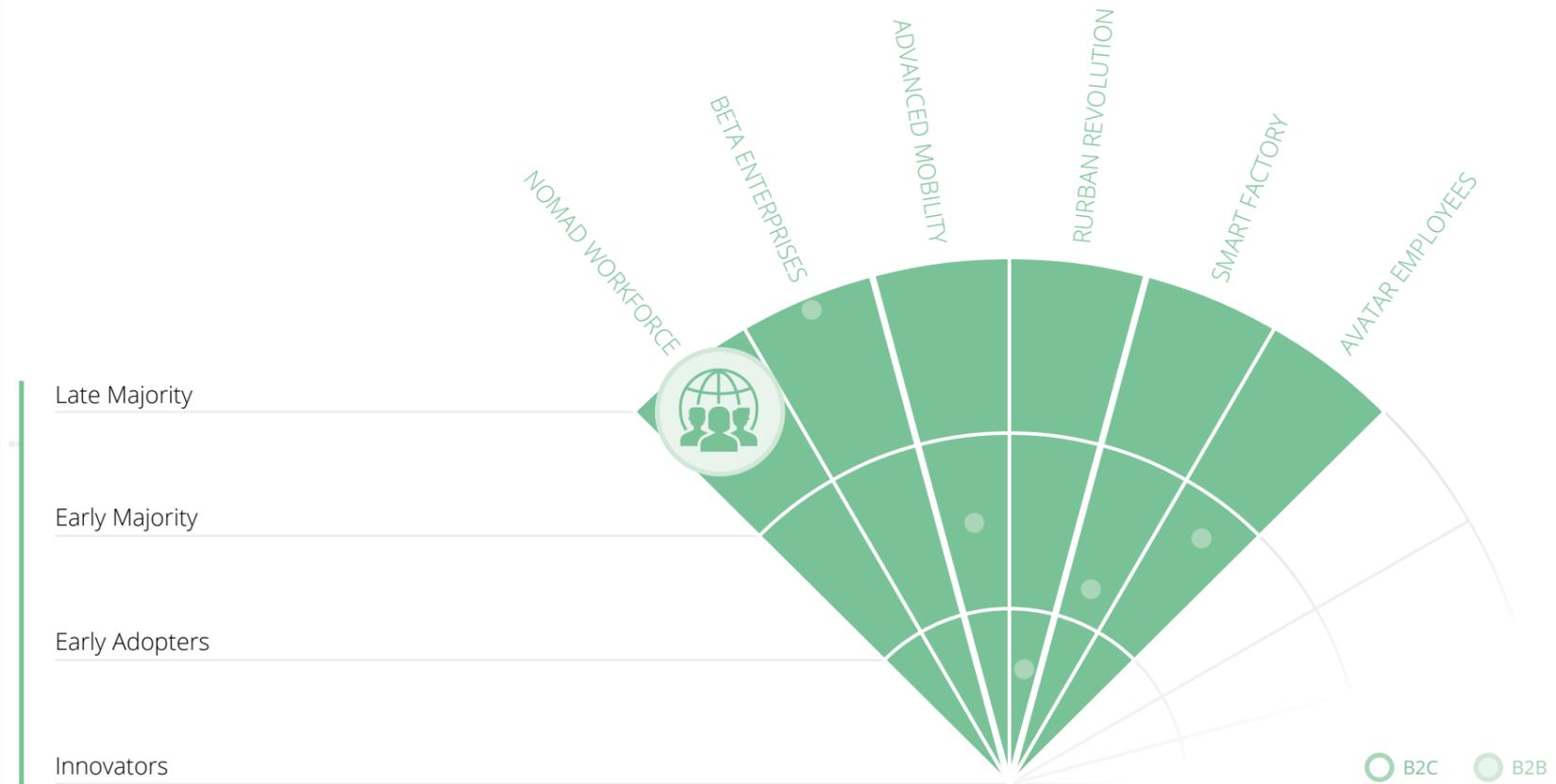
As this microtrend has already been gaining momentum over the last years, we position it among the late majority but still see potential for further growths over the next years.

ECONOMICAL CHANGE

7 / NEW WORK
// NOMAD WORKFORCE



NW NEW WORK UH URBAN HUBS I4.0 INDUSTRY 4.0



INNOVATION SNAPSHOT

Home is where you park it: living la vida #vanlife.



The #vanlife movement as a concept and community has spread out on social media with more than 1.7 million hits on Instagram alone, and the increase in the number of van-lifers has been massive in the past three years.

The recent surge in nomad lifestyle can be attributed both to its idealization on social media and the availability of 4G mobile internet nationwide. More and more people work from their computers, enabling location-independent working. As long as employees have an internet connection and power, it doesn't matter where they are.

Why this is interesting:

The surge of Millennials who choose to live on the road has incited major automakers, such as Nissan and Volkswagen for example, to invest in amenity-stuffed van models. And while more and more car companies are rushing to respond to this movement, we also see a boom in van customization companies, who take over where automakers left off.

Fast food chain trials four-day work week for select employees.

U.S. fast food chain, Shake Shack, announced in March 2019 that it started testing a four-day work week for some of its employees to help recruit and retain qualified employees. The program applies to managers working at restaurants in Las Vegas, Los Angeles, Dallas, San Antonio, and Detroit. However, to get the same pay, employees still need to work 40 hours a week under the new arrangement. They just have to condense that into four days, instead of five.

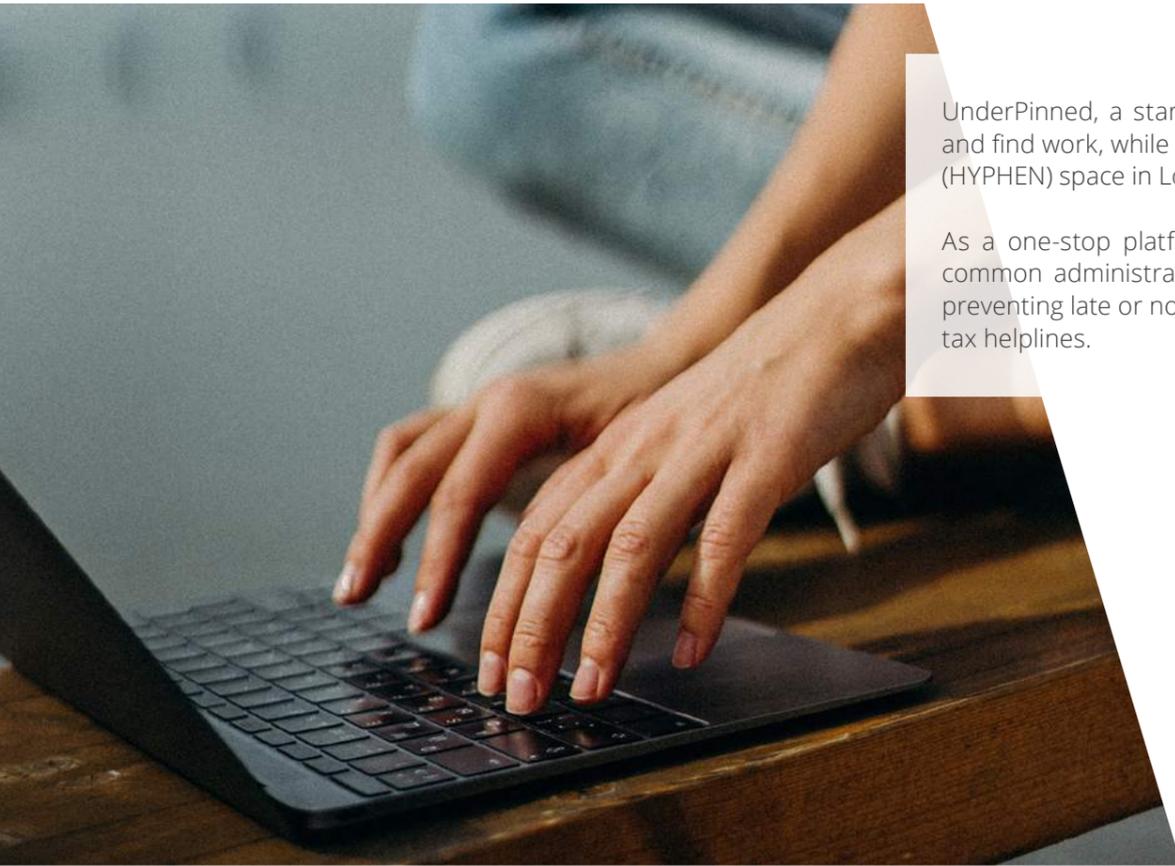
The trial comes after a report by a New Zealand-based insurance firm, Perpetual Guardian, which found that its four-day work week trial improved its employees' productivity by 20 percent and work-life balance by 24 percent.

Why this is interesting:

In order to attract and retain qualified employees, who increasingly opt for a more flexible work style, established companies need to find new and more attractive ways of standard working. By answering to these newly evolving employee needs, companies not only keep their staff but can even boost their productivity and commitment.



A freelancers' hub for everything from e-mails to invoices.



UnderPinned, a startup business, which aims to help freelancers realize their career goals and find work, while also offering support with common issues, has opened a new co-working (HYPHEN) space in London while launching its Virtual Office platform at the same time.

As a one-stop platform for freelance workers, UnderPinned offers members solutions to common administrative freelancer issues, such as building sustainable work pipelines and preventing late or non-payments, as well as providing 24-hour access to counseling, legal, and tax helplines.

Why this is interesting:

As the number of remote and self-employed workers increases, new options to serve their needs are emerging, opening up new business opportunities – making the nomad workforce an industry itself.

SUCCESSFUL INDUSTRY PLAYERS



Co-working spaces



Freelance platforms

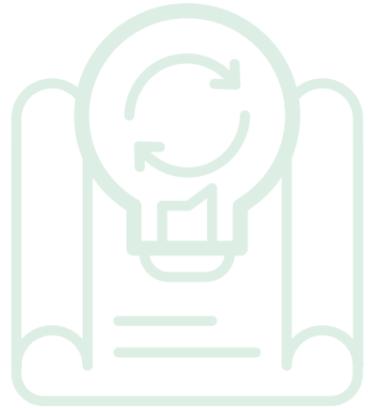


Digital conference technologies



Flexible hiring





Microtrend #8

BETA ENTERPRISES

The entrepreneurial landscape is always changing. Persistent acceleration and disruption in business and society are the norm rather than the exception in today's economy. And both will only multiply as we progress into the future.

In light of these rapid changes, an agile culture remains a critical organizational competency. However, agility alone doesn't guarantee success. A continued emphasis on productivity and incremental reactions to the current business environment are mindsets that help companies grow in today's disrupted markets. "If you always do what you always did, you will always get what you always got." Albert Einstein's words ring even more true today. Macroeconomic factors and lifestyle shifts are pushing entrepreneurs to rethink traditional company structures and look for more adaptive ways for businesses.

So significant is this change in the business arena, that a new entrepreneurial mindset is evolving – one that focuses on launching ideas in 'beta' mode. These new entrepreneurs are taking the digital know-how and Silicon Valley mechanism into the real and non-digital world industries, i.e. being highly responsive, risk-friendly, networked, small-scale, and innovation-driven. For quite a few businesses, setting up a five-year business plan doesn't make sense anymore, because the rate and pace of change are so fast.

No longer just part of the DNA of on-the-go startups, like Uber, Netflix and Airbnb, who have disrupted whole industries, business model innovation is the leading paradigm to corporate growth. Shrinking S&P 500 lifespans, digital disruption, and pressure on once-reliable business models mean that it's no longer enough to simply offer better products and services. As the success of the startup generation shows, the future belongs to the serial business model innovators.

The spirit of Beta Enterprises originated on the internet, but today this culture is just as likely to come from the boardrooms of established companies trying to adapt to this new way of doing business.

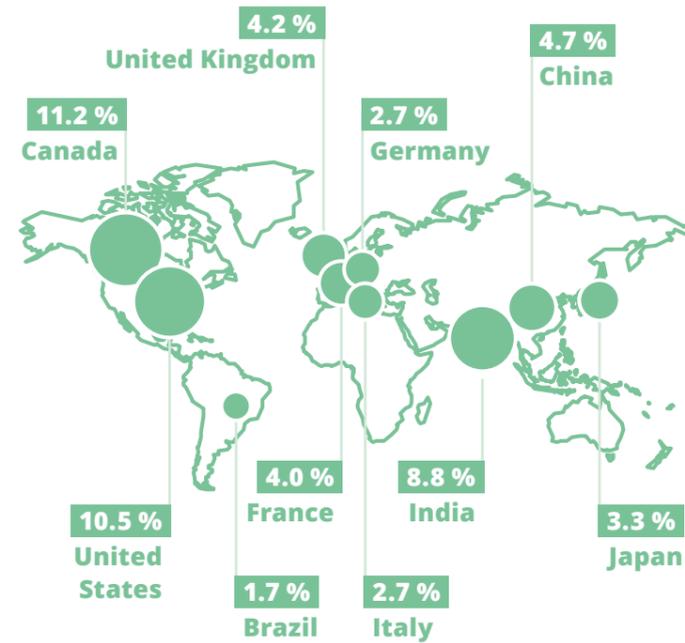
What's in the trend?

STARTUPS // UNICORNS // INNOVATION LABS //
INCUBATORS // BUSINESS MODEL INNOVATION //
DESIGN THINKING // AGILE MANAGEMENT //
ACCELERATOR PROGRAMS // INNOVATION CULTURE //
PLATFORM ECONOMY // PROTOTYPING

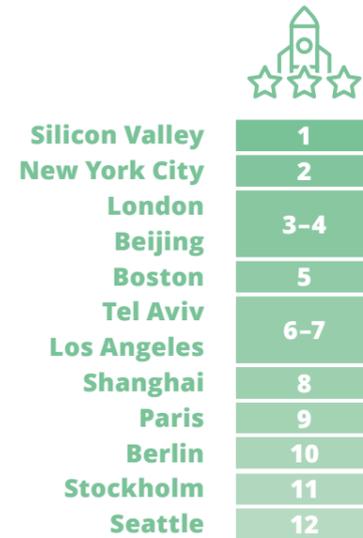


SUPPORTING FACTS

// Start-up rate of leading economic nations in 2018



// Top 12 global startup ecosystems in 2019

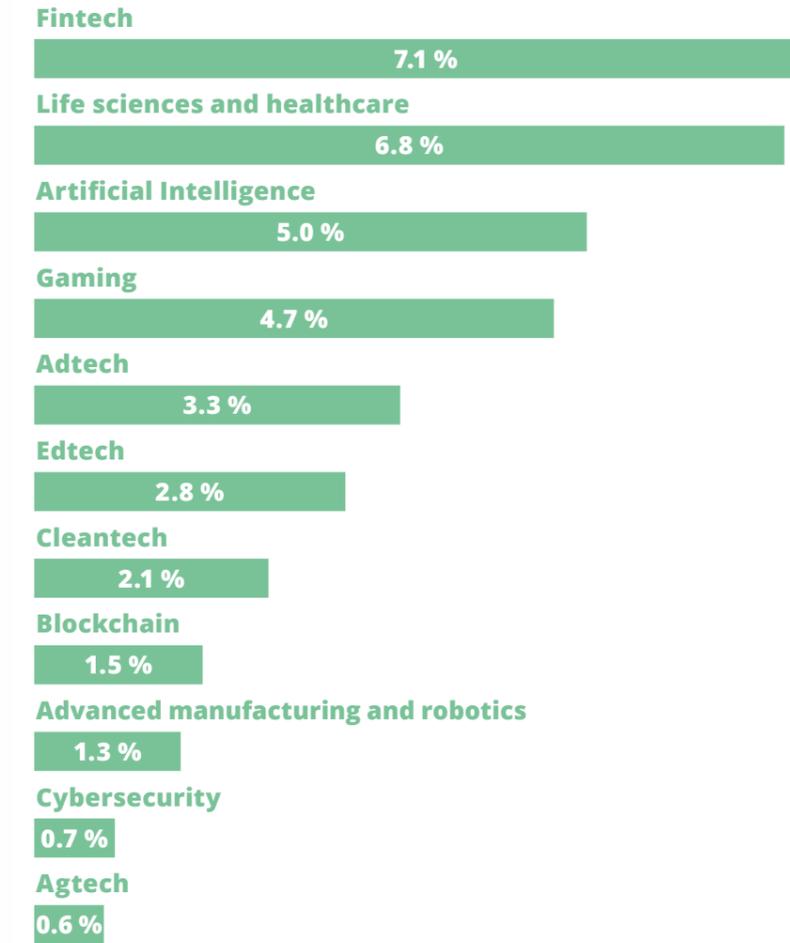


The size of the global startup economy rose **20 %** in one year to reach \$ 2.8 tn.

The entrepreneurial spirit is changing the face of the business world. Drivers of this ongoing growth in entrepreneurship are technological innovations that have made becoming an entrepreneur more accessible to a wider range of people – and easier. Due to these technological advances, the barriers to starting one's own business are much lower – encouraging more people, even on a small scale, to get their ideas started. In Germany for instance, the time to form an enterprise has dropped from 45 days in 2003 to only 8 days in 2018. Main motive for German founders with 40.8 percent: independence.

While we've seen that globally – with regional hotspots – the whole startup sector is growing continuously, some industries are growing faster than others. One of these industries is technology, which is booming with sub-segments like robotics, AI, blockchain, big data & analytics. The largest companies are now dominated by tech: Apple, Google, Microsoft, Amazon, Facebook - all of them former startups that started the triumphal march from their garages.

// Distribution of startups worldwide in 2017, by industry



Gen Z is poised to become the most entrepreneurial generation ever: **50 %**

Half of Gen Z see themselves as entrepreneurs.

// Largest U. S. companies in 2018 vs 2008, by company value

2018			2008	
\$ bn	Company	Rank	Company	\$ bn
890	Apple // 1976	1	Exxon // 1870	492
768	Google // 1998	2	General Electric // 1892	358
680	Microsoft // 1975	3	Microsoft // 1975	313
592	Amazon // 1994	4	AT&T // 1885	238
545	Facebook // 2004	5	Procter & Gamble // 1837	226
496	Berkshire // 1955	6	Berkshire // 1955	206
380	J&J // 1886	7	Google // 1998	198
375	JP Morgan // 1871	8	Chevron // 1879	192
367	Exxon // 1870	9	J&J // 1886	192
316	Bank of America // 1909	10	Walmart // 1962	184

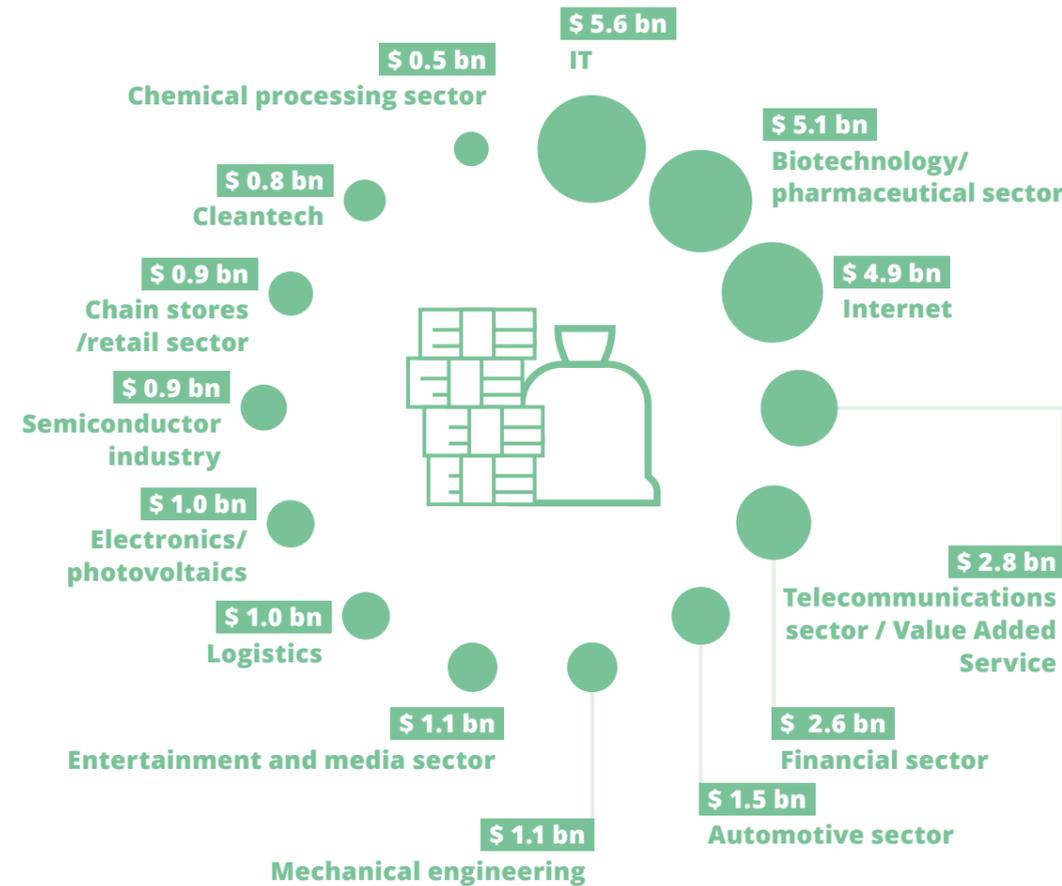


China has ambitious plans to build its own Silicon Valley by 2035.

The Chinese government wants to turn the so-called Greater Bay Area, which comprises 11 cities in southern China, into a global tech and financial center, rivaling California's Bay Area. The Pearl River Delta, which is home to nearly 70 million people, will be united into a giant megalopolis. The area is already the country's most economically dynamic region, embracing Shenzhen as the tech hub, Hong Kong as the financial center, and Macau as the gambling hub. As of today, the Pearl River Delta already contributes an eighth of China's GDP, with an economy worth 1.5 trillion U.S. dollars – which roughly equals Australia's and Spain's.

The Greater Bay Area initiative is part of China's overall approach to drive and push innovation forward. China is rapidly becoming the land of the unicorns. Thirty-seven Chinese companies reached billion-dollar valuations in 2018. The Chinese capital of Beijing has the largest concentration of fast-growing unicorns – startups valued at least 1 billion U.S. dollars – with an estimated 79 such companies located in the city in 2018.

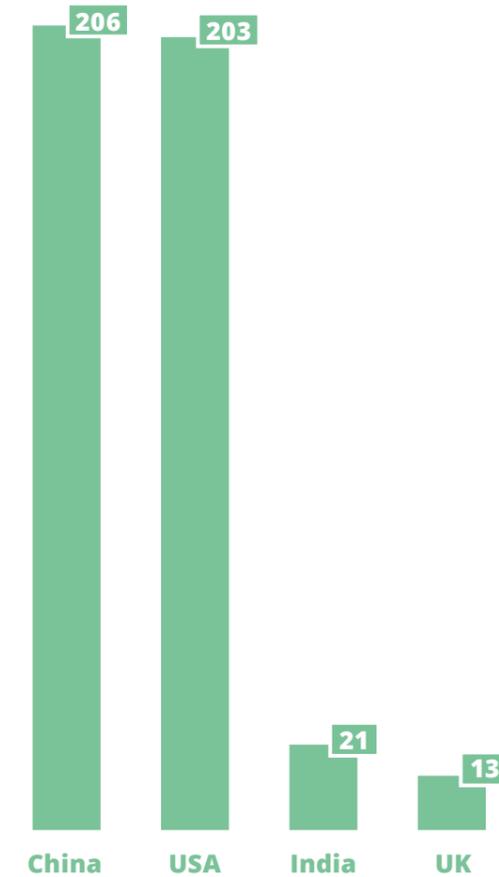
// Volume of venture capital investments in China in 2018, by sector*



China created a unicorn every 3.8 days.
The valuation of China's biggest unicorn, Ant Financial, has exceeded \$ 151 bn.*

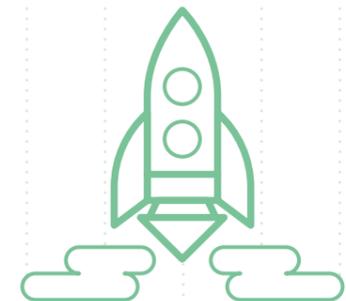
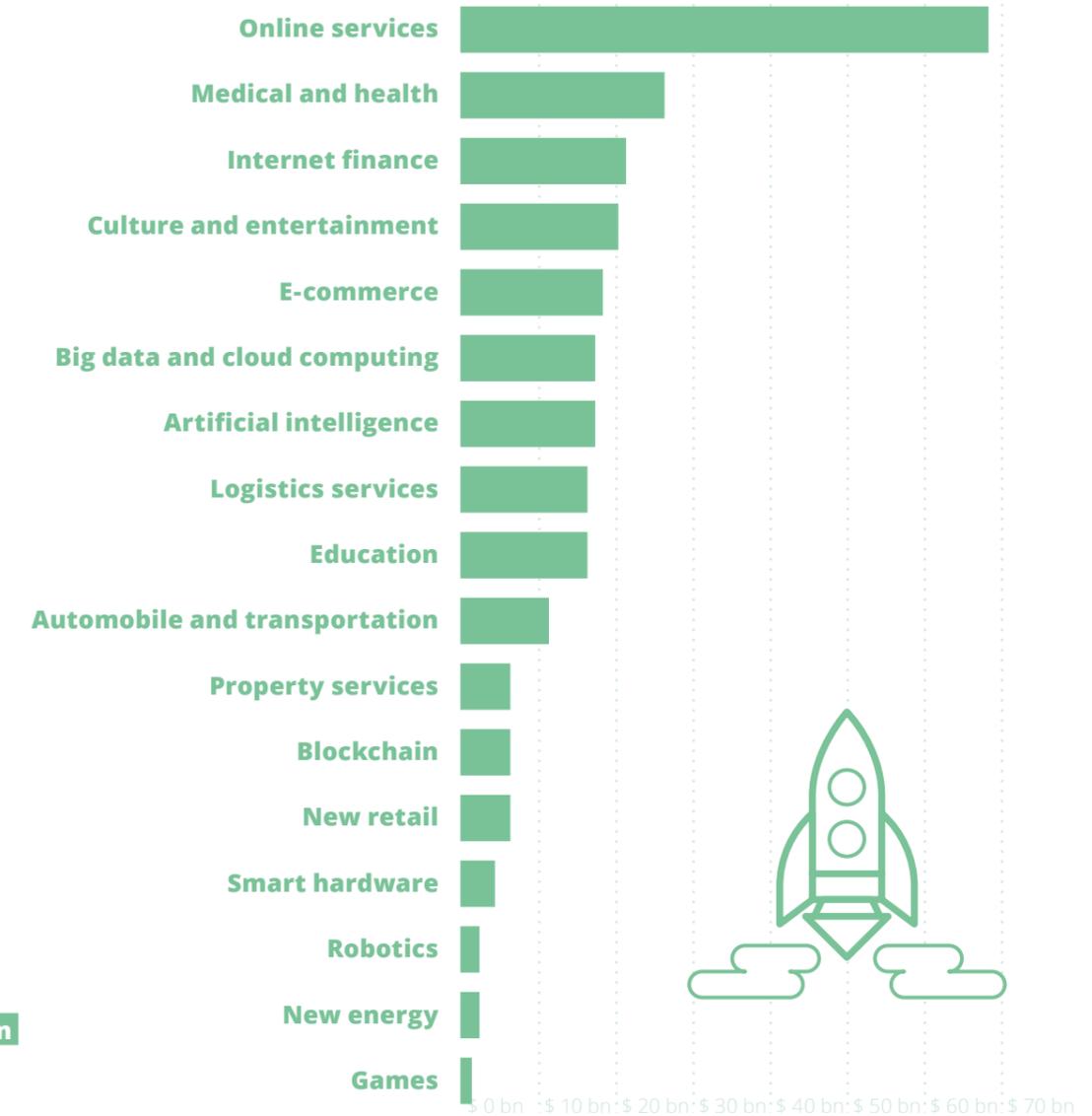
* Calculations based upon 2018 average exchange rate: RMB 1 = USD 6.62

// Global Unicorn List 2019. The "Big 4".



China fostered a total of 206 unicorn startups by Q2/2019, despite an economic slowdown and a prolonged trade war with the United States.

// Chinese startups worth at least 1 billion U.S. dollars in 2018



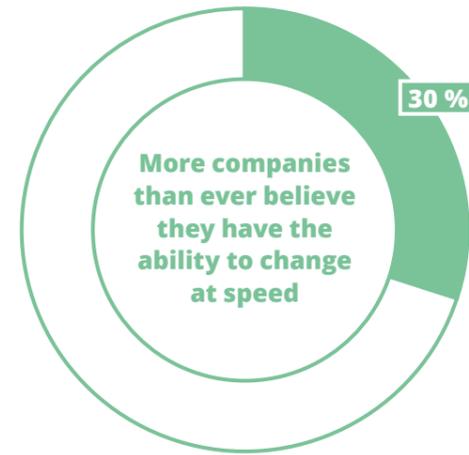
The global disruption is forcing companies to rethink and re-evaluate their current business practices in order to keep competing.

It seems no wonder that R&D spendings are rapidly increasing. According to a PwC report, global R&D spending among the world's 1,000 largest corporate R&D spenders increased by 11.4 percent in 2018 to a record high of 782 billion U.S. dollars.

Additionally, the role of accelerator and incubator, who support start-ups to attain success, has gained importance, as "classic" companies increasingly opt for investing in select start-ups in order to insource innovation from outside. Servicing the booming start-up ecosystem, incubators have built their service offering on the back of standard start-up support, made up of office space, mentoring, and networking. Meanwhile, accelerators addressed the next-level issues of differentiation through investment and access to technologies.

In the last decade, the number of accelerators and incubators grew fivefold.

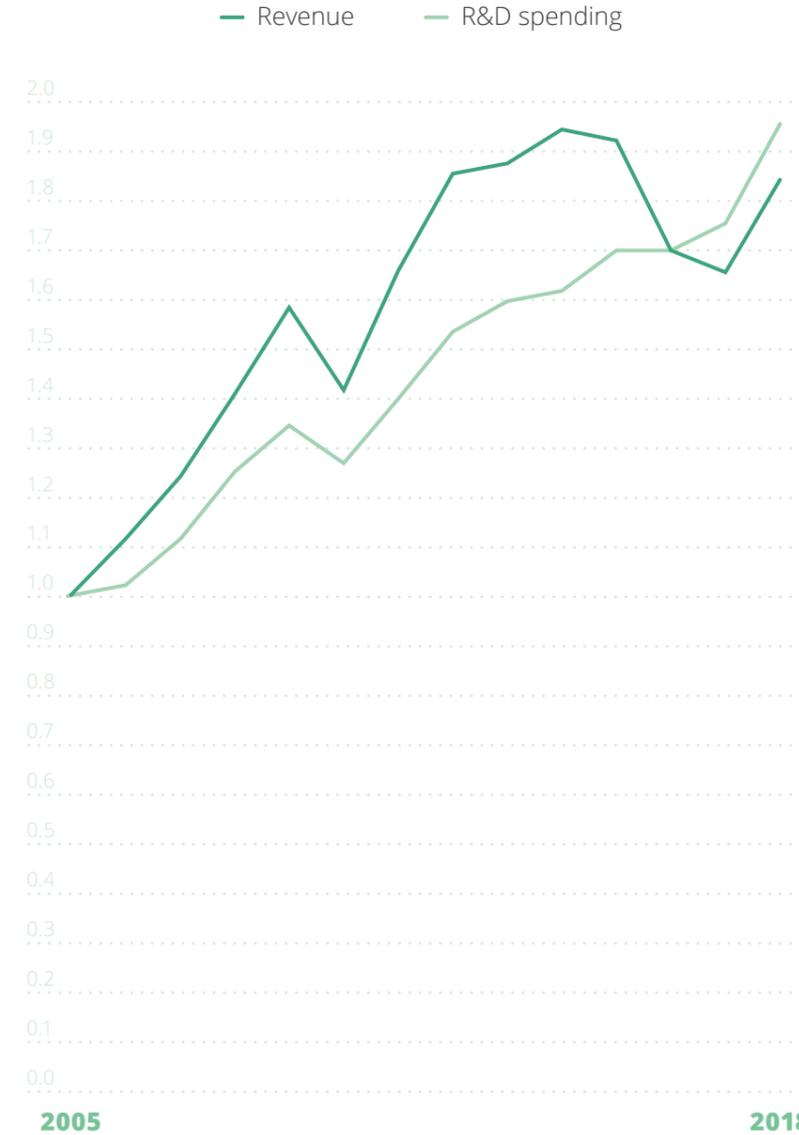
// Confidence to adapt to change



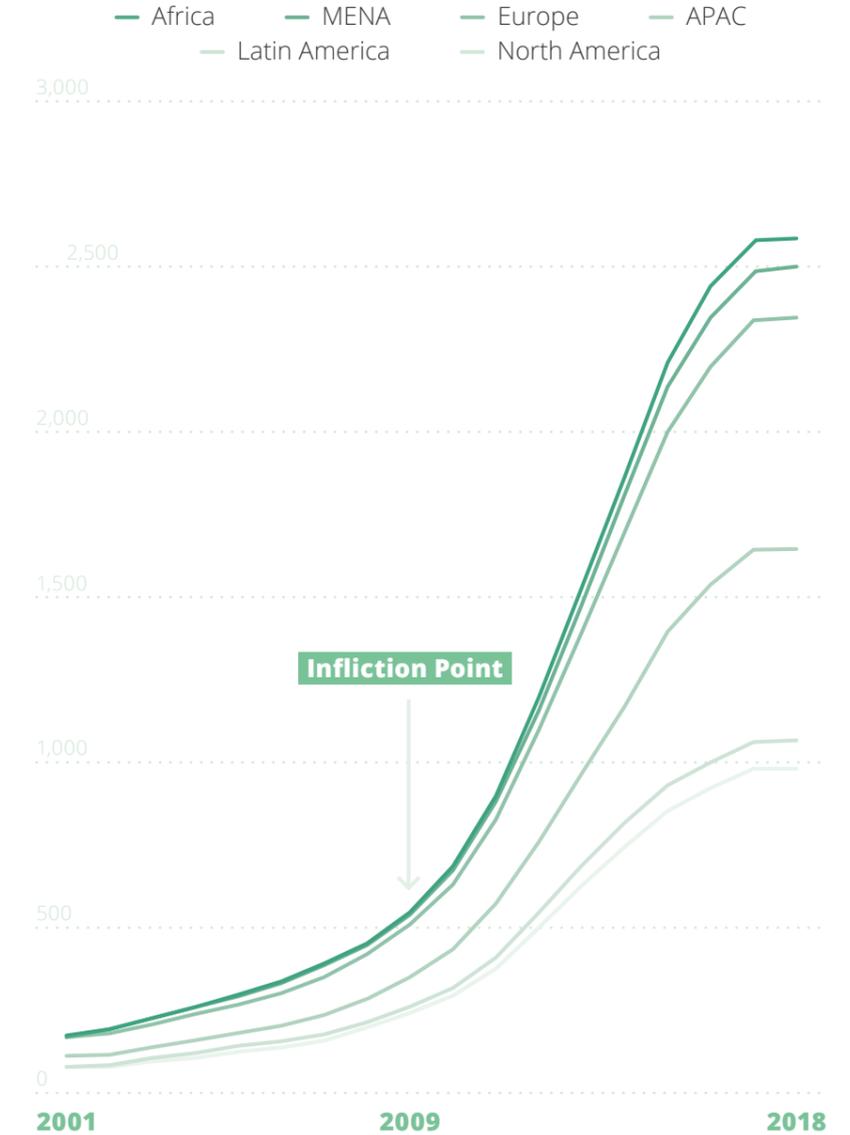
50 %
of the S&P 500 will be replaced in
the next 10 years.



// R&D and revenue spending among the Global Innovation 1000



// Openings of accelerators and incubators started surging in 2019



STATISTA RELEVANCE COMPASS

Evaluation Insights:

The philosophy and operative realization approach for modern innovative business building, understood as Beta Enterprises, is best described by the classical start-up. And although many corporates have started to adopt this approach of innovation development within their corporate structures, thus making this microtrend even more resounding, we limit the scope for quantifying this microtrend to the core of stand-alone start-ups. We quantify its economic impact by the amount of financial resources founders invest to launch their businesses. This amount is forecast to reach approx. 10 billion U.S. dollars globally by 2025.

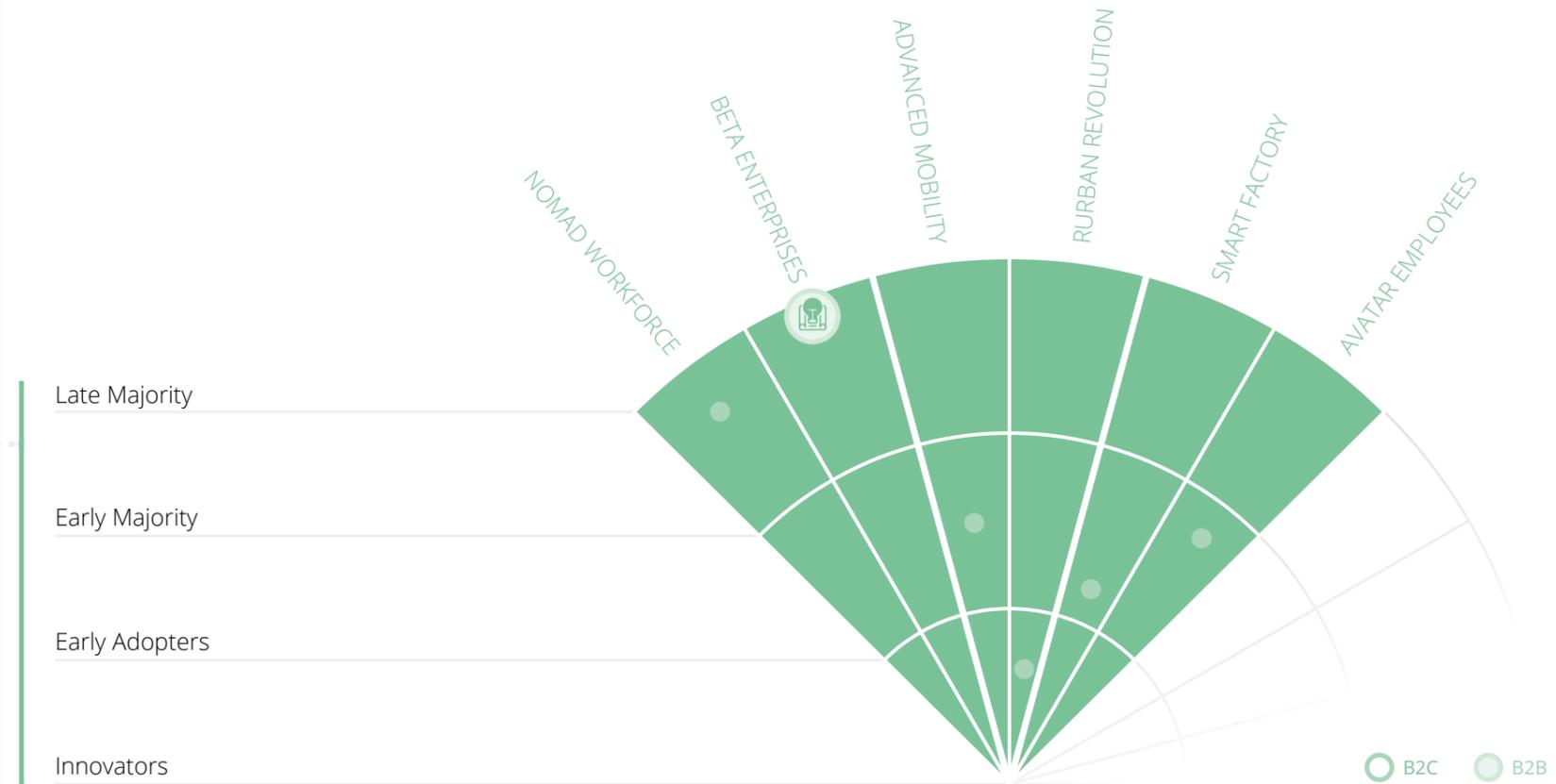
We see Beta Enterprises as one of the most mature among the microtrends presented in the TrendCompass, and expect it to become part of daily (economic) business.

ECONOMICAL CHANGE

8 / NEW WORK
// BETA ENTERPRISES

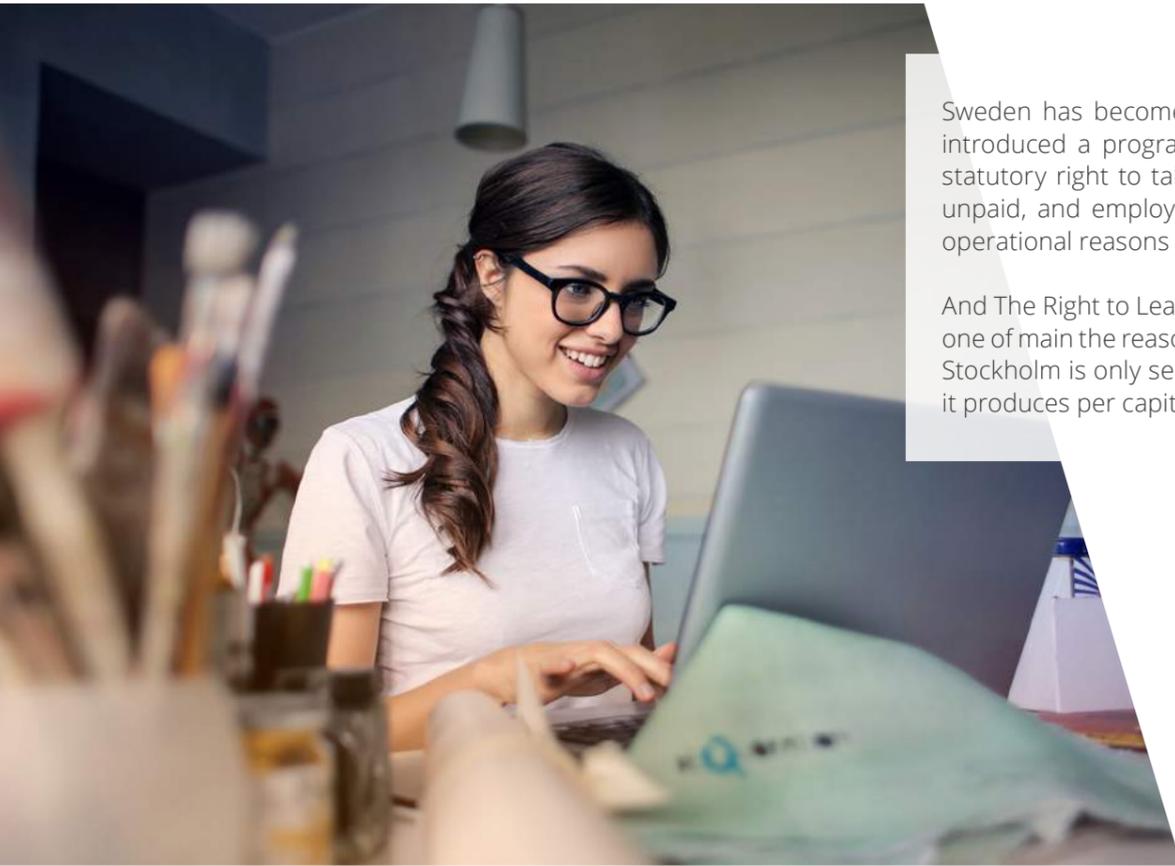


NW NEW WORK UH URBAN HUBS I4.0 INDUSTRY 4.0



INNOVATION SNAPSHOT

Sweden allows employees to take time off to start their own business.



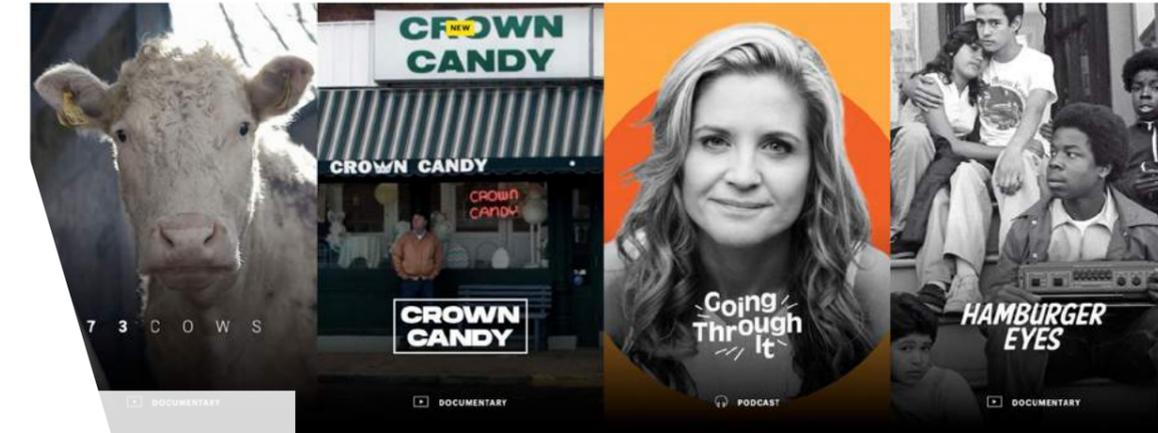
Sweden has become a country for entrepreneurs. Back in 1998, the Swedish government introduced a program – known locally as tjänstledighet – which gives Swedish people the statutory right to take six months leave and start their own business. The leave is typically unpaid, and employers are only entitled to reject the request once if there are significant operational reasons or if the new business is considered a direct competitor.

And The Right to Leave to Conduct a Business Operation Act is paying off: The tjänstledighet is one of main the reasons the country's capital, Stockholm, has become Europe's start-up capital. Stockholm is only second to California's Silicon Valley for the number of unicorn startups that it produces per capita.

Why this is interesting:

A recent global competitiveness report by The World Economic Forum highlighted that as much as innovation is needed for countries across the globe, most are failing to make it a growth engine. Germany, the U.S., and Switzerland were all named innovation powerhouses, but for most countries, innovation capacity remains limited or very localized, or exists in just a few sectors.

Short-form series, films, and podcasts created with entrepreneurs in mind.



In June 2019, MailChimp, the marketing platform best known for its newsletters, launched a new entertainment division to inspire entrepreneurs: MailChimp Presents. The new entertainment division is creating original series, films, and podcasts aimed at entrepreneurs and small-business owners and their shared struggles.

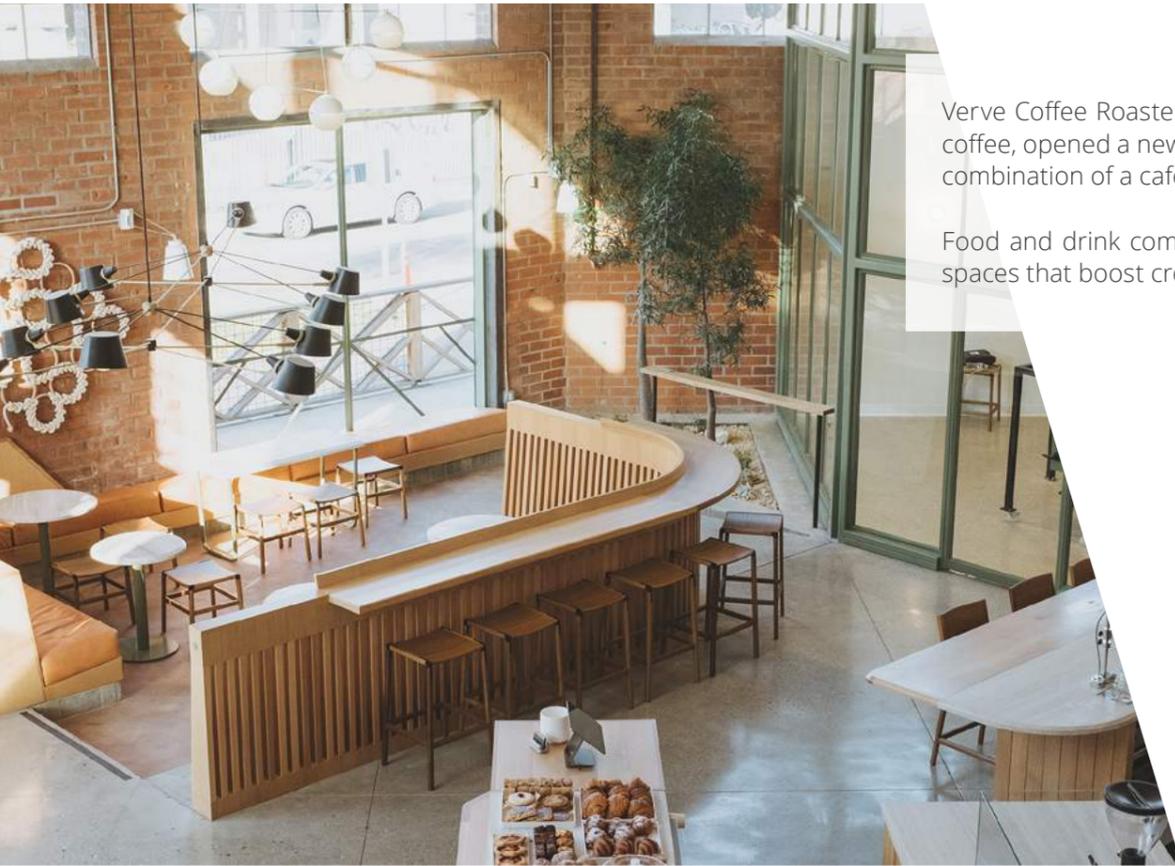
In doing so, MailChimp follows e-commerce platform Shopify's recent launch of its TV-and-film division Shopify Studios, which also aims at inspiring business owners with entrepreneur-focused, feature-length documentaries and docu-series.

Why this is interesting:

Branded content is far from a new concept. New, however, is the distinctive focus on entrepreneurs and startups, which is hinting at the evolvement of a new and particularly attractive target that established companies like to boast about.



Californian café meets R&D lab.



Verve Coffee Roasters, a California-based coffee company specialized in highest-quality craft coffee, opened a new café spot in L.A. in August 2019. The 7,000 square-foot location acts as a combination of a café, roastery, restaurant, test kitchen, and innovation lab.

Food and drink companies are increasingly drawing inspiration from Silicon Valley with new spaces that boost creativity, innovation, and collaboration.

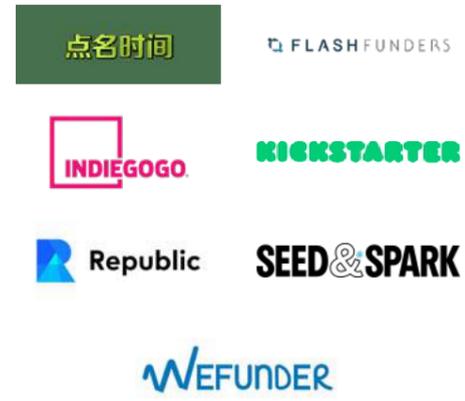
Why this is interesting:

While the primary goal of the new Verve café is to create small-batch, made-to-order coffee for the entire Southern California market, the attempt to become a beverage innovation center is more than interesting. As we have seen the Nomad Workforce leave fixed office spaces, cafés will shift their focus from being a space for relaxation towards a location where ideas start spreading.

SUCCESSFUL INDUSTRY PLAYERS



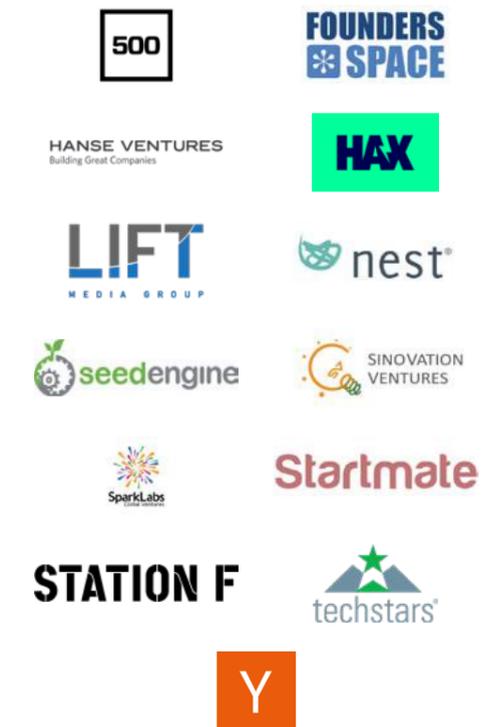
Crowdfunding platforms



VC Firms



Incubators



Macrotrend #5

URBAN HUBS



The world is becoming urban. Cities have always been manifestations of the cultural, economic, and social acceleration that we have experienced in modern history. Industrialization has given cities a key role in human development.

City consumers, with their rising earnings and spending power, make up the majority of global consumption and are driving major consumer trends. As the 21st century unfolds, an increasing majority of the world's population will live in cities.

By 2050, it is estimated that

68 % of the world's population will be living in urban areas.

Within this overall growth, the pace of urbanization will vary across the world. Today, the most urbanized regions include Northern America (with 82 percent of its population living in urban areas in 2018). Latin America and the Caribbean (81 percent), Europe (74 percent) and Oceania (68 percent). Asia (50 percent) and Africa (43 percent) are lagging behind.

As the volume of urban consumers continues to increase, billions of people will be impacted by the globe-spanning race to build future-proof cities. Public and private institutions will have to take bold steps to rethink living in

cities, as the scale of urban risk is increasing due to the similarly increasing urban density. At the forefront are issues like reconsidering transport with **Advanced Mobility** concepts (Microtrend #9), tackling isolation due to the increasing number of single households, or mitigating the climate change due to pollution.

In order to boost the quality of life in cities, modern urban planning is directing its focus towards urban consumers' needs: human-scale cities is the new buzzword when it comes to redesigning them. Connected, smart solutions allow for a more adaptable steering of people, goods, resources, and traffic, to make cities less congested, more liveable, and safer. Buildings, streets, and squares are being built to do justice not primarily to cars but to people's needs. And independent initiatives are adding a green and natural touch to concrete and steel. The **Rurban Revolution** is unfolding (Microtrend #10). The state of the new urbanization models' evolution will become a key factor for economic, ecologic, as well as social stability all over the world.

DRIVERS

WHAT ENABLES THIS MACROTREND?

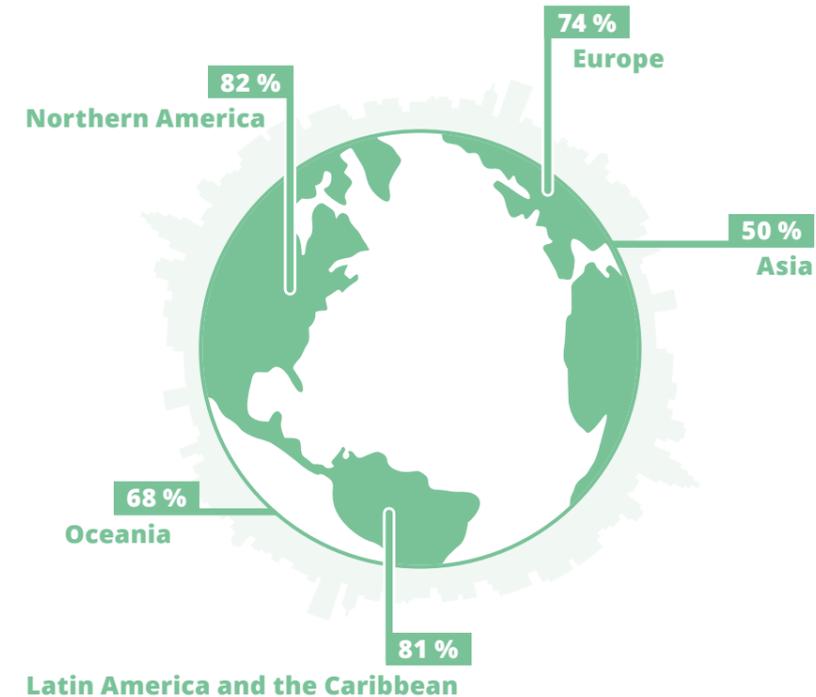
As cities become bigger and bigger, with more people living and working in metropolises, new challenges arise to manage traffic, enable affordable housing, provide for recreation, and make cities inhabitable.

KEY MOTIF

WHY ARE WE KEEN ON SUCH OPPORTUNITIES?

People have always been drawn to cities as centers of economic activity, opportunity, and innovation. And while cities get more and more dense and crowded, people not only long for frictionless urban infrastructures, they also want to feel more grounded by reconnecting to nature within their own urban microcosms and be embedded in their immediate local environments.

// Share of the population that live in urban areas 2018



80 %

of global GDP was generated in cities.

MANIFESTATIONS

Microtrend #9

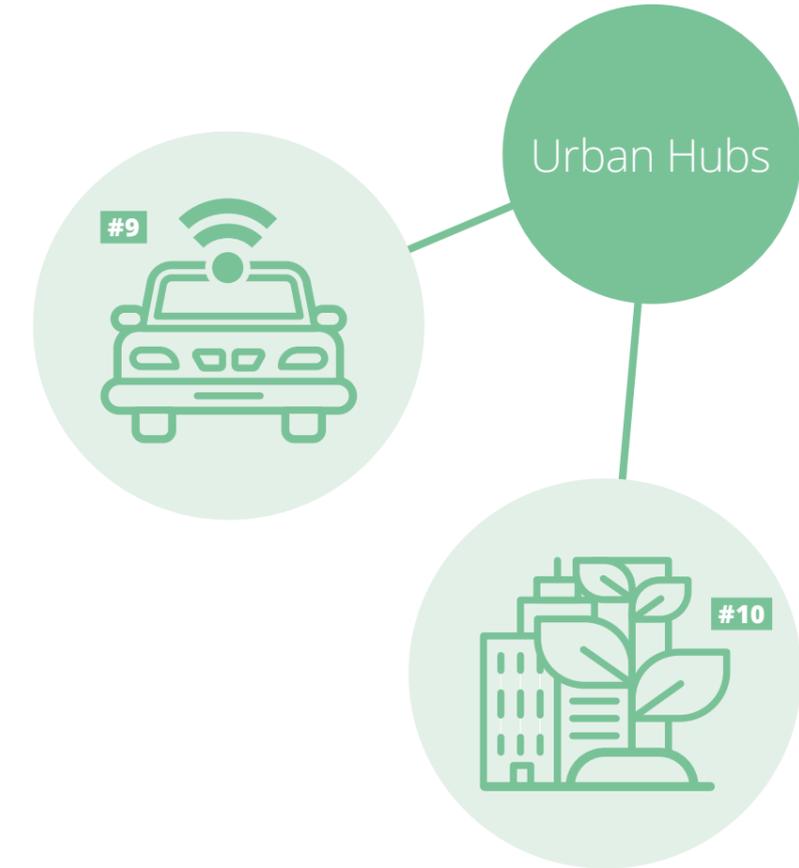
ADVANCED MOBILITY

We may stand at the forefront of the biggest changes ever in the domain of mobility. Combinations of new technologies and services, from autonomous transport to shared modalities and drone travel, can have a huge impact on congestion in the coming years.

Microtrend #10

RURBAN REVOLUTION

City dwellers are rejecting the impersonal 'bigness' of globalization and corporations, and prefer reconnecting with their communities. They are living hyperlocally, growing their own food, and embracing small-scale micro-brands. They are making their urban lives feel as rural as possible.





Microtrend #9

ADVANCED MOBILITY

With more and more people living in urban areas and cities, smart urban mobility will be a, if not the vital factor to keep these megacities running.

People must move for work and for leisure, and at the same time, the goods that they need or desire must be manufactured and brought to convenient locations, whether those are retail outlets or the consumer's front door. According to the OECD, passenger transport will increase nearly three-fold between 2015 and 2050, from 44 trillion to 122 trillion passenger kilometers. Global freight demand will triple between 2015 and 2050 based on the current demand pathway.

All over the globe, established industry players and newcomers are moving quickly to seize opportunities as they arise, adapting to the changing needs of future cities, and creating safer, more adaptable, and above all, more sustainable mobility concepts. The need to reduce carbon emissions and increase energy security has resulted in significant advancements in technology. The global automotive industry is undergoing an unprecedented transformation.

Game-changing technological solutions mainly revolve around electrically powered vehicles, ride sharing and autonomous driving.

Not to forget innovative mobility concepts on two or no wheels, as increased public focus on health and wellness is pushing mobility choices towards more active modes, such as walking and cycling. Some cities, such as Copenhagen for example, are already moving towards becoming car-free. Furthermore, drone development is progressing rapidly as advances in battery development, sensor miniaturization, and computational power make them more accessibly priced.

Transport systems in the future will focus on multi-modal solutions, with seamless transfer between different mobility modes, such as cars, buses, rail, and non-motorized transport. Moving passengers and freight will become more intelligent and more integrated.

What's in the trend?

AUTONOMOUS MOBILITY // E-MOBILITY //

3-D-MOBILITY // RIDE-SHARING // UBER ECOSYSTEMS //

DRONES // BIKEBOOM //

INTELLIGENT TRANSPORT SYSTEMS

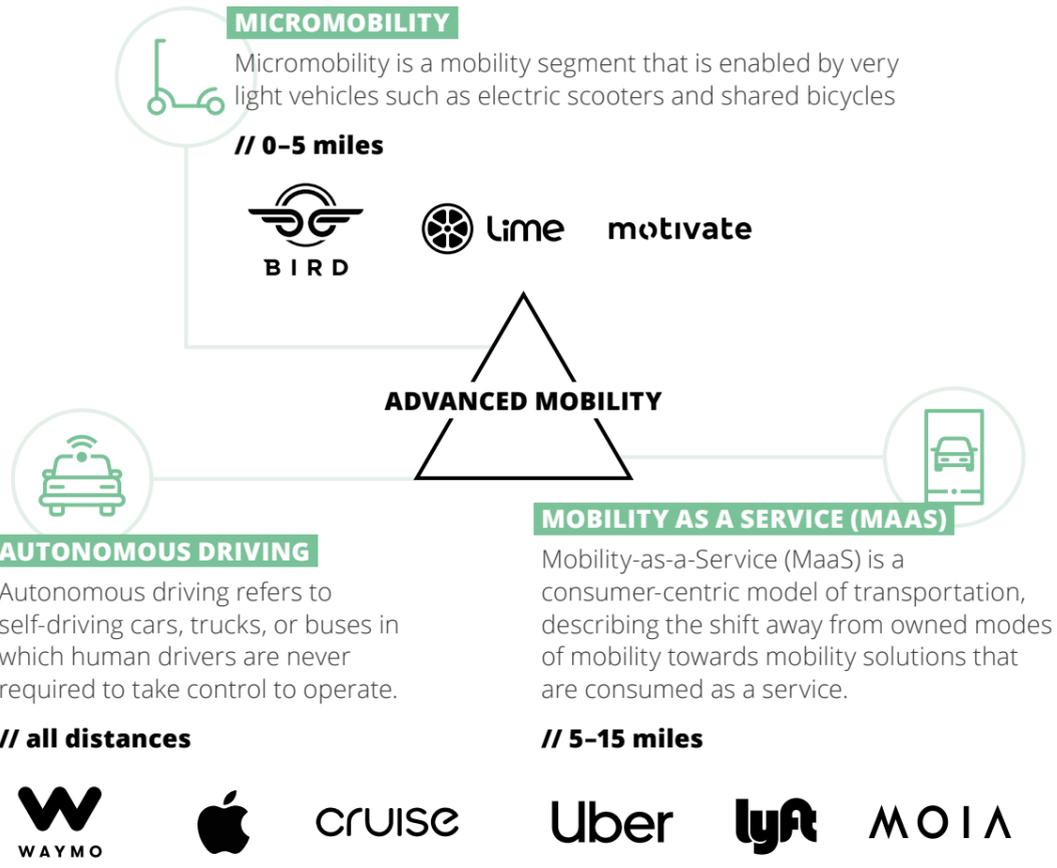


SUPPORTING FACTS

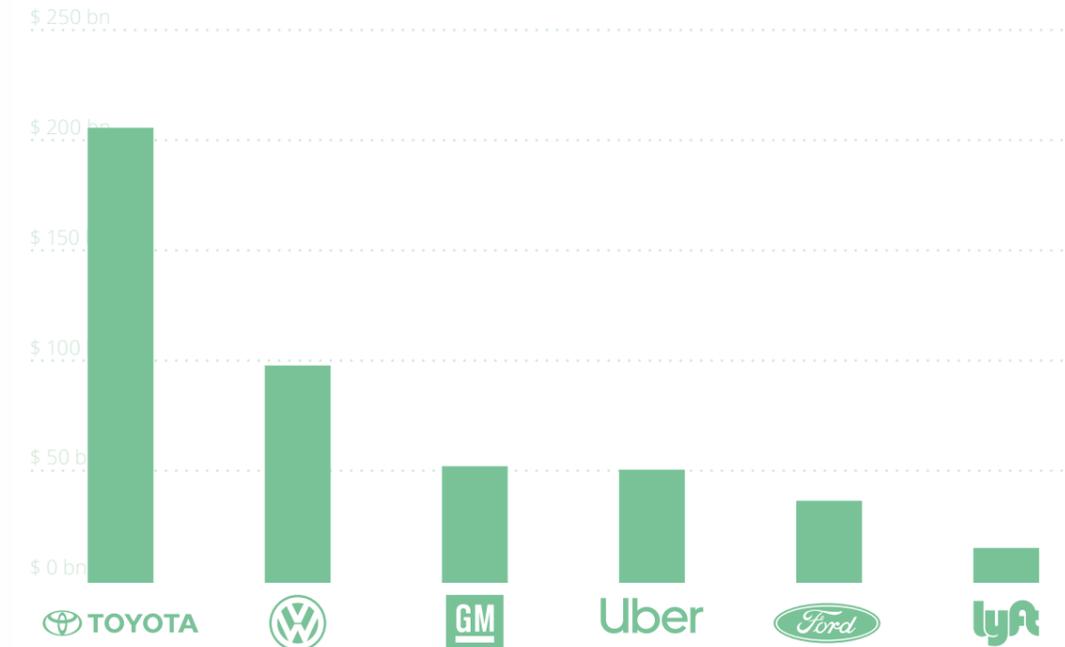
Traditional concepts of mobility as we know it are about to change fundamentally, as consumers search for more convenient, better, faster, healthier, and more sustainable options to get from A to B.

Not only cities will grow, but our mobility demand and traffic will increase accordingly: According to Eurostat, transport ranks as second-highest household expenditure by consumption purpose (13 percent) only surpassed by housing and utility expenditures like water, electricity, gas, etc. As more of the world's cities become congested and polluted, new business models and technologies are emerging to solve the mobility challenge that urgently needs to be solved.

A mobility disruption no longer looms, it is well under way. From ride-hailing to advanced optimization algorithms to autonomous driving – innovation is fueling the mobility market from several angles. The dynamic mobility segment leaves plenty of space for newcomers while putting pressure on traditional forms of mobility and on well-established automotive players.



// Latest market value as of december 2019



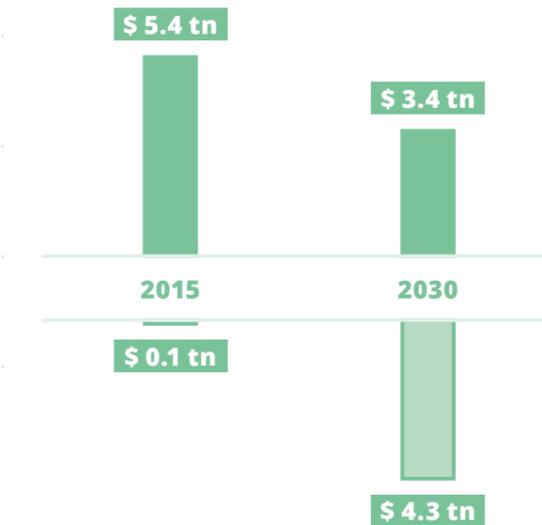
// Urban passenger mobility demand worldwide*



* The values for 2030 and 2050 are projections.

// Global automotive ecosystem revenues

TRADITIONAL
eg. taxis, nonautonomous vehicles, fuel sales



DISRUPTED

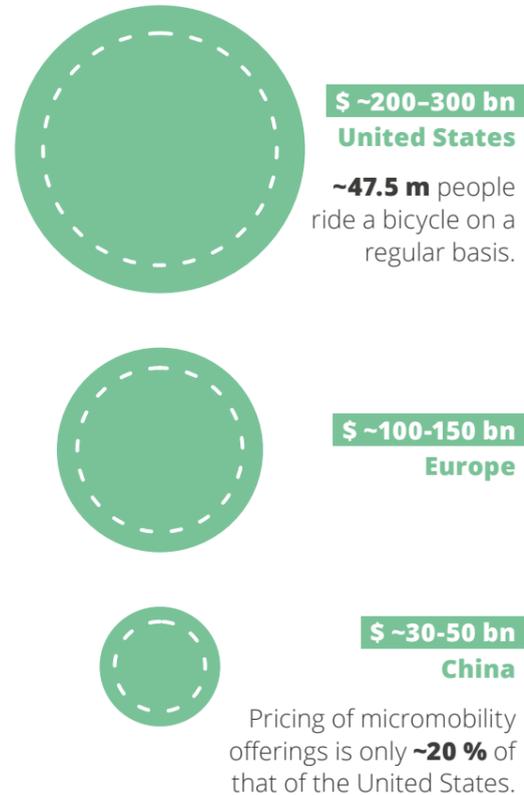
eg. e-hailing, L3-L4 vehicles, algorithm-based insurance

Americans have lost an average of 97 hours a year due to traffic congestion. In 2018, it cost Americans roughly

\$ 87 bn,
or an average of \$ 1,348 per driver.



// Estimated size of micromobility market, by region, in 2030



Worldwide, investors have already poured more than \$ 5.7 bn into micromobility startups in the past 4 years.

With most cities all over the world dealing with high levels of pollution and congested streets, micromobility could help ease these problems.

Especially for urban dwellers, taking short-distance trips with a bike or scooter is often much cheaper than owning a car or taking a taxi. Micromobility could theoretically encompass all passenger trips of less than 8 kilometers (5 miles), which account for as much as 50 to 60 percent of today's total passenger miles traveled in China, the European Union, and the United States. Due to constraints like age fit, dependence on weather conditions, or limited space for loading cargo however, experts estimate that the shared micromobility market will cannibalize only about 8 to 15 percent of this theoretical market.

The potential thus keeps staying huge, with stakeholders investing a huge amount of money into the micromobility market, pushing startups like Lime and Bird to valuations that exceed 1 billion U.S. dollars, making them some of the fastest growing unicorns to date.

Same as micromobility, the concept of Mobility as a Service (Maas) is rapidly spreading across cities. From concepts like car-sharing to ride-hailing or pooled rides in shuttles, Mobility as a Service is unstoppable entering urban streets.

The increasing popularity of car-sharing and ride-hailing is associated with a fundamental change in consumer behavior. Especially for

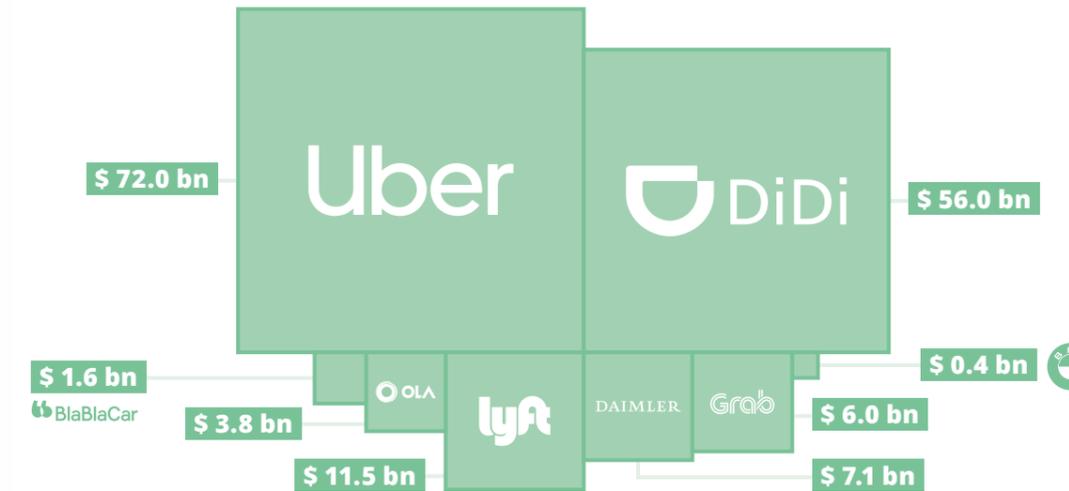
younger customers, owning a car has lost its status appeal. The sharing economy, which is affecting quite a number of industries now, has transformed our global consumption patterns. These are no longer focusing on ownership but on service. Being mobile no longer equals owning a car.

While car-sharing is becoming increasingly big, ride-hailing is following, especially in the U.S. According to a survey conducted by the Pew Research Center in fall 2018, the share of Americans who use ride-hailing services has increased dramatically: 36 percent of U.S. adults say they have used a ride-hailing service such as Uber or Lyft at least once.

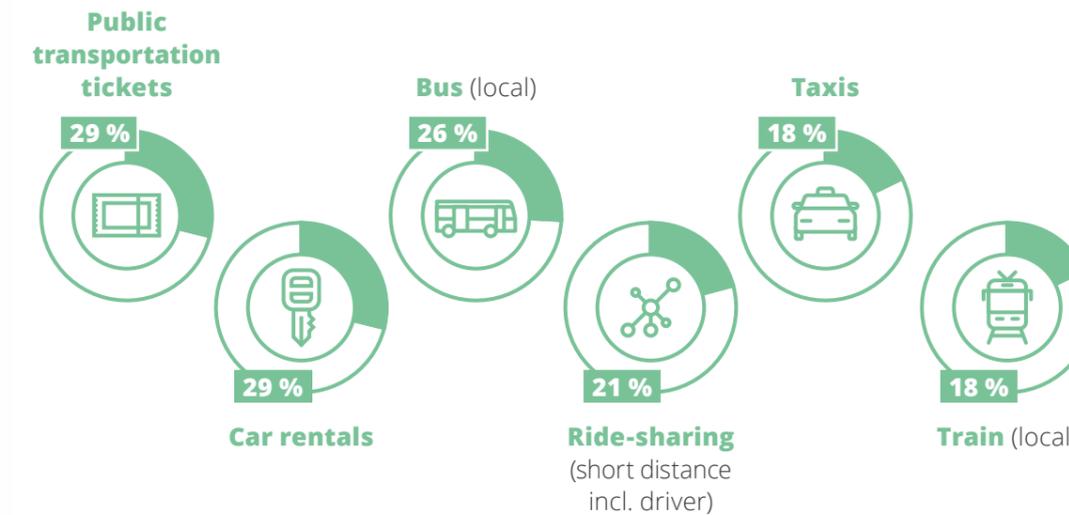
Both, car-sharing and ride-hailing are promising concepts to keep city traffic flowing and to dissolve traffic congestion by reducing the number of car ownerships.

While there were nearly 700,000 car-sharing users in Europe at the end of 2011, it is estimated that by 2020 there will be around 15 m.

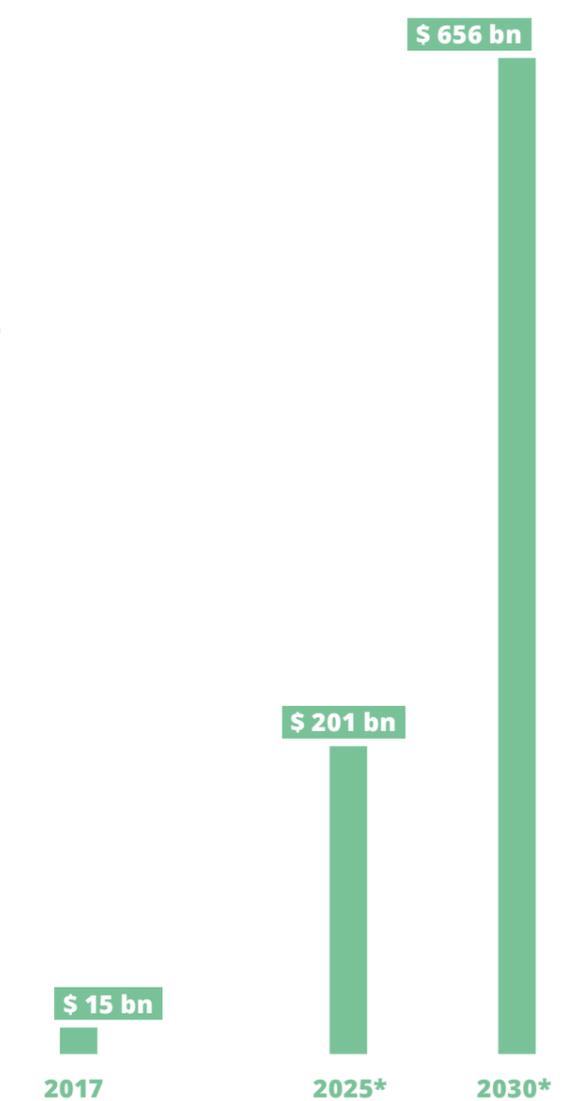
// Ride-hailing market value worldwide as of May 2018, by key operator



// Which of these mobility services have you used in the past 12 months?



// Projected vehicle-based mobility as a service (MaaS) market size in China



Additional information: United States; February 23 to March 21, 2019; 2,100 respondents; 18-64 years; * Forecast.

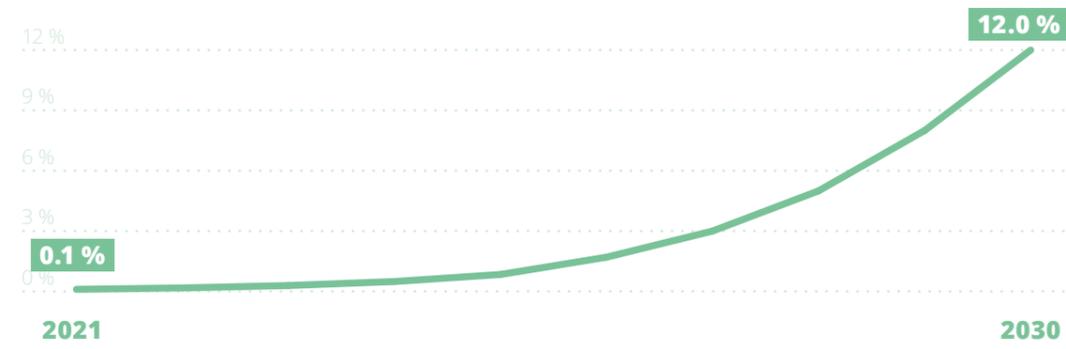
The rise of automated autonomous driving will deeply impact our transportation behaviors, and it will further shift mobility from a product-centric ownership towards shared service concepts.

Automated driving is finally becoming a reality. New technological developments combined with advanced infrastructure solutions and the evolution of regulations sped up automated driving solutions. What started in 2005 as a rather futuristic idea by Google only, is affecting numerous players from various industries today. In 2019, traditional car manufacturers and new competitors have all announced major progress in driverless mobility.

In December 2018, Waymo, the company that emerged from Google's self-driving-car project, officially started its commercial self-driving car service in Phoenix, Arizona. While the service is available only to a few hundred passengers in the first phase, it is important to note what it implies: Customers start paying for robot rides.

Autonomous driving comes with 5 levels, from level 0: "No Automation", where the driver controls the car without any support from an assistance system, to level 5, where the car can drive without any human interaction. Today level 3: "Highly Automated Driving", level 4: "Fully Automated Driving", and level 5: "Full Automation" are still in the testing phase.

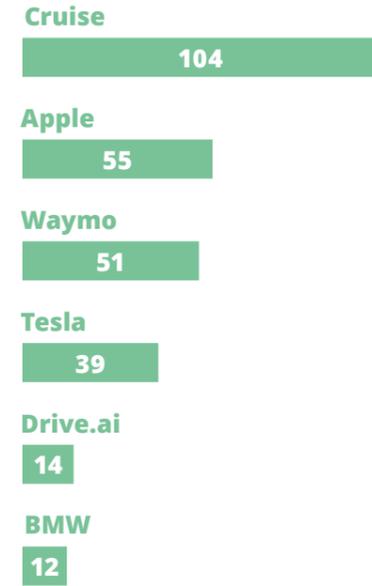
// Projected autonomous vehicle market penetration worldwide



// Index scores on level of preparedness for driverless cars in 2019 (30 = best prepared)*



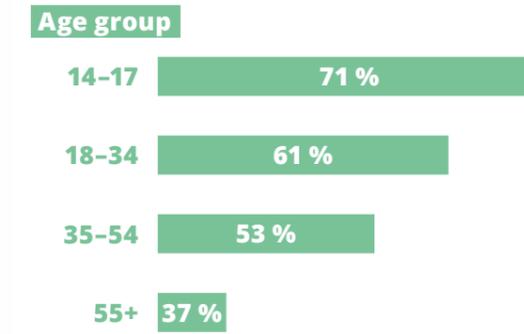
// Number of autonomous vehicles registered to be tested on public roads in California**



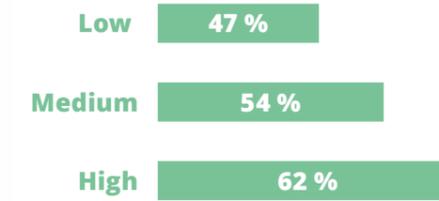
* The Autonomous Vehicle Readiness Index (AVRI) is based on four pillars: policy & legislation, technology & innovation, infrastructure, and consumer acceptance.
** As of May 9, 2018



// Willingness to be a passenger in a self-driving vehicle



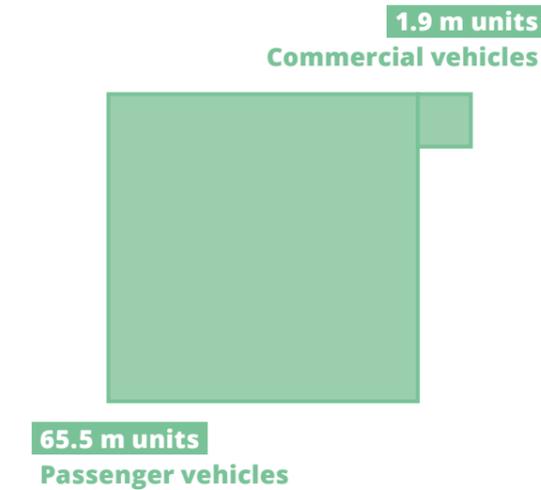
// Income level



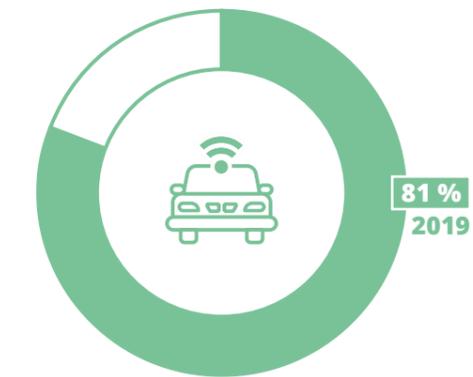
54%
of online consumers are willing to be a passenger in a self-driving vehicle***

81%
In 2019, of Chinese consumers agreed that travelling in a fully autonomous car will be a positive experience.

// Projected autonomous vehicle market worldwide in 2028, by vehicle type



// Share of consumers who agree that traveling in a fully autonomous vehicle will be a positive experience in China



The race to participate in the self-driving cars segment is on. According to Allied Market Research estimates, the autonomous vehicle market will grow from 54.23 billion U.S. dollars in 2019 to 556.67 billion U.S. dollars in 2026. Waymo's competitors are closing in: Yandex launched Russia's first commercial driverless taxi service in August 2018, now expanding to the U.S. and Israel. And April 2019 saw the UK test its first driverless cars in London. And as early as 2020, drone taxis will begin trial operations in Dubai, Los Angeles, Dallas, and Singapore, with commercial use starting from 2023. Moreover, autonomous driving is also integrated into local public transport concepts. According to research done by BMW, there are now 10 public test lanes for autonomously driven e-shuttle buses in Europe alone.

Despite all the buzz, self-driving cars are not there yet. There are self-driving cars on the roads, but industry experts predict it will be at least 12 more years before fully autonomous vehicles will be sold to private buyers, according to a J.D. Power survey.

95%
By 2030, it is forecast that of passenger miles traveled in the U.S. could be happening in on-demand, autonomous electric cars owned by fleets rather than individuals. The average family could be saving \$ 5,600 a year on transportation.

*** Total number of online consumers = 21,000; 14-17 (n= 1,124), 18-34 (n= 8,550), 35-54 (n= 7,605), 55+ (n= 3,721), Low (n= 5,302), Medium (n= 9,559), High (n= 6,139)

STATISTA RELEVANCE COMPASS

Evaluation Insights:

The mobility industry is not only one of the biggest industries in general, it is also one that is affected the most by the digital and technical transformation. Hence, a multitude of new products and service offerings have emerged, and even more will become production-ready. For the quantification of Advanced Mobility, we refer to the Mobility-as-a-Service market consisting of self-driving car services, ride hailing services, and sharing of cars/bikes/e-scooters/micro-buses. Traditional taxi services ordered via apps or online tickets for traditional transportation services, like trains or planes, are not included. We estimate the end consumer spending for Advanced Mobility to reach up to approx. 375 billion U.S. dollars globally by 2025.

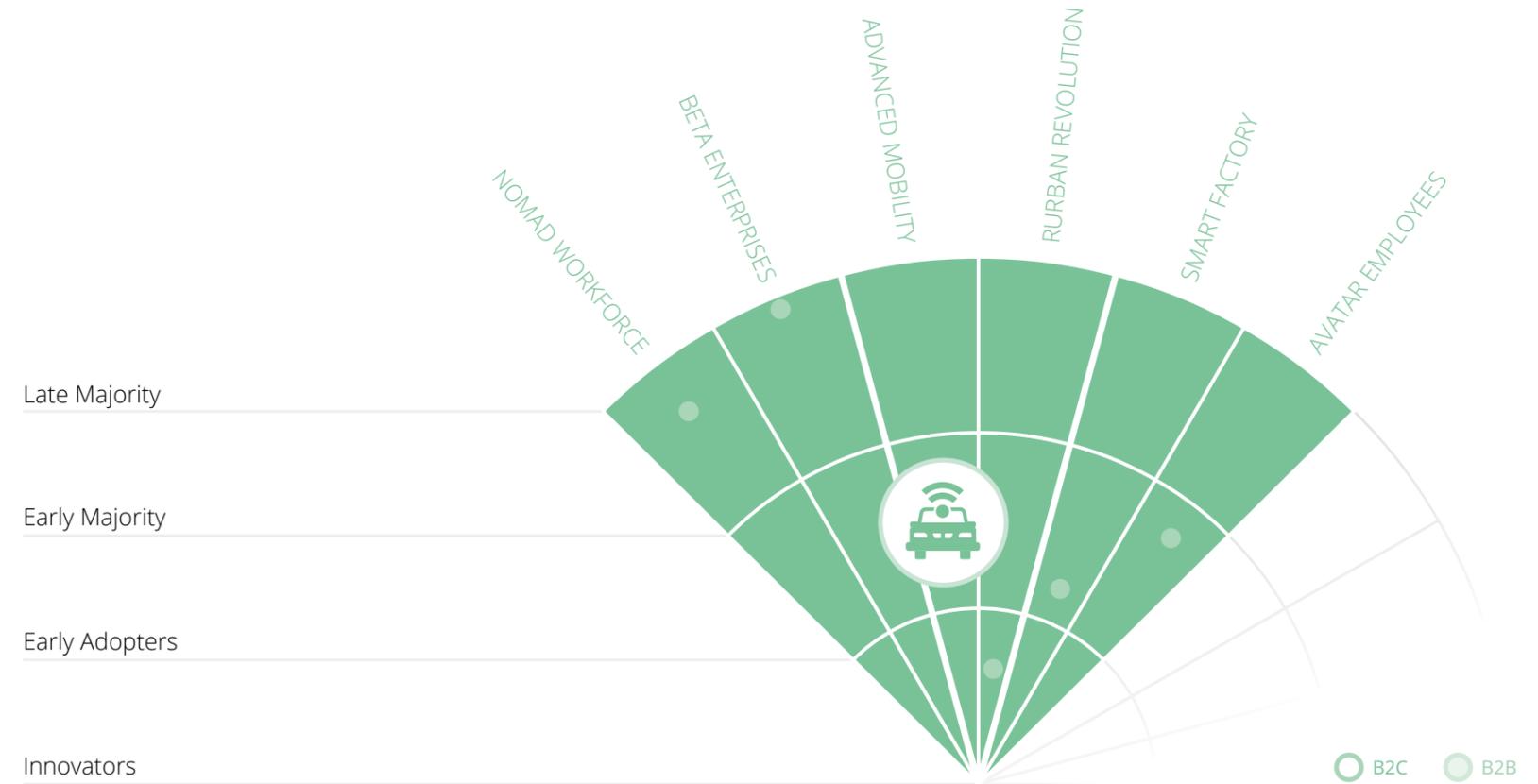
As this microtrend reaches already substantial customer segments in urban areas but lacks deep penetration outside those regions, we locate Advanced Mobility between early adopters (for non-metropolitan areas) and the early majority (for metropolitan areas).

ECONOMICAL CHANGE

/ URBAN HUBS
9 // **ADVANCED MOBILITY**



NW NEW WORK UH URBAN HUBS I4.0 INDUSTRY 4.0



INNOVATION SNAPSHOT

First drone delivery business worldwide wins approval in Australia.



In April 2019, Googles' Project Wing has been given the go-ahead to turn its drone delivery trials in Canberra, Australia, into a service that's open to the public.

Wing customers can order a range of products, such as fresh food, household items, or OTC chemist items, through a mobile app. The goods will be delivered directly from local businesses to their homes by drone in a matter of minutes.

Wing predicts that drone deliveries could be worth as much as 30 to 40 million Australian dollars to businesses in the area, and says drones could deliver as many as one in four takeaway orders by 2030.

Why this is interesting:

Drone delivery projects are already benefiting isolated communities around the world and are now presenting new opportunities for "regular" consumers to shop. While drone delivery primarily provides greater autonomy to those busy consumers (families, shift-workers, people who need assistance with mobility), the all-electric drones also reduce traffic, as well as pollution, and carbon-emissions. Imagine an almost instant product delivery even in more populated regions, once sensors and AI allow for safe journeys.

Volvo and Uber launch self-driving car for autonomous ride-sharing.

It wasn't a given that Uber would continue working on self-driving cars after the tragic death of Elaine Herzberg in March 2018 and Arizona consequently banning Uber from further testing autonomous driving.

In June 2019 however, Sweden-based carmaker Volvo and U.S.-based ride-sharing company Uber launched their purpose-built self-driving car – the XC90. The SUV, which is built to fit Uber's self-driving technology at the factory level, will start testing on public roads in 2020. With multiple redundant backup systems built into the vehicle, specifically around steering, braking, and battery power, the new version of Uber's self-driving car should reportedly be safer than its predecessors.

Why this is interesting:

As the race to push out autonomous cars across the globe heats up, carmakers struggle to maintain profit margins, faced with the rising costs of making electric, connected, and autonomous cars. As a result, they are setting up new alliances to combat spiraling development costs and to create the future of mobility.



Lilium, the Munich-based startup developing an on-demand “air taxi” service.



German aircraft manufacturer, Lilium, has unveiled the prototype of a five-seater jet-powered electric air taxi. After completing its maiden flight in May 2019, the Lilium Jet is expected to be operational in cities around the world by 2025.

The five-person design is an update of Lilium’s two-seater jet that successfully completed flight testing in April 2017. The advanced five-seater Lilium Jet has 36 all-electric jet engines, takes off and lands vertically, and has a top speed of 186 miles per hour and a range of 186 miles.

Why this is interesting:

According to the company, future passengers will be able to use the Lilium app to locate a landing pad near them, in much the same way that people currently book a journey with ride-sharing services such as Lyft and Uber, while comparable in price to a regular road-based taxi, but four times faster.

SUCCESSFUL INDUSTRY PLAYERS



<p>Ride hailing</p>	<p>Autonomous driving</p>	<p>Air taxi</p>
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Microtrend #10

RURBAN REVOLUTION

Extensive urbanization and digitization increasingly disconnect us from nature, real life, and tactile sensations. Consumers long to reconnect with nature within their own urban microcosmos. Cities around the world try to embrace a more ecological and sustainable lifestyle.

And as city-dwellers increasingly long for the rural life, new markets open up promoting anything local, natural, and rural. Behind that emotional consumer longing for a return to nature, we find a huge global urgency: Cities are a key contributor to climate change, responsible for more than 60 percent of carbon dioxide emissions, according to the United Nations. Cities all over the world race to reach ambitious climate goals, looking towards sustainable urban designs to help residents cut energy use, cope with rising heat and boost social well-being. Green infrastructure, with parks, agriculture, woods, rivers, and ponds in and around cities, has the potential to improve environmental conditions and air quality, and reduce urban temperatures. Reusing existing idle infrastructure is highly beneficial for urban areas, both economically and socially, as New York's Highline project shows: A former freight train trail in western Manhattan has been successfully transformed into a public park, creating vital green space for its citizens.

Initiatives that support a return to greener surroundings are on the rise. Urban farming is another example to make the city greener. In-

dependent initiatives all over the world are adding a rural touch to cities, installing self-sustaining gardens in backyards and on rooftops, re-vegetating vacant lots, founding community gardens, or becoming rooftop beekeepers. Urban agriculture has grown out of the niche and has become an industry. And New York City is leading the world in urban agriculture. Amidst the bustling metropolitan grid of skyscrapers, where nature seems sparse, lies a multitude of indoor farms and gardens – more than 700 city farms and garden citywide.

Designing spaces that acknowledge the impact of digitization, globalization, and climate change make it easier for people to live happier, greener, decelerated lives.

What's in the trend?

- URBAN GREENING // GREEN INFRASTRUCTURE //
- HUMAN SCALE CITIES //
- URBAN FARMS AND AGRICULTURE //
- REGIONAL AND LOCAL PRODUCE //
- ECOLOGICAL INITIATIVES



SUPPORTING FACTS

Today, 55 percent of the world's population lives in urban areas, a proportion that is expected to increase to

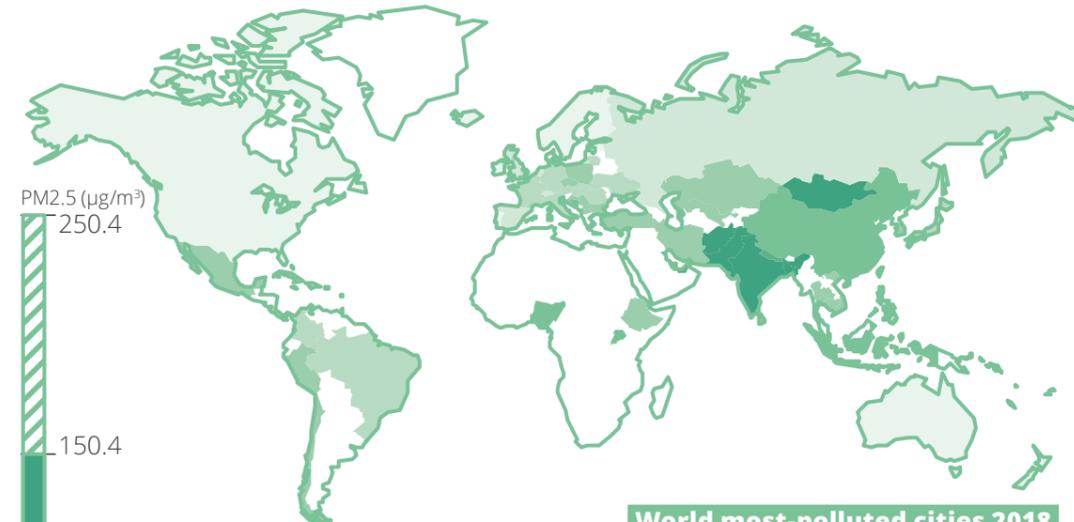
68 % by 2050.

While the world is getting more and more urbanized, and cities get more crowded and polluted, the need for greener city initiatives is growing considerably.

Within 68 years, the global urban population increased from 751 million people to 4.2 billion in 2018. And by 2050, it is estimated that 2.5 billion more people will live inside urban areas.

In terms of size, cities make up only 2 percent of landmass but consume over two-thirds of the world's energy and account for more than 70 percent of global CO2 emissions. According to latest research, the world's 100 largest cities make up for 20 percent of humanity's overall carbon footprint.

// World most polluted cities 2018



World most-polluted cities 2018

- | | |
|----------------------------------|-------------------------------|
| 1 // Gurugram, India | 6 // Noida, India |
| 2 // Ghaziabad, India | 7 // Patna, India |
| 3 // Faisalabad, Pakistan | 8 // Hotan, China |
| 4 // Faridabad, India | 9 // Lucknow, India |
| 5 // Bhiwadi, India | 10 // Lahore, Pakistan |

With these alarming numbers, it seems obvious that our current use of urban spaces needs to be reformed.

To mitigate the negative effects of living in cities – particularly pollution and global warming – cities all around the world are starting green city initiatives. From New York to Paris, and from London to Singapore, global cities are incorporating green solutions to improve the quality of living in cities – especially megacities – first and foremost: Singapore, which aims to become the world's greenest city. According to the Green City Index, the city-state of Singapore, a small, dense, island nation, where 100 percent of the population is urbanized, is Asia's greenest city and arguably has only a few competitors in the rest of the world.

According to the Green Building Information Gateway, as of today, Singapore maintains 961 green buildings, with the goal to convert 80 percent of its buildings into green buildings by 2030. Moreover, Singapore aims to increase its local food production by growing veggies in sky farms and vertical gardens. According to recent estimates, Singapore produces about 10 percent of its own food. However, as the population is growing and climate is changing, it wants to raise food production to 30 percent by the year 2030 under the initiative '30-by-30'. In doing so, the city-state will not have to depend as much on imports to feed inhabitants.

With more than 1,000 newly established allotment gardens, the city additionally aims to en-

courage its inhabitants to start farming themselves. Each planter – measuring 2.5 meters by 1 meter – can be leased for three years for 57 Singapore dollars (42 U.S. dollars) per annum.

Singapore's target is to raise food production to

30 % by 2030, through urban farming initiatives that aim to "grow more with less."

Singapore has more than **30** "sky farms", a number that has doubled in the last three years.



GREEN CITY INITIATIVES:

 **Singapore** initiated the Green Mark Scheme which aims for 80 percent of buildings to be green by 2030.

 **Paris** plans to "green" 100 hectares of buildings by 2020.

 **London** hopes to make the capital the world's first National Park City, where more than half of the city's area is green by 2050.

 **New York** has introduced the city's 14 billion U.S. dollars Green New Deal as part of a plan to reduce greenhouse emissions by 30 percent by 2030. Including the measure to ban all-glass skyscrapers.

In April 2019, New York City passed a bill referred to as the **Green Roofs Act**, requiring "Green Roofs" on all new buildings in NYC, whether they are residential or commercial. The legislation also applies to buildings undergoing significant renovations.

The global green-roof market is to expand with a significant CAGR of **19 %** during 2018-2022.

The global green building materials market is projected to reach a value of **\$ 432.5 bn** by 2024, registering a CAGR of **11.7 %** during 2019-2024.

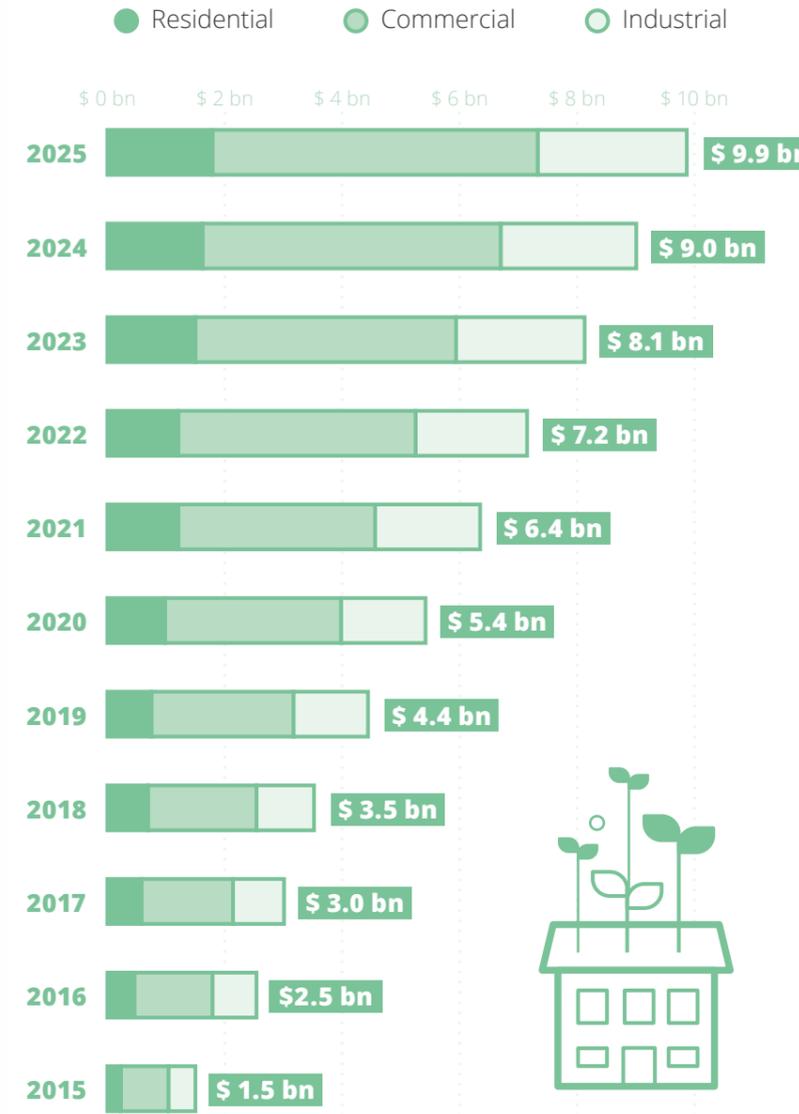
With cities all over the world becoming greener, the market of green infrastructure is soaring to new heights.

From the green building materials market to green roofs, cities all around the world are adopting new means to make cities greener and healthier by lowering greenhouse gas emissions especially. In addition, the reduced operational and maintenance costs provided by green buildings, due to less energy consumption, is further stimulating the demand for the market.

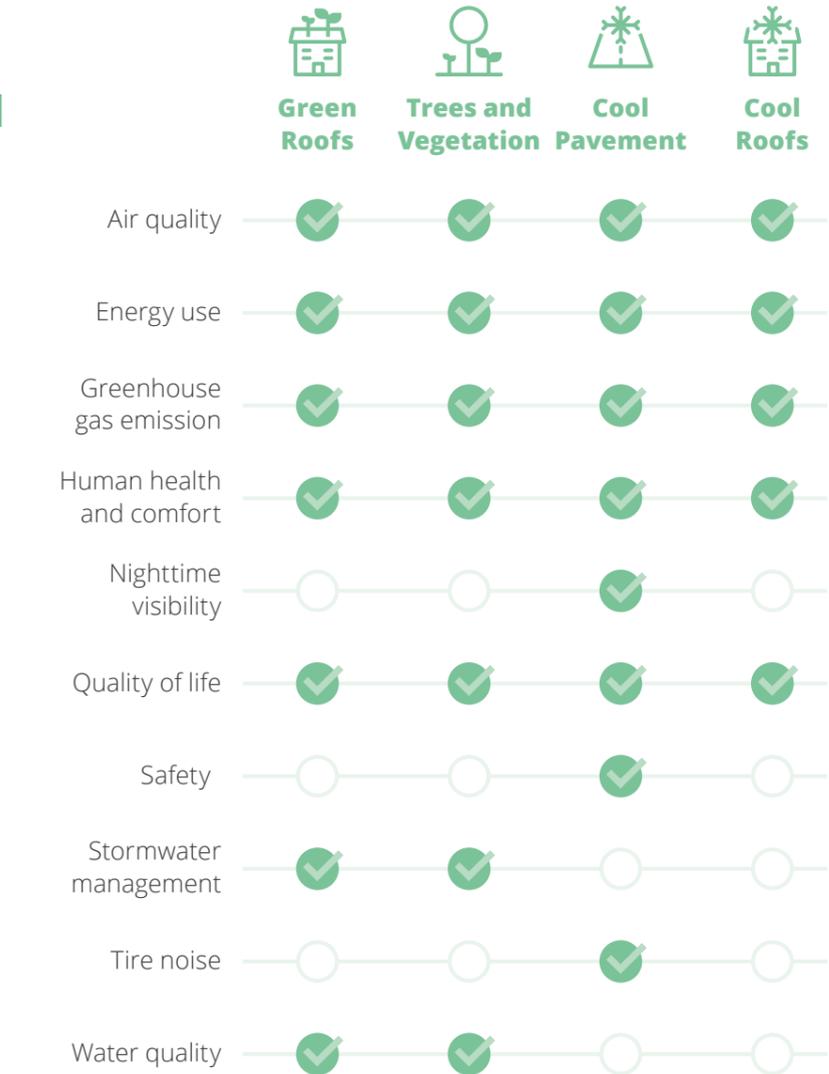
Especially in the U.S., the demand for green roofs, also known as living roofs, is growing. Green roofs are roofs partially or entirely covered with vegetation, providing oxygen production while offering savings in heating and cooling, reducing noise pollution, and helping to reduce heat islands. In recent years, many major cities in the U.S. have adopted new requirements for green roofing on new buildings – primarily to battle global climate change. The demand for green buildings is further driving the green roofing systems market, which is expected to report a CAGR of more than 19 percent during the period 2018-2022.

When it comes to green rooftops in Europe, Hamburg has taken a leading role among major German and European cities; Hamburg began implementing its policy on green roofs in 2015 and as of today, has fitted 70 percent of all suitable rooftops with vegetation.

// Germany green roof market size, by application



// Co-Benefits of heat island mitigation strategies



In recent years, urban agriculture has become a global trend - and it is continuing to grow steadily.

Urban agriculture, also known as urban farming, refers to growing food in cities. While some urban farms are built for education or training reasons only, most of these farms are meant to be "real farms", producing local foods, increasing access to locally grown produce. And as the demand for local products increases, a new wave of urban farms matches recent trends in more eco-friendly cityscapes while shortening supply chains.

By bringing the food production right into the city, urban agriculture eliminates the need for long transport distances and refrigeration, both producing quite an amount of carbon emissions. This in turn caters to the increasing need of consumers to buy local, strengthening local economies.

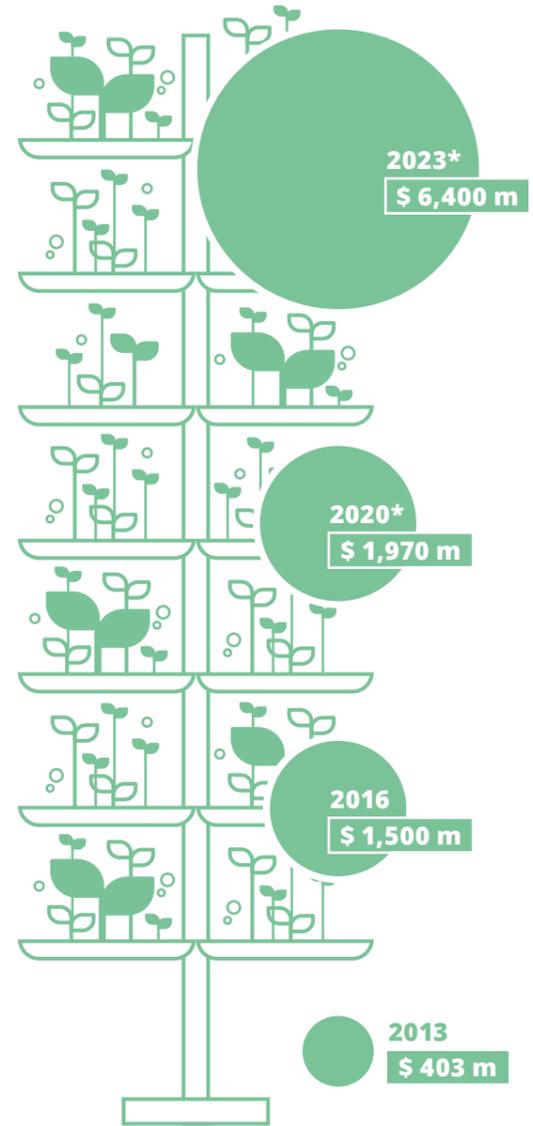
Especially vertical farming, which refers to producing food vertically inside a building, usually in a city, while using technology instead of natural means, has advanced heavily with major investment into the segment. By 2023, the vertical farming market is estimated to be valued at 6.4 billion U.S. dollars. And stakeholders are heavily investing in vertical city farming. July 2017 saw Softbank invest 200 million U.S. dollars in Plenty and IKEA, while the Sheikh of Dubai invested 40 million U.S. dollars in AeroFarms in August 2017. In December 2018, Google Ventures invested 90 million U.S. dollars in Bowery Farming.

46 %
of U.S. consumers said they were aware of the need to buy local.

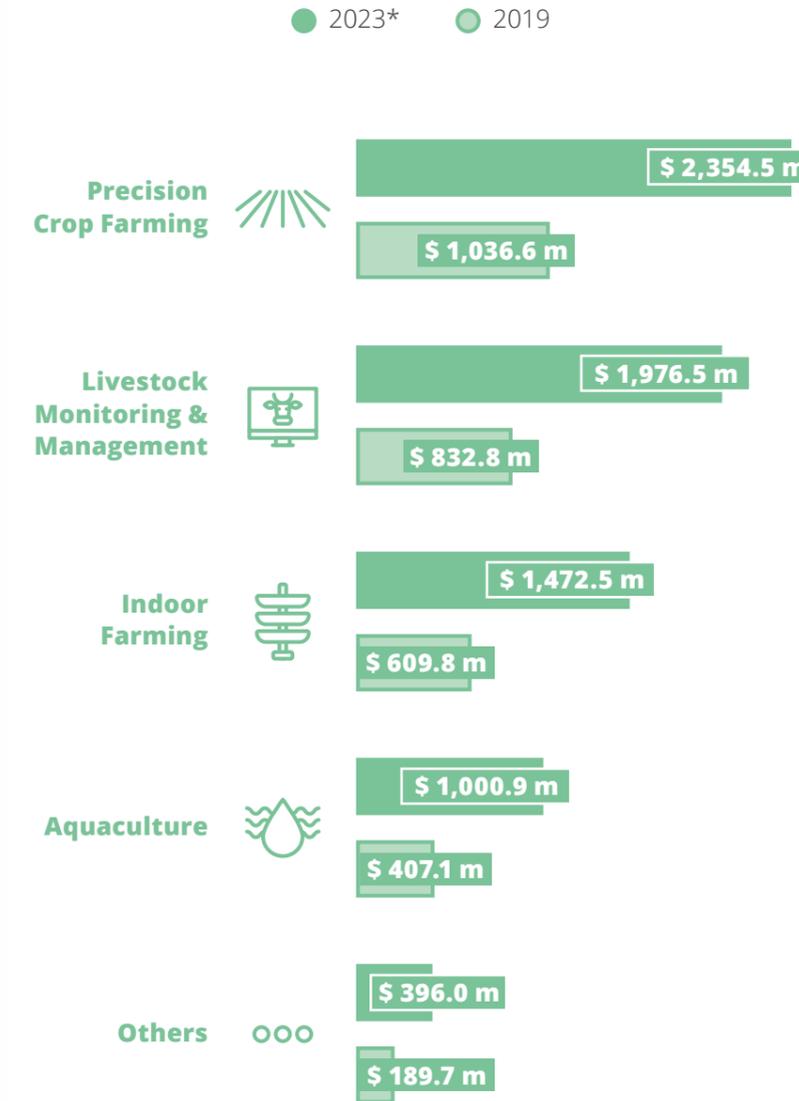
In the U.S. alone, the vertical farming market is projected to reach values of around 3 billion U.S. dollars by 2024. Globally the predicted value is

\$ 6.4 bn
by 2023, with both figures growing at a similar rate of 24 percent CAGR.

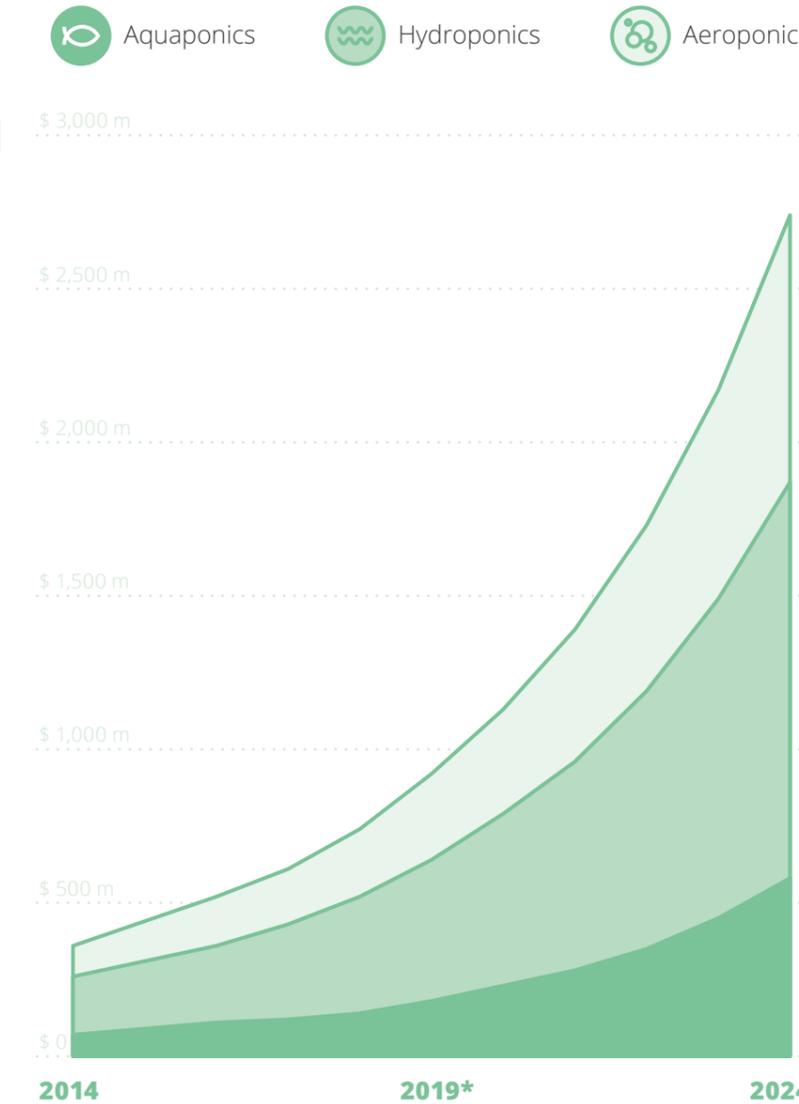
// Projected vertical farming market worldwide



// Size of the smart farming market in Europe, by application vertical



// Estimated market value of vertical farming in the United States, by technology type**



* Forecast

** Estimated 2017-2024

STATISTA RELEVANCE COMPASS

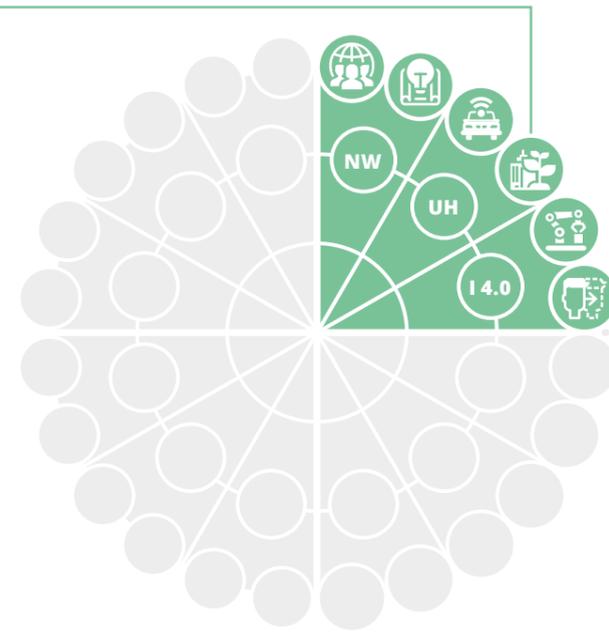
Evaluation Insights:

For the quantification of the economic potential of the microtrend Rurban Revolution, we refer to two core segments: On one hand, vertical farming startups create solutions to enable a mass market cultivation of agricultural products inside industrial buildings within highly urbanized regions (e. g. on top of supermarkets, inside former industrial warehouses). We estimate this market segment to grow to 17 billion U.S. dollars globally by 2025. On the other hand, especially larger cities try to improve their eco-balance and quality of life of their inhabitants through green roof solutions. This market segment is expected to reach 19 billion U.S. dollars globally by 2025. In total, we see an economic impact of this microtrend up to approx. 35 billion U.S. dollars globally by 2025.

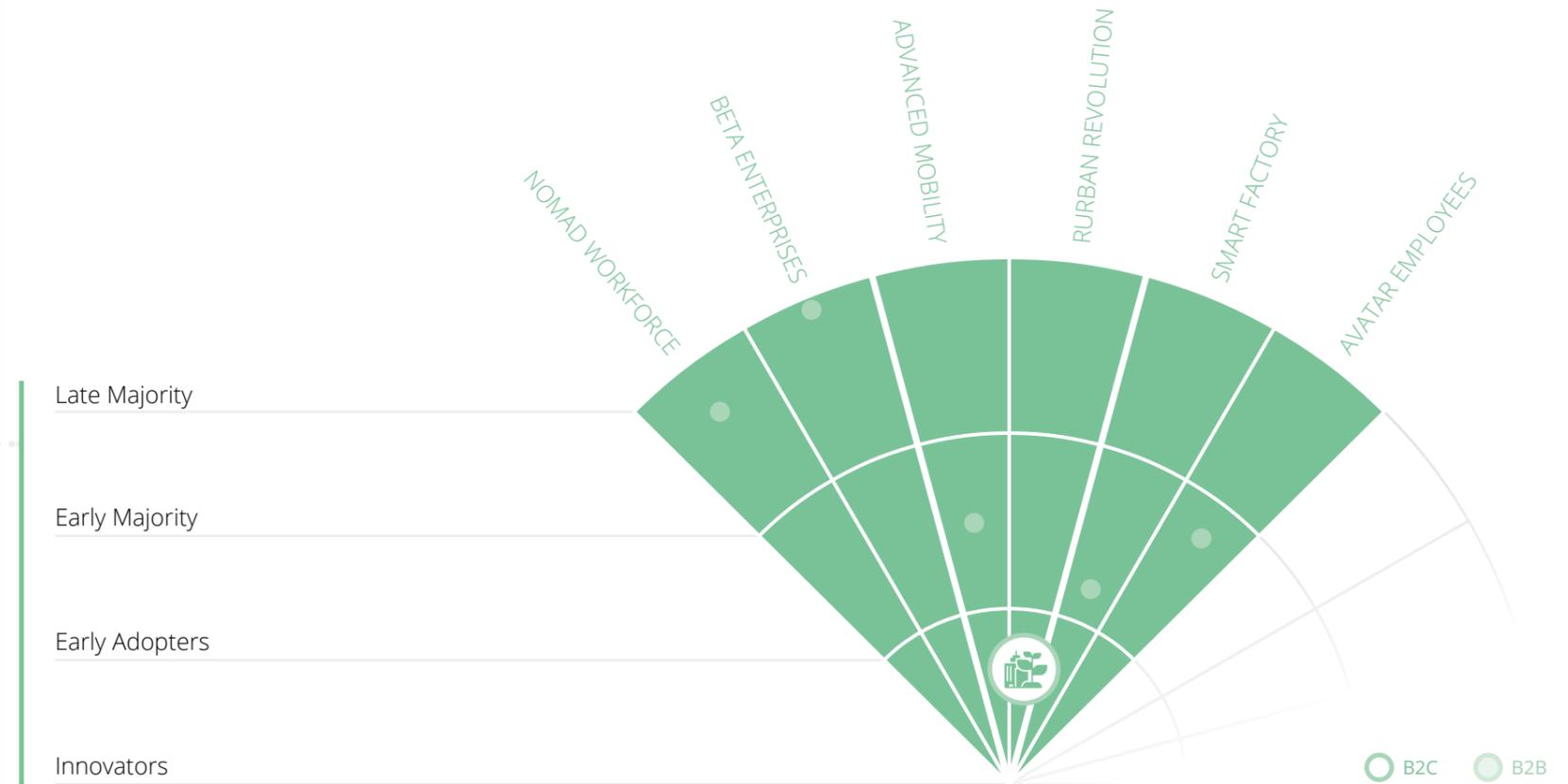
We see the Rurban Revolution between innovators and the early adopter level and expect significant roll-out potential for the upcoming years, especially in the context of growing urbanization and challenges from climate change.

ECONOMICAL CHANGE

/ URBAN HUBS
10 // RURBAN REVOLUTION



NW NEW WORK UH URBAN HUBS I4.0 INDUSTRY 4.0



INNOVATION SNAPSHOT

Paris is set to open the world's largest urban rooftop farm.



Agripolis, a Paris-based urban farming company, recently won a contract to design the world's largest rooftop farm as part of a redesigned entertainment complex. With around 150,000 square feet, the farm will easily outpace Chicago's South Side, a 75,000-square-foot greenhouse, the largest one when it was built in 2016. Opening in 2020, the urban farm is managed by a team of 20 gardeners who will grow 30 different plant species. Representatives from Agripolis say that the site will likely produce about 1,000 kilograms (2,200 pounds) of fruit and vegetables every day in high season, feeding thousands of people every year. Local residents will also have the opportunity to have small garden plots of their own.

Why this is interesting:

Although crops from urban farms will be more expensive than conventional crops, experts expect the farm to begin making a profit in the first year. The food will go directly to residents in the area, either through subscription boxes or in local stores and restaurants, not only reducing emissions from transportation but also catering to the need for local products.

Singapore bets on a new green face with a green wall boom.

Government policy has contributed to the city-state green wall boom. In addition to planting trees on expressways and factory grounds, the government also focuses on greening high-rise buildings. The governmental initiative LUSH [Landscaping for Urban Spaces and High-rises] aims at encouraging developers and architects to add more greenery into their designs. Up to half the cost of green walls and rooftop gardens is paid for by the government.

Lee Kuan Yew, Singapore's first Prime Minister, once emphasized that the attempt to turn Singapore into a garden city would give it a competitive advantage. By 2030, 80 percent of the buildings in Singapore will be Green Mark certified, up from 20 percent in 2013, according to a forecast by the Building and Construction Authority.

Why this is interesting:

The greening of high-rises is one part environmental conservation, reducing greenhouse gas emissions – the other part is cost savings: Green walls help reduce the cost of cooling a building by reducing the temperature of exterior walls. Imagine how our cities would look if green walls entered mainstream.



Utrecht turns bus stops into bee stops.

In July 2019, the province of Utrecht in the Netherlands has decorated more than 300 bus stops in the city with green roofs to support bee pollination and bee reproduction. The bee sanctuaries on top of the bus stops contain grass and wildflowers that attract bees but require little water and maintenance to survive. Utrecht is also incentivizing their residents to transform their own rooftops into greener versions, offering a compensation to anyone with a roof over 20 square metres.

The aim of the bus stop initiative is to encourage the city's biodiversity while improving street level air quality.



Why this is interesting:

Biodiversity has become a major issue in urban city planning. By making our cities greener, we encourage animals living in the wild, such as bees for example, to reconquer urban space. As pollinators, bees play a very important role, namely in terms of food production for humans and many foods we regularly enjoy would not be so readily available without bees.

SUCCESSFUL INDUSTRY PLAYERS



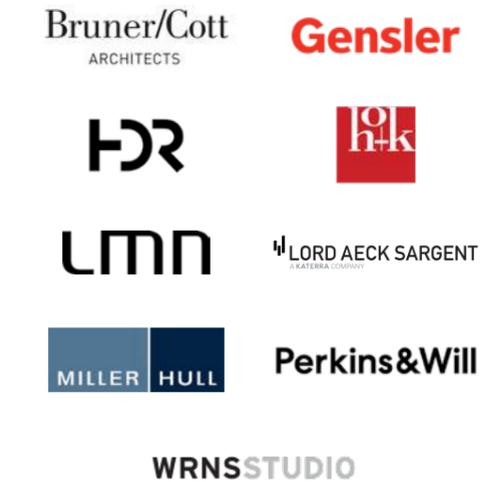
Vertical farming



Green roof systems



Green architecture



Macrotrend #6

INDUSTRY 4.0

Industry 4.0 is transforming the world of work, shaking up global labor markets, and causing turmoil in jobs and skills alike.

From the first industrial revolution (the steam power revolution) to the second using electricity, Industry 4.0 will evolve what was started in the third industry with the adoption of computers, enhancing it with smart, autonomous systems fueled by data and machine learning. Industry 4.0 is not another industrial revolution, but a wholesale digital transformation in both the things we make and the way we make them.

Advancements in robotics, artificial intelligence, and machine learning are ushering in a new age of automation. Machines and algorithms not only match but outmatch human performances in quite a huge range of work fields, including ones that require cognitive and humanlike capabilities. **Avatar Employees** (Microtrend #12) will take over more and more.

According to a report from the World Economic Forum, 42 percent of the core job skills required today all over the world are set to change substantially by 2022.

It is forecasted that globally by 2022, we could see **75 m** jobs be displaced by automation technologies.

However, another 133 million new roles may emerge by 2022, as companies redistribute labor between humans and machines.

Breakthroughs in computing, mobile connectivity, AI, sensors, robotics, 3D printing, and advanced materials are profoundly transforming production and manufacturing systems paving the way for **Smart Factories** (Microtrend #11). All these advancements allow industries to react more quickly and individually to the needs of the market. And as this new Industrial Revolution blooms, organizations are seeking to comprise these emerging technologies to reach a higher level of efficiency, compete with new products for a global consumer base and expand into new markets. In the long run, Industry 4.0 will lead to the manufacturing system being able to organize itself independently. Mass production once outsourced to Asia could come to an end then.

DRIVERS

WHAT ENABLES THIS MACROTREND?

Rapid advancements in technological innovation, like automation and robotics, are advancing quickly, dramatically changing the nature of manufacturing and working. Ubiquitous high-speed mobile internet, 5G, AI, widespread adoption of big data analytics, cloud technology and quantum computing are further positively affecting business growth.

KEY MOTIF

WHY ARE WE KEEN ON SUCH OPPORTUNITIES?

Competition is fierce and companies seek to stay relevant and profitable, reacting quickly and individually to the needs of the market. Automation will improve productivity and performance, while reducing costs at the same time.



\$ 85,000

average company saving per employee is five digital technologies in particular – autonomous vehicles, augmented and virtual reality, big data, machine learning, and mobile computing are combined

\$ 6 bn

potential additional average market capitalization with a slightly different digital technology mix – autonomous robots, mobile computing, autonomous vehicles, 3D printing, and machine learning

\$ 1.6 bn

average total savings for companies in the industrial-equipment sector if they combined autonomous robots, AI, blockchain, big data, and 3D printing

MANIFESTATIONS

Microtrend #11

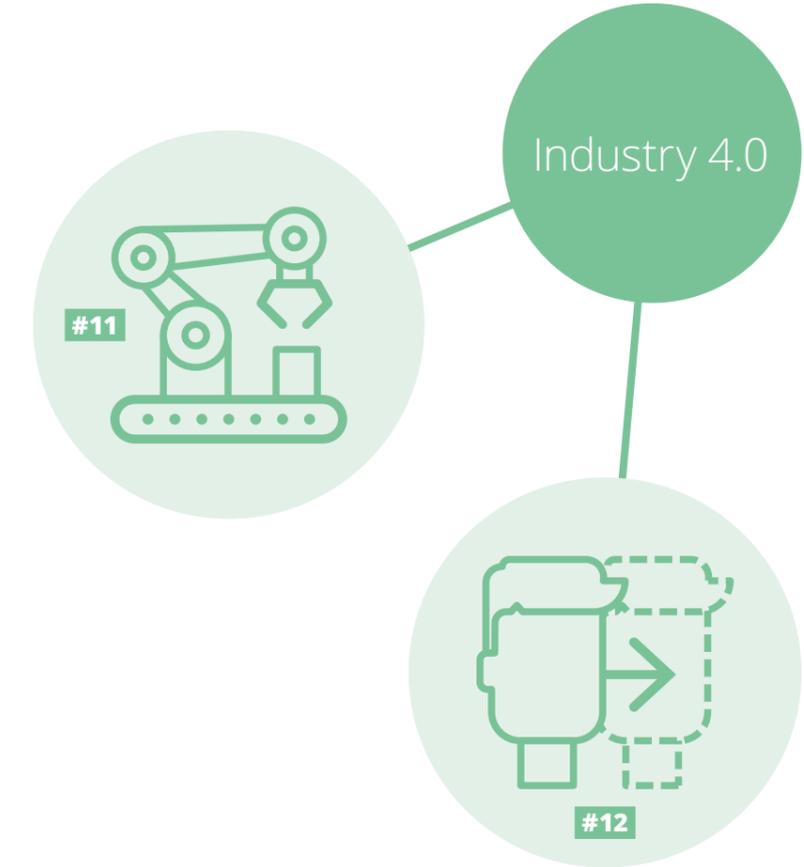
SMART FACTORY

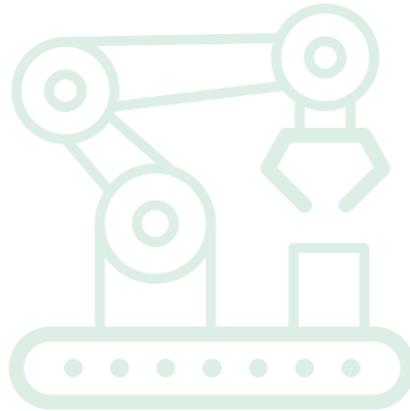
Smart factories are a highly digitized and automated production facilities. These facilities aim to have production and logistics organized without human intervention. And they will change manufacturing forever.

Microtrend #12

AVATAR EMPLOYEES

We are living in a new automation age in which robots and computers can not only perform a range of routine physical work activities better and more cheaply than humans, but are also increasingly capable of accomplishing activities that include cognitive capabilities.





Microtrend #11

SMART FACTORY

With Industry 4.0, we're in the midst of a significant transformation regarding the way we produce goods thanks to the digitization of manufacturing.

The convergence of multiple technologies – such as artificial intelligence (AI), cloud computing, advanced robotics – is empowering a new era of manufacturing. Smart and autonomous systems fueled by data and machine learning will be exploring new paths to how we produce and sell products and services. In industries from automotive to pharmaceuticals, business and technology leaders are embarking on their most rapid and dramatic transformation in decades.

The smart factory embodies the vision of the self-organizing factory in which production capacities, material flows, and logistics processes are managed flexibly and automatically. This allows for working with customers, employees, and partners on a whole new level, enabling mass customization, in real time, with smart connected products.

3D printing has revolutionized the ways that parts are designed and manufactured, from printing entire houses to bioprinting tiny human organs (organelles). Advanced smart materials interact with their surroundings in order to improve and adapt performance. And

finally, digital twin concepts, just to name a few technological advancements, make it possible to mirror real products, objects, systems, and processes on a digital level by permanently comparing real components and digital copies.

With millions of new data-rich devices connect in new ways, the volume of data available to enterprises is growing exponentially, and so is an ever-higher demand for processing power. Which is why Google, IBM, and a handful of startups are racing to create the next generation of supercomputers, or quantum computers, to enhance the way information is stored and processed.

What's in the trend?

- REAL-TIME ANALYTICS // MACHINE LEARNING //
- CLOUD COMPUTING // ARTIFICIAL INTELLIGENCE //
- BIG DATA // QUANTUM COMPUTING //
- DIGITAL TWIN //
- INDUSTRIAL INTERNET OF THINGS (IIOT) //
- 3D-PRINTING // QUANTIFIED ENTERPRISE //
- RFID OR QR CODES



SUPPORTING FACTS

The smart factory turns manufacturing into an adaptive and fully connected system.

Smart factories quite simply apply the use of digital technologies to the manufacturing process, in order to produce higher-quality goods at reduced costs. A smart factory acts as a flexible system that is able to self-optimize its performance in a network, learn and self-adjust to new conditions, and self-run entire production cycles. The output is a more efficient and flexible process, less production downtime, and above all, a faster ability to adjust to changes – from inside the factory and from the outside, responding faster and better to new customer needs.

Companies betting on smart factories are now experiencing major benefits in terms of lower costs, improved efficiencies, increased yield, mass customization, and, most importantly, new revenue and business models.

INDUSTRIAL SENSORS

One of the key drivers of smart manufacturing is the increasingly widespread availability of innovative devices. These devices like sensors, or RFID tags and beacons, will fundamentally change the way businesses function. It is estimated that by 2025 there will be **75 billion sensor devices** installed.

ARTIFICIAL INTELLIGENCE

The economic impact from AI on the industry output could be tremendous. Accenture estimates that, by 2035, the impact of AI on manufacturing profits could be an uplift of 39 percent compared to baseline, translating into an additional GVA of nearly **4 trillion U.S. dollars**

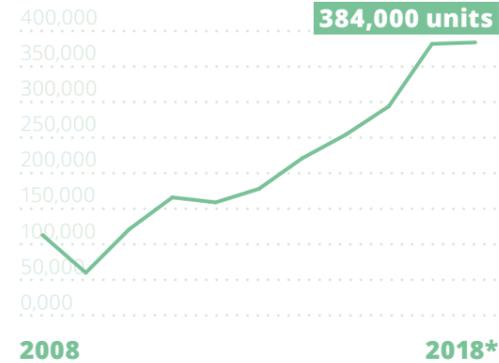
IP TRAFFIC

Global data center IP traffic will reach **20.6 zettabytes (1 billion terabytes)** per year by 2021, emphasizing the increasing need for data centers and cloud resources.

INDUSTRIAL ROBOTS

Industrial robots are used in commercial environments to automate manufacturing processes. They are key to smart factories, and the industrial robotics market continues to thrive after years of growth globally.

Estimated worldwide annual shipments of industrial robots



INDUSTRIAL IOT

By 2025, the total global value of IoT technology could be as high as **6.2 trillion U.S. dollars** – most of that value from devices in health care (2.5 trillion U.S. dollars) and manufacturing (2.3 trillion U.S. dollars).

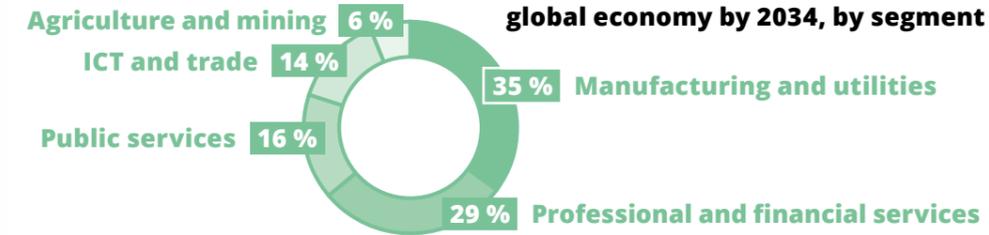
Global IIoT platforms for manufacturing, market size



5G

It is forecast that by 2025 the number of 5G connections will reach **2.7 million**.

Forecast share of 5G's contribution to global economy by 2034, by segment



QUANTUM COMPUTING

The market of quantum computing will grow into a billion-dollar industry between 2020 and 2030. Depending on the scenario, experts estimate the market somewhere between **60 billion U.S. dollars** in 2035 (BCG) and **10 billion U.S. dollars** (Morgan Stanley) in the next ten years.

3D PRINTING

Global spending on 3D printing (including hardware, materials, software, and services) will be 13.8 billion U.S. dollars in 2019, an increase of 21.2 percent over 2018. By 2022, IDC expects worldwide spending to be nearly **22.7 billion U.S. dollars** with a five-year compound annual growth rate (CAGR) of 19.1 percent.

Note: The IIoT Platforms for Manufacturing market accounts for both Factory & Non-factory settings; that is standardized production environments such as factories, plants, workshops, as well as custom production worksites such as mines, offshore oil&gas and construction sites





Adidas production in low cost centers in Asia

- // approx. 403 million pairs of shoes in 2017 – more than a million a day on average
- // made from manual work
- // new designs take up to 18 months to get to market

The Adidas Speedfactory makes a major robot-powered leap in design and production techniques, manufacturing sneakers by using completely digitally automated machinery.

Adidas, which was founded in 1920, today designs, develops, produces, and markets millions of athletic and sports lifestyle products worldwide. Until 2015, Adidas' production was outsourced to low cost centers in Asia, where workers assembled components and sewed materials with still quite a huge amount of labor costs. This changed in 2015, when Adidas opened its first Speedfactory in Ansbach, Germany. The Adidas Speedfactory is a fully automated facility, incorporating what the company calls "intelligent robotic technology", using digital techniques such as robotics, data analytics, and additive manufacturing to design and manufacture shoes and other sporting goods.

By using smart manufacturing processes, the Speedfactory allows Adidas' production process to become faster, reducing potential

lead times while accelerating speed to market. Additionally, the Speedfactories' proximity to the consumers enables the company to better meet local needs and respond more quickly with market customization in locations all over the world. This in turn satisfies consumers' expectations more efficiently.

In 2017, Adidas opened its second Speedfactory in Atlanta, Georgia. In conjunction, Adidas said, it hopes the two factories can produce one million pairs of shoes a year by 2020, while getting shoes to market three times faster than by using traditional means.

In November 2019 however, Adidas decided to close its high-tech Speedfactories in Germany and the U.S. Instead, the technologies pioneered in their robot factories will be applied to two of the company's suppliers in Asia in order to concentrate the production of the Speedfactories where the know-how and the suppliers are located.



Adidas production in Speedfactories (Ansbach, Atlanta)

- // approx. 1 million pairs of shoes per year manufactures in its two Speedfactories by 2020
- // made with intelligent robotic technology
- // approx. 160 employees in Ansbach; 150 employees in Atlanta
- // new designs get to market three times faster in a Speedfactory

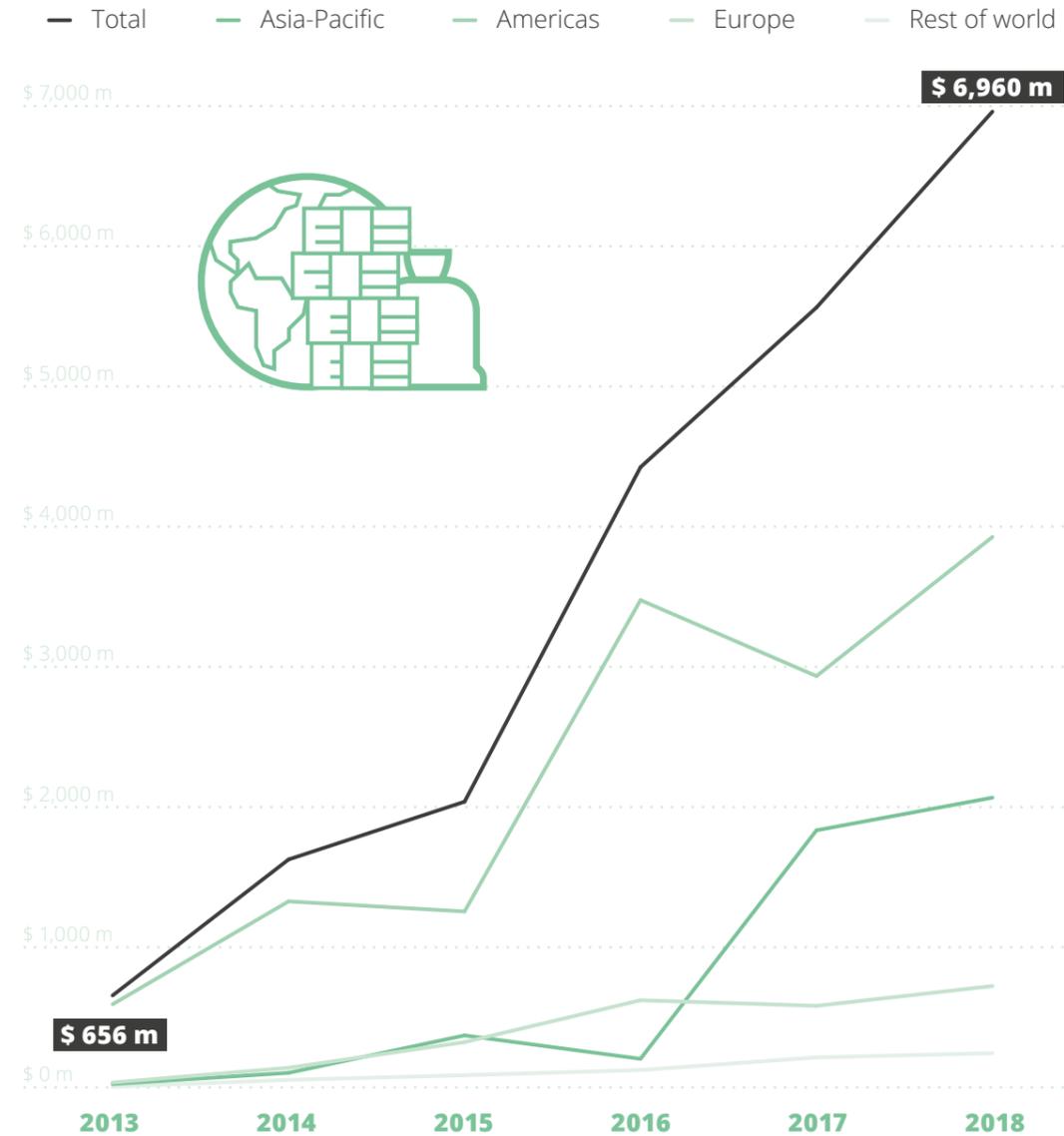


With smart factories, manufacturing is becoming increasingly more modular, efficient, and attractive to invest in.

Many companies are making investments in smart factory capabilities, and fundings in smart factories are rising. According to a recent report by GP Bullhound, of the 1,300 venture capital transactions worldwide in 2018 that were worth a total of 17.4 billion U.S. dollars, the U.S. undisputedly ranked first in investments, receiving 11.4 billion U.S. dollars. Asia and Europe followed with 3.9 billion U.S. dollars and 2.1 billion U.S. dollars in mergers and acquisitions.

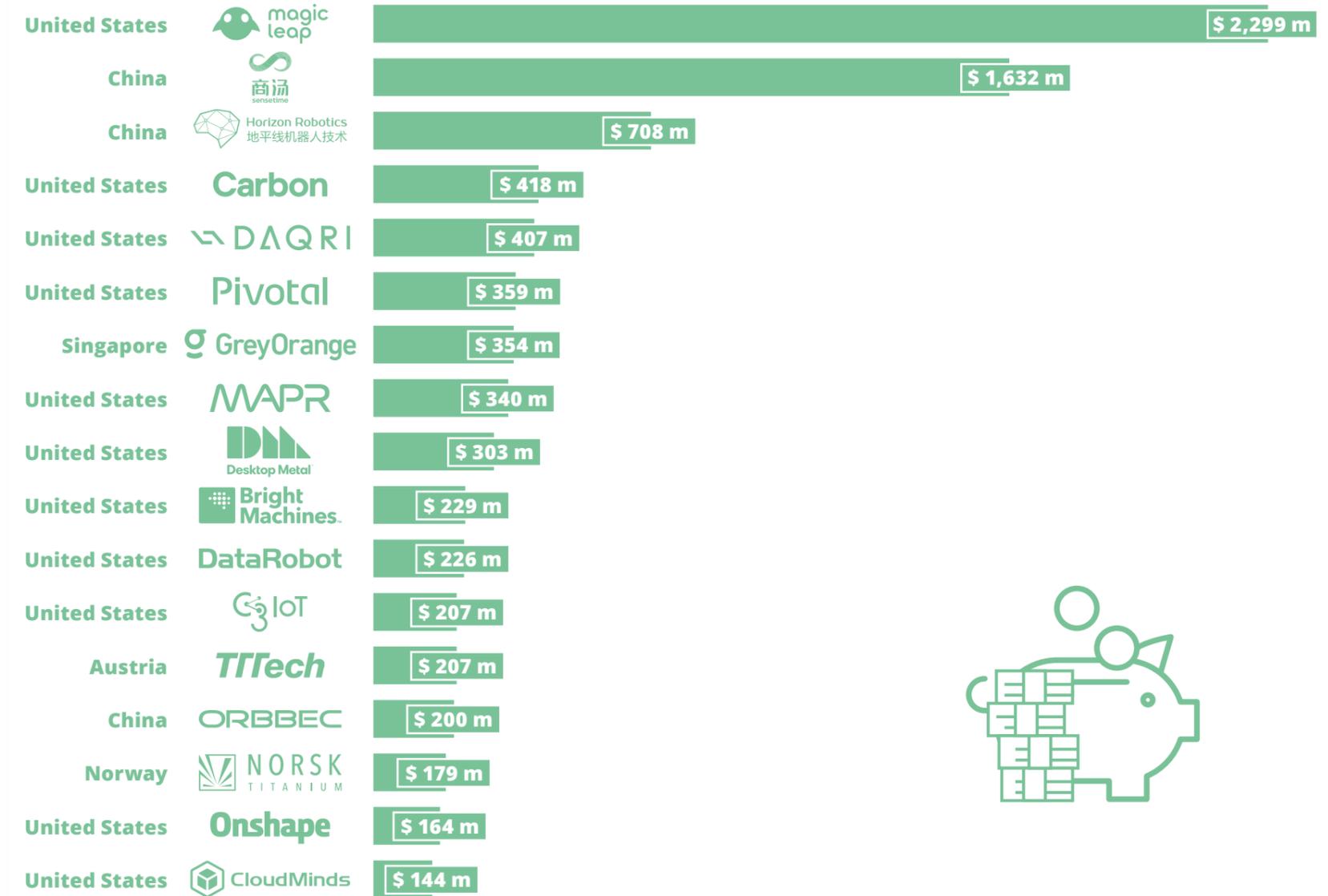
While recent big fundings have largely been driven by key players coming from the U.S. and China, like Magic Leap, Sense Time, and Horizon Robotics, which could collect large amounts of capital, it is remarkable to see many well-capitalized firms in the 100-300 million U.S. dollar-range. Investments cover all verticals, from data and analytics up to hardware and design & simulation.

// Venture funding volume by region*



* Calculations based upon 2018 average exchange rate: EUR 1 = USD 0.847

// Most funded companies 2013–2018*



STATISTA RELEVANCE COMPASS

Evaluation Insights:

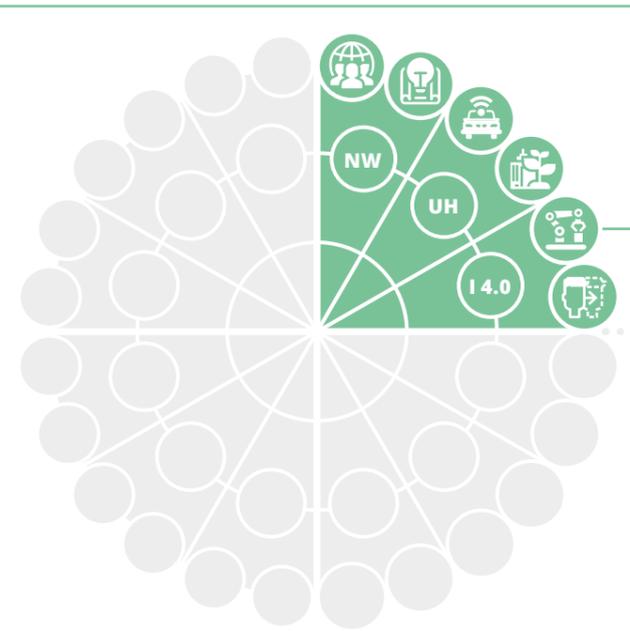
The development towards smart factories has by far the largest economic impact of all trends mid-term, as it has the potential to revolutionize basically all aspects of manufacturing – just like the introduction of steam engines in manufacturing during the Industrial Revolution.

Regarding the quantification of the economic impact, we apply the impact from artificial intelligence (AI) on manufacturing and construction as a proxy to forecast the revenue potential of smart factory and expect an economic potential of over 1 trillion U.S. dollars on a global scale by 2025.

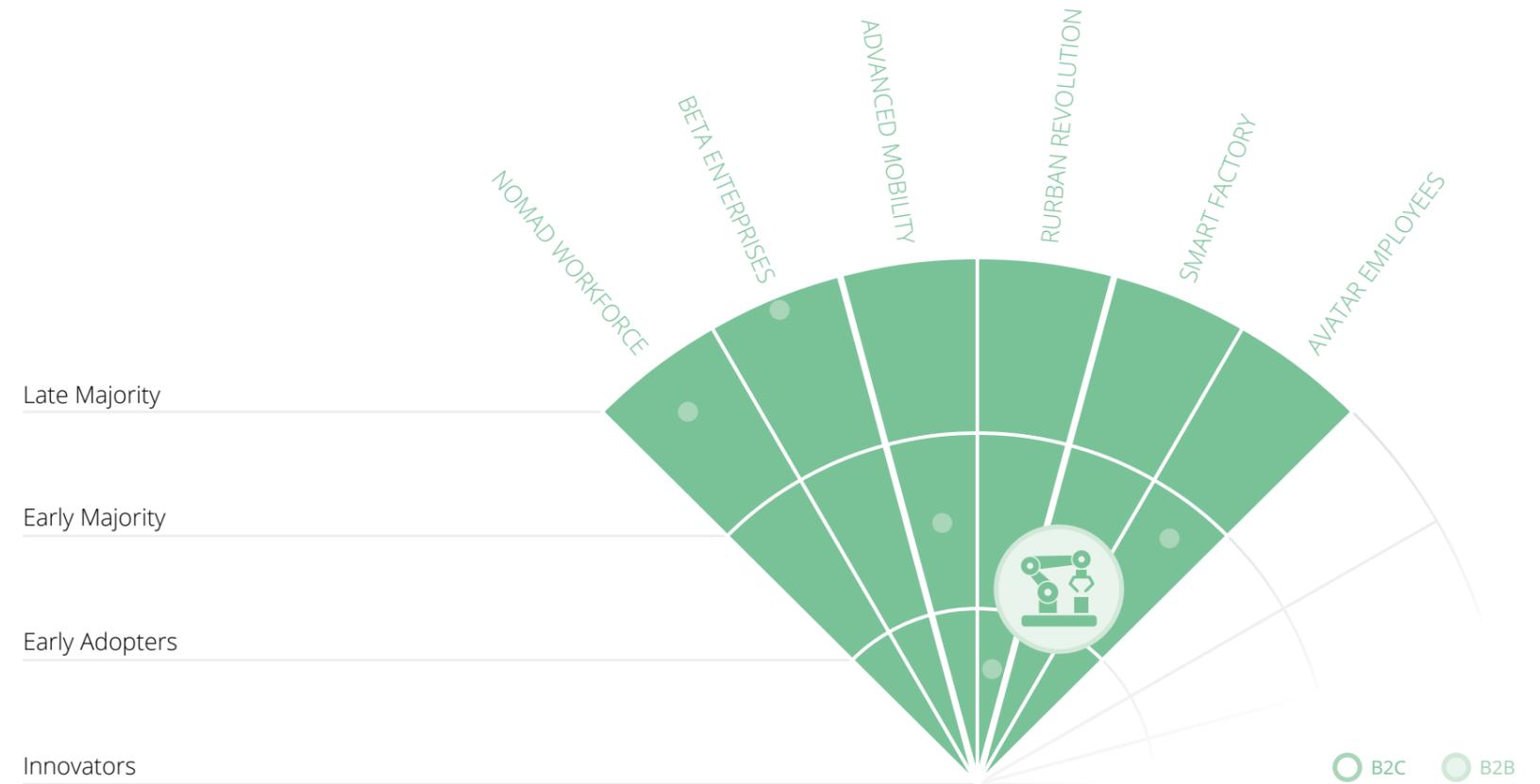
As the transformation towards smart factories requires both massive investments in infrastructure (5G networks, automation, computing power, etc.) and new operational and organizational approaches, we locate this microtrend among early adopters. However, the potential for significant efficiency improvements and cost savings will lead to an accelerated implementation of smart factory solutions soon.

ECONOMICAL CHANGE

11 / INDUSTRY 4.0
// SMART FACTORY



NW NEW WORK UH URBAN HUBS I4.0 INDUSTRY 4.0



INNOVATION SNAPSHOT

Manufacturing moving back to the cities.



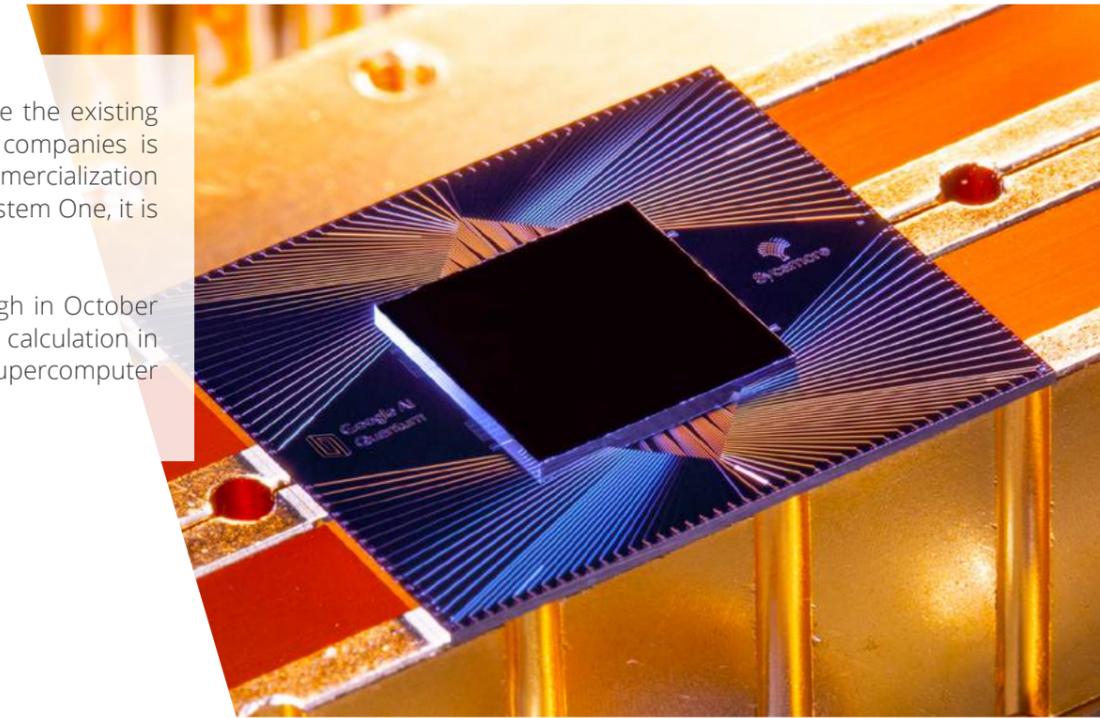
While humans and machines move closer together in manufacturing in order to make production more responsive to the changing needs of customers, manufacturing is altering its image. Around the globe, a new urban industrial wave is emerging from Brussels to New York, bringing industry back to the cities.

One of these successful examples is Brooklyn's Navy Yard. A converted ship-building site was transformed into a shiny industry location. Less dirty and toxic, due to automation processes and machine learning, and full of well-paid creatives. The 300-acre campus supplies New Yorkers with 9,500 jobs with another 11,000 following in the next few years – a quarter of which in manufacturing.

Why this is interesting:

With industry getting less dirty and unhealthy, it is moving back to the cities, attracting high potentials and creatives from classic office jobs, film production, and manufacturing. While automation is taking over dull job roles, it frees employees to take over more interesting, creative, and empathetic roles.

The era of quantum computing has arrived.



Raising the expectation that quantum supremacy has finally arrived to replace the existing high-speed computing systems may be premature. However, a number of companies is competitively working on exactly that. One of them is IBM, expecting the commercialization of quantum computers in three to five years, and with its 20-qubit system Q System One, it is quite close to reaching this benchmark.

Another rival Google, already confirmed its "quantum supremacy" breakthrough in October 2019. Google said that its 54-qubit sycamore processor is able to perform a calculation in 200 seconds. A calculation that would have taken the world's most powerful supercomputer 10,000 years.

Why this is interesting:

Data will provide new insights that help us understand and shape the future. All information, however, requires processing at a super-fast speed if it's to be useful. In order to do this, companies are exploring not only AI and machine learning, but also quantum computing, to see if it can extract better solutions faster than classical computers.

The world's first 3D-printed neighborhood.



Over the past year, a team of engineers and materials scientists tested the design of the "Vulcan II," a huge, 33-by-11-foot 3D printer that will be able to print the frame of a small house in less than a day. The plan is to print the world's first neighborhood with more than 50 homes.

Homes not for the early adopters of technology, but rather for families who live on less than 200 U.S. dollars per month and without safe shelter in Latin America. The project was initiated by Silicon Valley-based nonprofit New Story in collaboration with the local community and Yves Béhar's Fuseproject. New Story says that the houses will be more affordable than the standard low-cost homes it currently builds in the developing world, which cost around 7,000 U.S. dollars.

Why this is interesting:

Printing houses in just a few days may tackle the problem of housing both more quickly and at a lower cost than traditional building. Imagine, however, if in the future we could not only print entire villages and cities, but nearly any object, from pills to planes, and imagine how this could impact the manufacturing and transport industries.

SUCCESSFUL INDUSTRY PLAYERS



Digital twin



Industrial wearables



5G

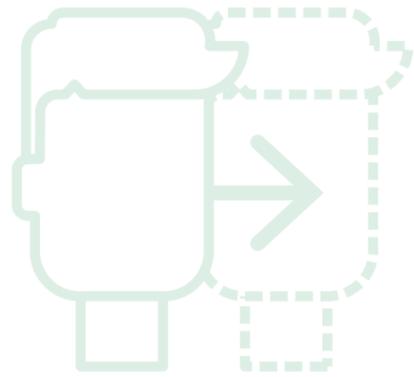


Predictive maintenance



Quantum computing





Microtrend #12

AVATAR EMPLOYEES

The automation age is transforming the world of work. We are living in an age in which machine learning (ML), digital platforms, and robots cannot only perform a range of routine physical work activities faster, better, and more cost-efficiently than humans, but also complete cognitive activities.

Today, automation, machine learning, and artificial intelligence are everywhere. Robots are capable of recognizing voices, faces, and emotions, interpreting speech patterns and gestures, and even of making eye contact. And the sophistication with which they can learn, sense, and act will continue to increase dramatically, moving them from stationary manufacturing applications into dynamic, everyday environments.

Today, companies are beginning to use mobile robots to clean windows of skyscrapers, flying robots to inspect powerlines, and wheeled robots to deliver parcels. Doctors are using robots to improve surgical procedures (and sometimes even let them take over completely), hand them over), restaurant owners use them to serve their guests, and consumers let them do the vacuuming. The increased democratization of robotics across sectors will fuel innovation and reduce costs. This will in turn drive a faster pace of robotic adoption and ubiquity.

While auto anxiety is still strong and many seem to be fixated on which jobs automation will make obsolete, the realization is growing

that machines are becoming an artificial co-worker to perform lower-order tasks, freeing up people to focus on higher-order tasks that require creativity, empathy, and judgment. Google, for example, is now using AI combined with humans to identify and remove controversial content across YouTube, drastically reducing the exposure to offensive content. Security robots team up with humans to patrol borders, switching over to human control when a suspect is detected. Amazon today employs more than 45,000 robots – and still continues to recruit people.

Over the next ten to 15 years, the adoption of automation and AI technologies will bring numerous benefits in the form of higher productivity, GDP growth, improved performance, and new prosperity, but it will also change the skills required of human workers.

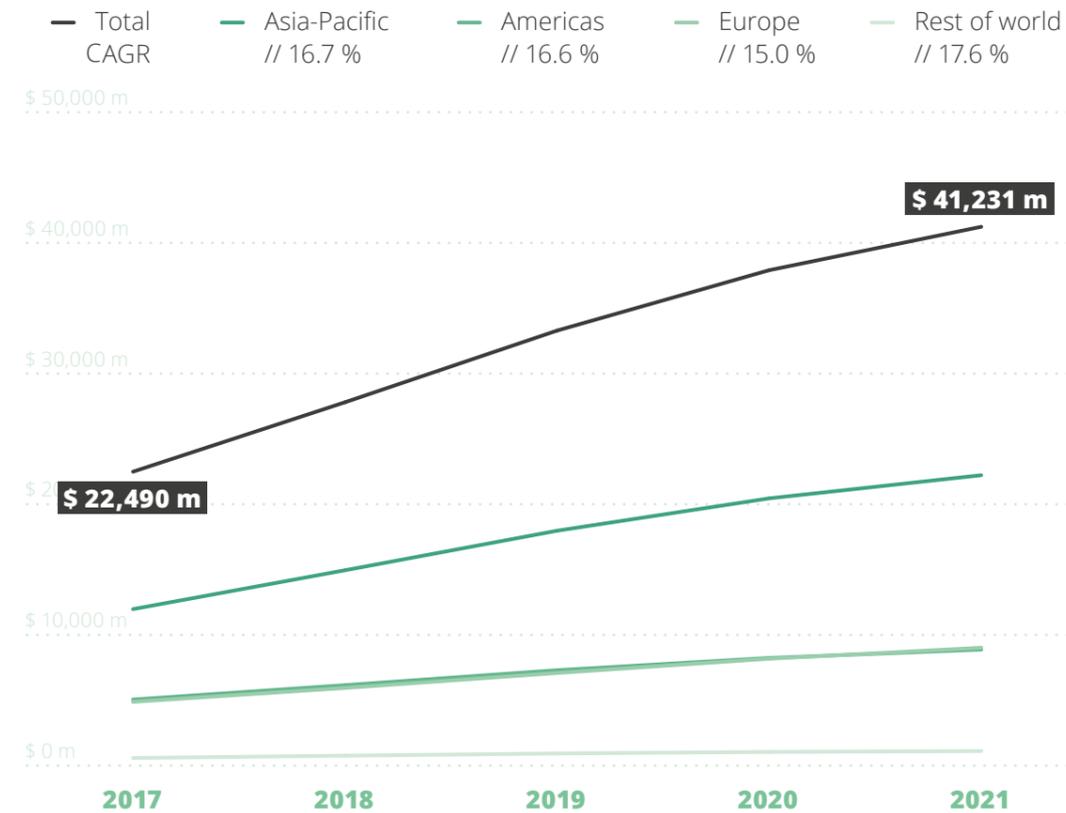
What's in the trend?

ADVANCED ROBOTICS // AUTOMATION //
ARTIFICIAL INTELLIGENCE (AI) // STAFFLESS STORES //
BIG DATA ANALYTICS // MACHINE LEARNING



SUPPORTING FACTS

// Industrial and service robotics sales volume worldwide*



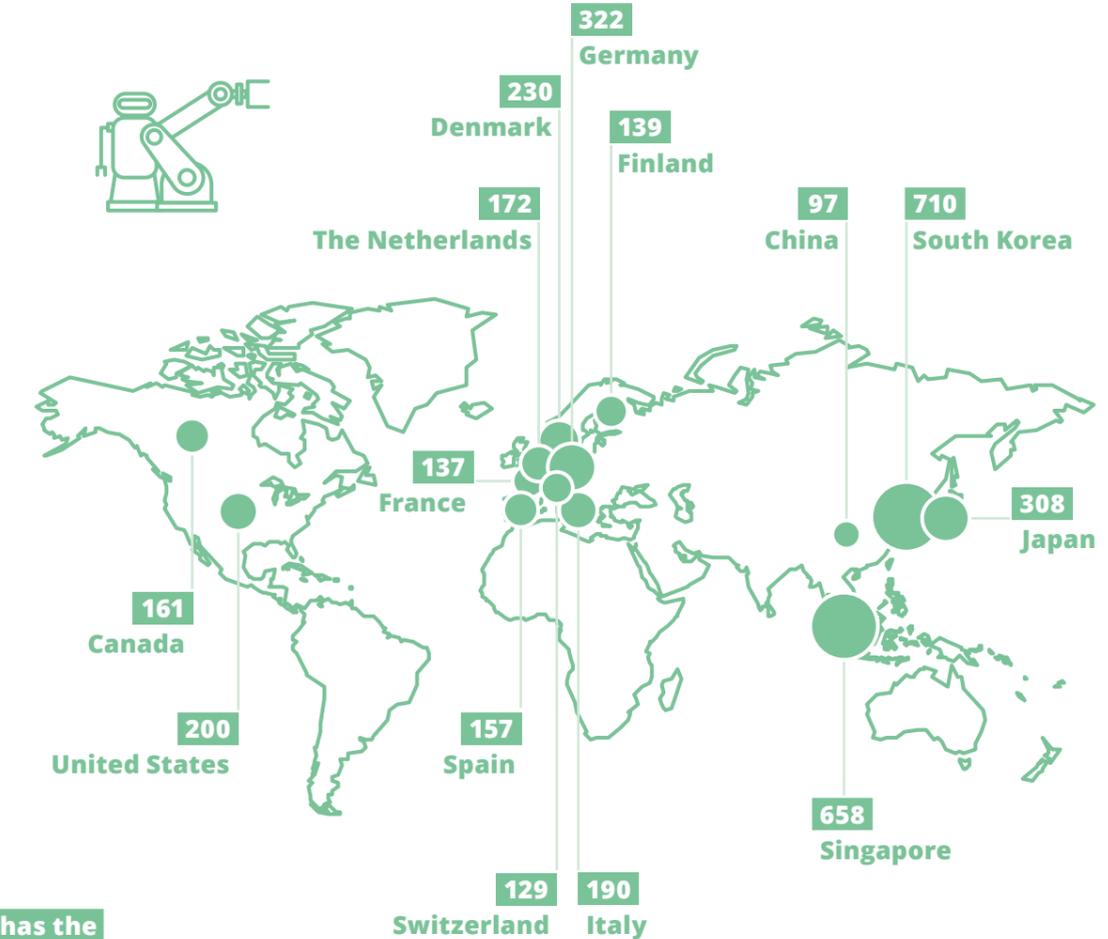
* Forecast

Robotics fuels economic growth and leads to productivity gains of up to 40 percent while changing the way we work.

Globally the robotics market is set to grow significantly – almost doubling in size over the five-year period from 2017 to 2021 and reaching a global sales volume of 41.2 billion U.S. dollars by 2021. This growth is mainly based on an increasing demand for automation in various industries.

According to research done by the IFR, in 2016, the average of global robot density was 74 robot units per 10,000 employees. A year later, this number increased to 85 across the manufacturing sector, according to the World Economic Forum. Leading the pace of automation is South Korea with 710 installed industrial robots per 10,000 employees in 2017 – primarily due to the ongoing installation of high-volume robots in the electronics and electric sectors.

// Installed industrial robots per 10,000 employees in the manufacturing industry (2017)*



Robot adoption rates diverge significantly across sectors, with 23–37 % of companies planning this investment, depending on the industry.

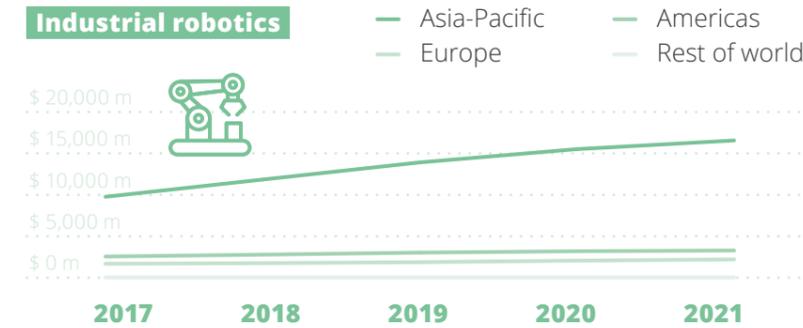
It is estimated that the use of robotics has the potential to increase labor productivity by up to 40 % until 2035. This could lead to reshoring of many jobs, especially in manufacturing, as it reduces the burden of high wage costs in developed countries.

* Selected countries

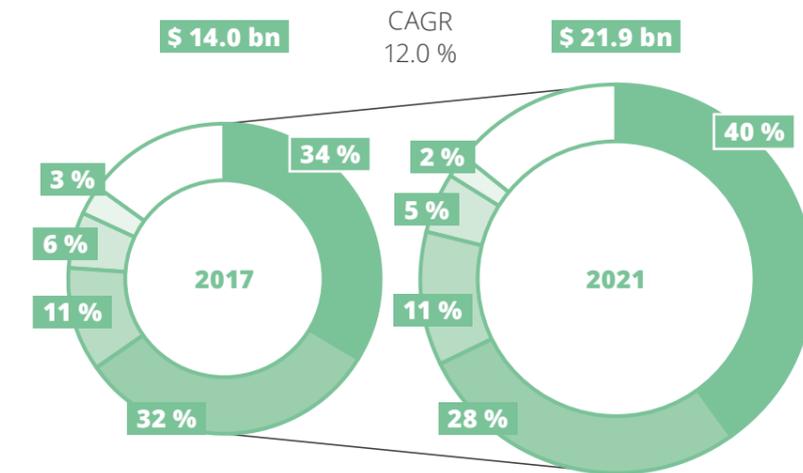
The industrial robotics market is set to grow with a CAGR of 12 % during the forecast period from 2017 to 2021.



// Industrial robotics and industrial robotics sales volume by continent



// Distribution of industrial robotics sales volume by application area

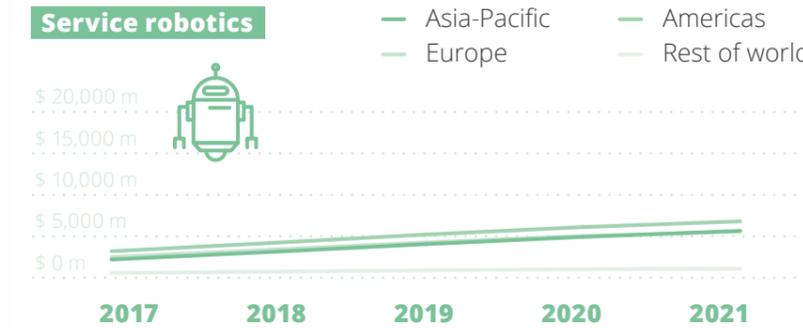


The robotics industry can be divided into industrial and service robotics, with the industrial market currently being almost twice as big as the service market.

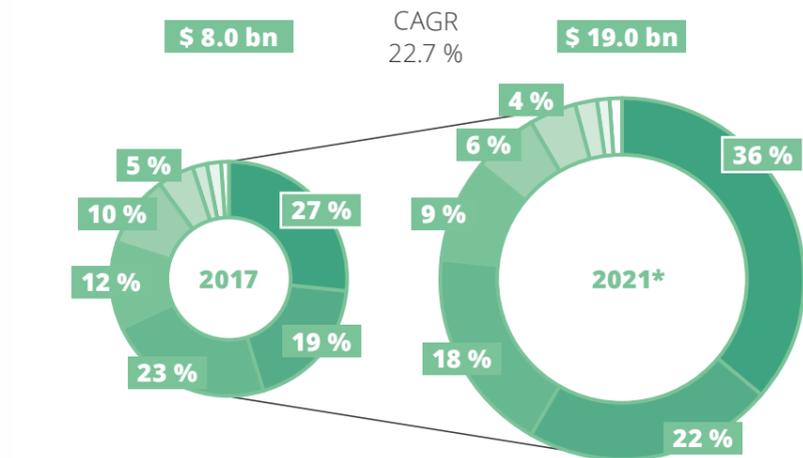
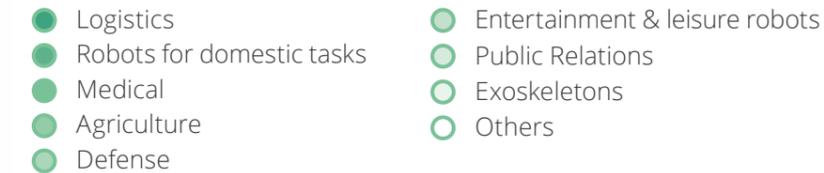
Robots are distinguished by their application area: industrial manufacturing and service processes. Industrial robots are defined by their use in a manufacturing environment, and the market is set to grow at a CAGR of 12 percent to 22 billion U.S. dollars in 2021.

While industrial robotics is firmly in the hands of the Asia-Pacific region when focusing on regional leads, we see the segment being dominated by electronics and automotive (almost 70 percent) when it comes to the application areas. Electronics surpassed the automotive sector in 2017 and will still be growing in the next years, while automotive is predicted to lose market share until 2021.

// Service robotics and service robotics sales volume by continent



// Distribution of service robotics sales volume by application area



Service robots gain importance in professional as well as private settings, as they offer increasing productivity and convenience.

The segment of service robots is divided into commercial and personal robotics. Commercial service robots are used to perform a service in an industrial environment, while personal service robots are deployed in private households – vacuum robots for example. Not only factories, but the entire infrastructure can be smart, both in companies and in households.

Especially service robots are predicted to grow strongly in the upcoming years (+140 percent from 2017 to 2021). We have seen the industrial robot market being led by Asia, now the service robotics market is led by the Americas, with application areas “logistics” and “robots for domestic tasks” at the forefront.

The ageing society is one of the key drivers when it comes to the growing market of robotics. The use of both, commercial and personal service robots is an appropriate method to support humans - and especially the ageing ones - in their daily tasks at home or at work. Furthermore, the logistics segment heavily profits from structural changes due to the usage of robotics (optimized processes, higher precision, lower costs, and less expenditure of time as an essential prerequisite for same-day deliveries, for example), further fueling the growth of the robotics market.

The total service robotics market is expected to grow by more than almost **140 %** from 2017 to 2021.



Job automation is set to transform global economies and the employment prospects of billions of people.

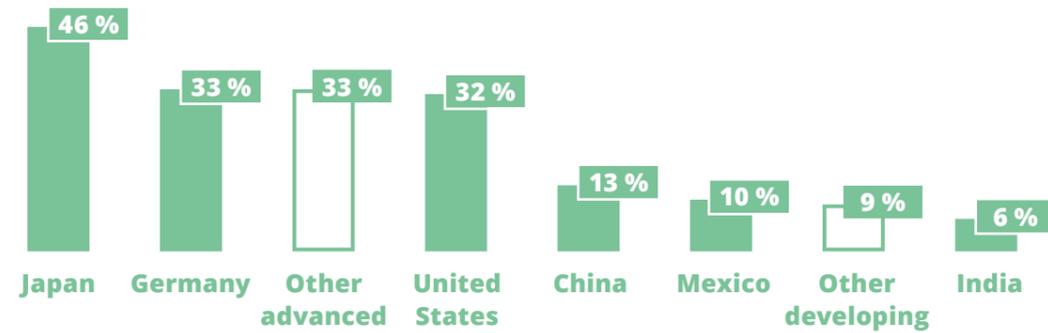
The increasing automation and the rise of robotics has a far-reaching impact on our global workforce. Experts estimate that 14 percent of jobs in advanced economies could become susceptible to automation while another 32 percent could be substantially changed. Nearly half of all workers in Japan and a third of the workforce in Germany and the United States face the need to move out of their current occupation by 2030.

As robotics is getting more important, many jobs done by humans are going to change. In a study done by Accenture and Frontier Economics, it is estimated that the use of robotics has the potential to increase labor productivity by up to 40 percent until 2035. Automation and AI could lead to sufficient increases in workplace efficiencies to allow workers to accomplish the same tasks in less time.

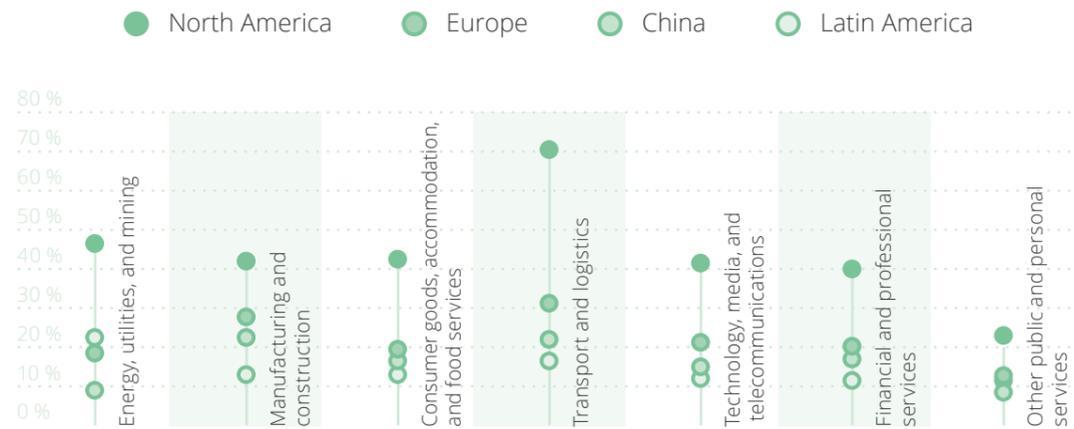
Industries with a high share of repetitive and heavy tasks are affected the most by automation. The workforce of the transport and logistics industry with its warehouses and delivery workers is projected to be strongly affected by robotics, for example.

However, most jobs will not vanish but rather see the rise of the robot as a new kind of colleague and assistant in a new human-machine collaboration.

// Share of workforce that needs to move out of current occupational categories in the period from 2016 to 2030

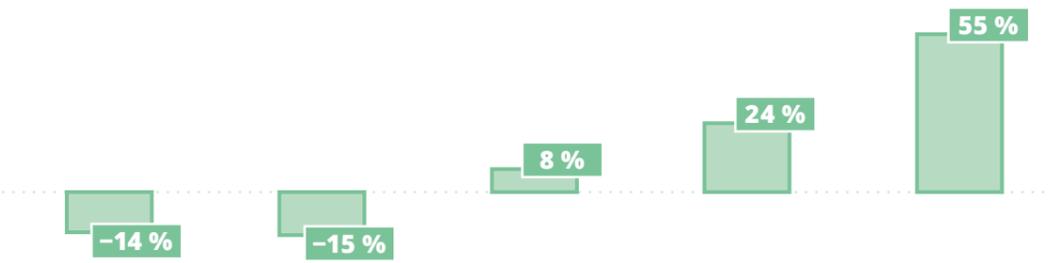
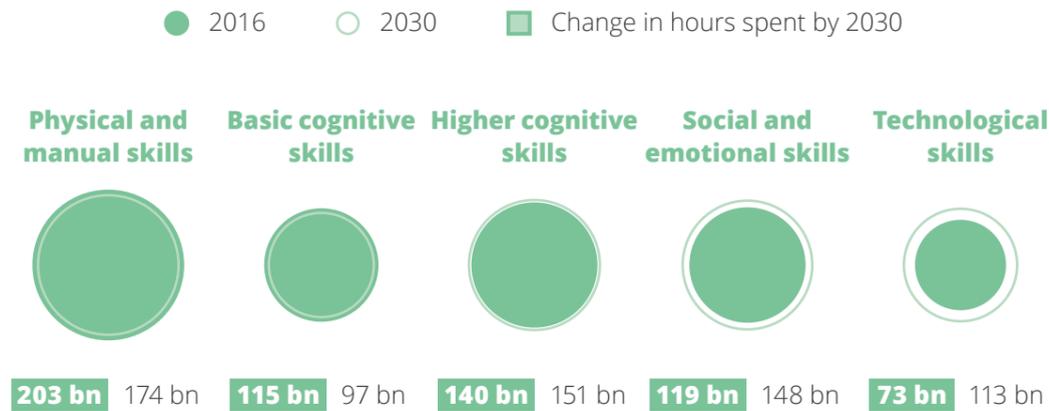


// Share of jobs at high risk of automation by industry by 2030



14 %
of jobs in advanced economies could become susceptible to automation and another 32 % substantially changed.

// Total hours worked in Europe and United States, 2016 vs 2030 estimate



80 %
... say soft skills are increasingly important to company success

Soft skills in high demand relative to their supply, based on LinkedIn data:

- 1 // Creativity
- 2 // Persuasion
- 3 // Collaboration
- 4 // Adaptability
- 5 // Time Management

This new human-machine solidarity will shift the future value of skills required. According to the World Economic Forum, in terms of total working hours, no work task was estimated to be predominantly performed by a machine or an algorithm yet in 2018. But this might change by 2022, with algorithms and machines increasing their average contribution by 57 percent.

According to LinkedIn behavioral data, creativity will become the most in-demand soft skill in the future. Furthermore, creativity is not only associated with art or design; it is rather a skill that is applicable to almost any role, as it implies solving problems in original ways – a skill that machines – a skill that machines cannot perform easily (yet).

However, to prevent high unemployment rates in the future, life-long learning will be necessary to allow employees to change career paths change career paths later in life as well.



STATISTA RELEVANCE COMPASS

Evaluation Insights:

In order to leverage the full economic potential from smart factories, an extended support from robots or even (partial) replacement of the human workforce by robots is required. We estimate the economic value of Avatar Employees according to the expected revenues generated through the sale of industrial or commercial service robots. We expect global sales for both segments to reach up to approx. 45 billion U.S. dollars by 2025, with industrial robots contributing 25 billion U.S. dollars and commercial robots 25 billion U.S. dollars.

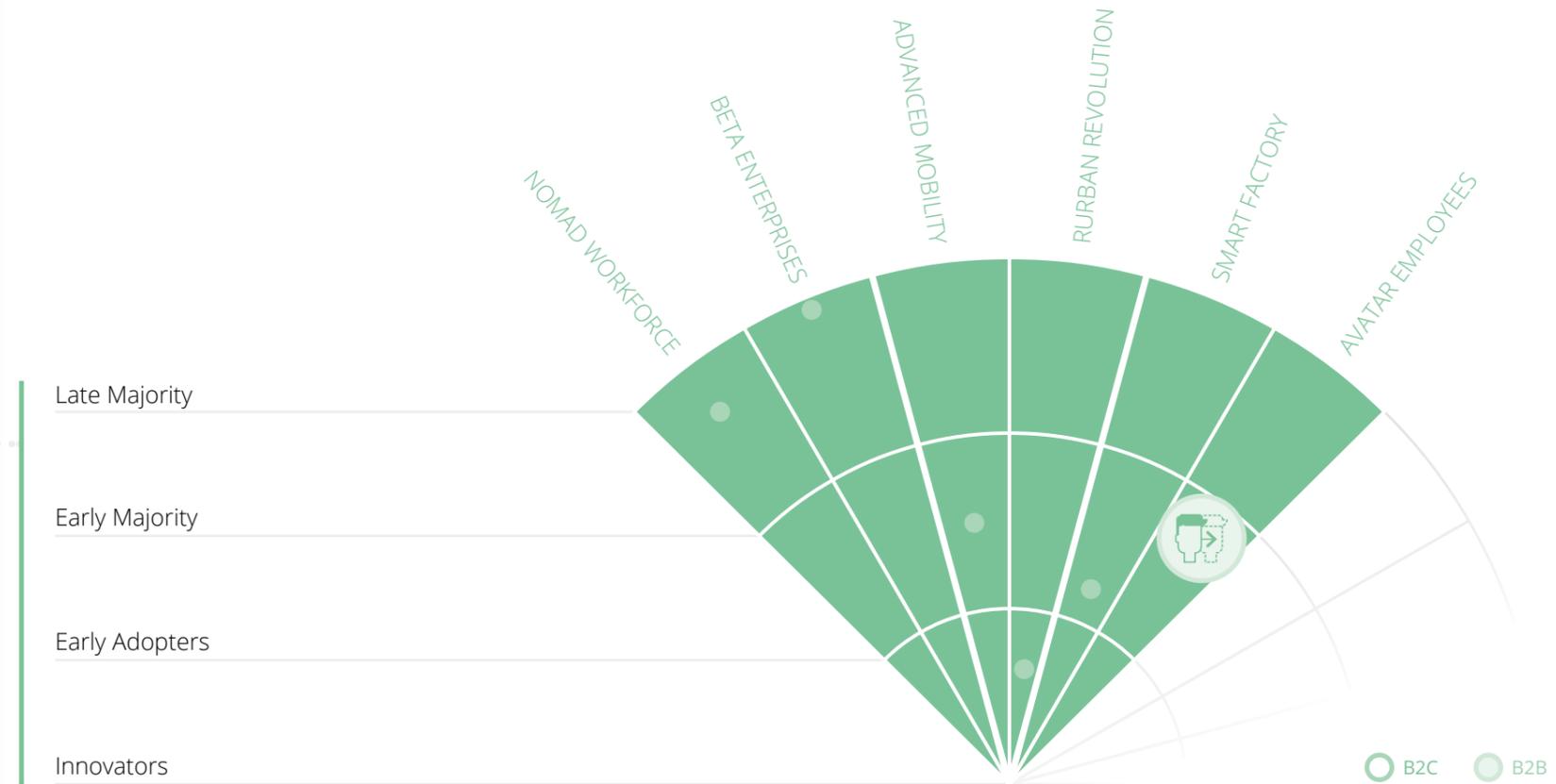
While the market for industrial robotics has already been growing strongly over the last years, applications for commercial robotics are still developing. And while the growth rate for the former will reach 12 percent per year (2017 to 2021), the latter is expected to grow by almost 23 percent per year in the same period. We therefore localize Avatar Employees between early adopters and the early majority.

ECONOMICAL CHANGE

12 / INDUSTRY 4.0
// AVATAR EMPLOYEES



NW NEW WORK UH URBAN HUBS I4.0 INDUSTRY 4.0



INNOVATION SNAPSHOT

Walmart opts for robots, not workers, stocking shelves.



For years, retailers like Amazon and Co. have been automating their warehouses using robots that can sort and pack items as they zoom along conveyor belts. Walmart, however, has taken one step further by slowly rolling out robots that roam around store aisles alongside customers. A project that started in 2017, staffing 50 stores with robots, has now been rolled out to 350 stores in 2019.

These bots are primarily designed to scan the shelves looking for items that are out of stock, thus eliminating a time-intensive chore that human workers no longer have to do. Yet workers still have to refill the shelves when the robot finds missing products.

Why this is interesting:

Robots are slowly moving out from behind the scenes into real-life situations – like shopping for example. And retail giants are increasingly turning over jobs and tasks performed in the past by human workers to a growing workforce of robots.

Ford announces Digit as the future of last-mile delivery.

Autonomous vehicles, as seen in our microtrend Advanced Mobility, might someday not only be able to navigate bustling city streets, but also deliver groceries, pizza, and packages without any human support. But until now, nothing has solved the curb-to-door problem.

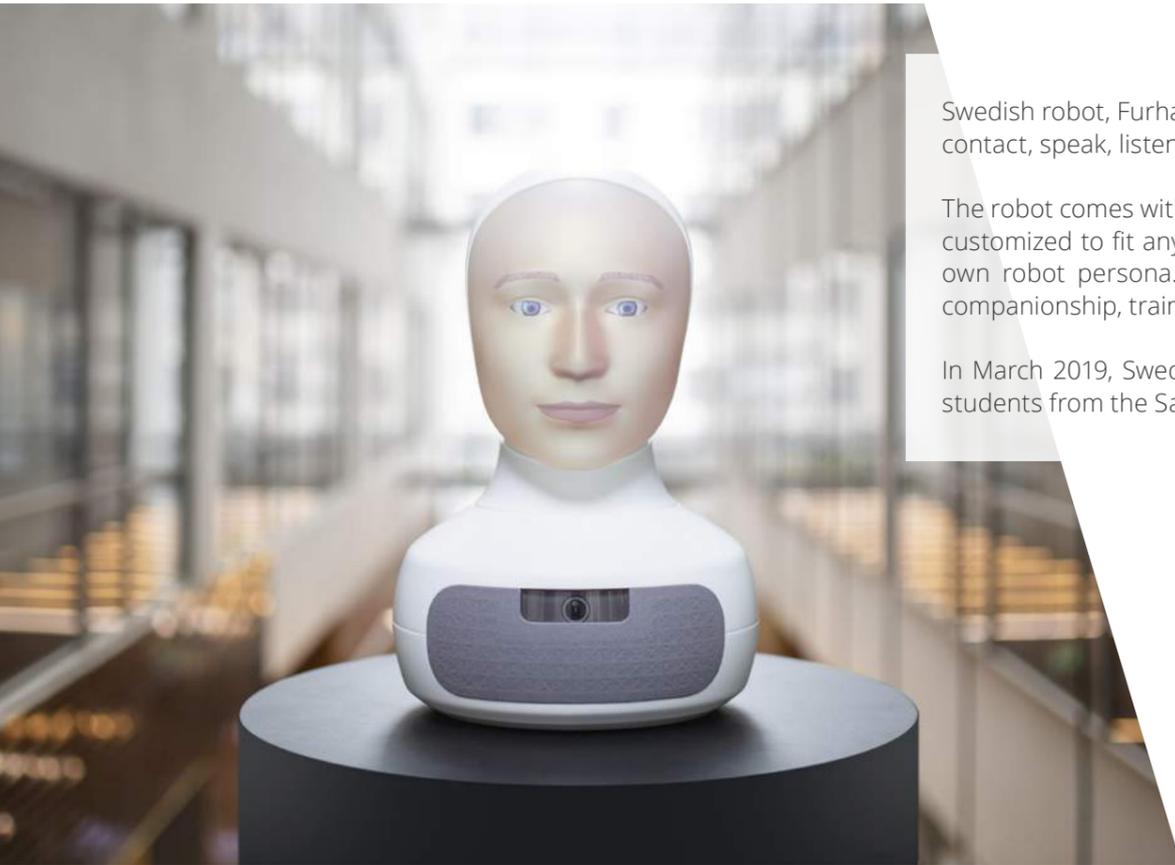
That's why Ford and startup Agility Robotics are partnering in a research project that will test how two-legged robots and self-driving vehicles can work together to solve the last 50-foot problem. The idea is that, after an autonomous vehicle parks on the destination's driveway, Digit (that's the name of the two-legged robot) unfolds and leaves the car's cargo area. The robot carries the box to the front stoop and then slides back into the AV, taking off to the next destination.

Why this is interesting:

What was once the dominion of FedEx, DHL, and UPS might come to an end with companies investing in their very own delivery system. Moreover, imagine mobility becoming more useful and resource-conserving. A ride-hailing trip could double as a delivery service, dropping off packages in-between transporting passengers.



A human element to robotics.



Swedish robot, Furhat, known as the “world’s most advanced social robot”, is able to make eye contact, speak, listen, and show emotion, as it reacts to what’s going on around it.

The robot comes with a range of pre-built expressions and gestures which then can be further customized to fit any character. Changeable masks allow users to fully personalize their very own robot persona. The company says that Furhat aims at serving customers, providing companionship, training employees, or even teach a language.

In March 2019, Swedish Furhat took part in a panel discussion in front of Oxford University students from the Saïd Business School.

Why this is interesting:

While the Furhat can be used for almost any purpose, it is evidently strong when it comes to humanlike interaction. Imagine Furhat practice tests, training employees, recruiting personnel or even working in the health sector.

SUCCESSFUL INDUSTRY PLAYERS



Collaborative robots



Autonomous robots



Drones



Unmanned ground vehicle



Staffless stores



5 experts on
**ECONOMICAL
 CHANGE**



Ginni Rometty
 Chairman, president and CEO IBM

“Big Data will spell the death of customer segmentation and force marketers to understand each customer as an individual within 18 months or risk being left in the dust.”



Klaus Schwab
 Founder and Executive Chairman,
 World Economic Forum

“Globalization 4.0 has just begun. Not only is it disruptive, but we are vastly underprepared for it. The need of the hour is to design a blueprint from the ground up that can capitalize on new opportunities while prioritizing sustainability and inclusiveness more than ever before.”



Marc R. Benioff
 CEO of Salesforce

“Speed is the new currency of business.”



Mary Barra
 CEO and Chairman of General Motors

“I believe the auto industry will change more in the next five to ten years than it has in the last fifty.”



Matt Mullenweg
 Social media entrepreneur, co-founder of WordPress,
 founder and CEO of Automattic

“In Silicon Valley, the big tech companies fish from essentially the same small pond or bay. A distributed company can fish from the entire ocean. Instead of hiring someone who grew up in Japan but lives in California, you can gain someone who lives, works, wakes up and goes to sleep wherever they are in the world.”

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General Motors (Mary Barra),
Automattic (Matt Mullenweg)

APPENDIX

GLOBAL NO.1 BUSINESS DATA PLATFORM

Further data, facts, and trends bundled on one platform

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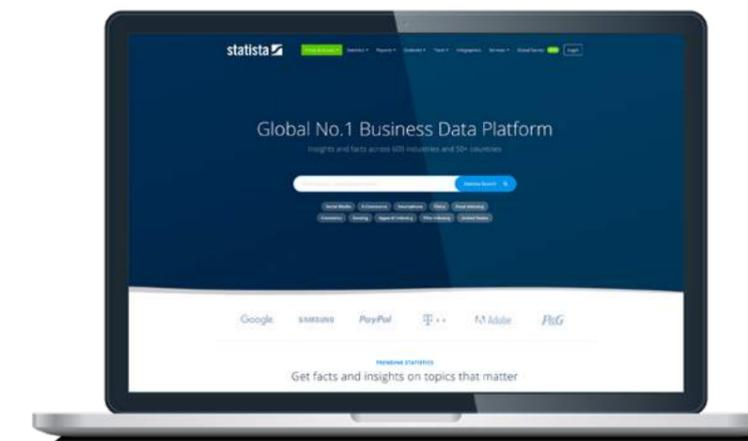
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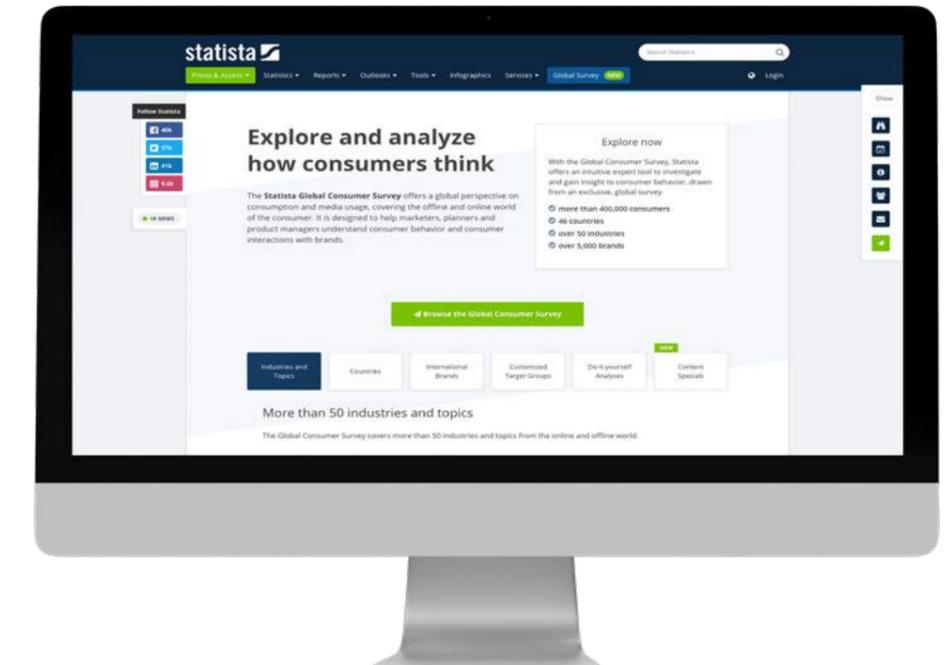
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Overview - industries & topics

- | | | |
|--|--|--|
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|  Internet & devices |  Media & digital media |  Mobility |
|  Finance & insurance |  Health |  Housing & household equipment |
|  Travel |  Services & eServices |  Characteristics & demographics |

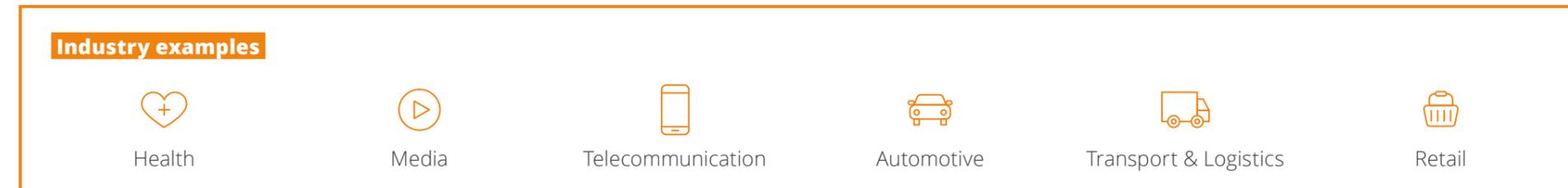
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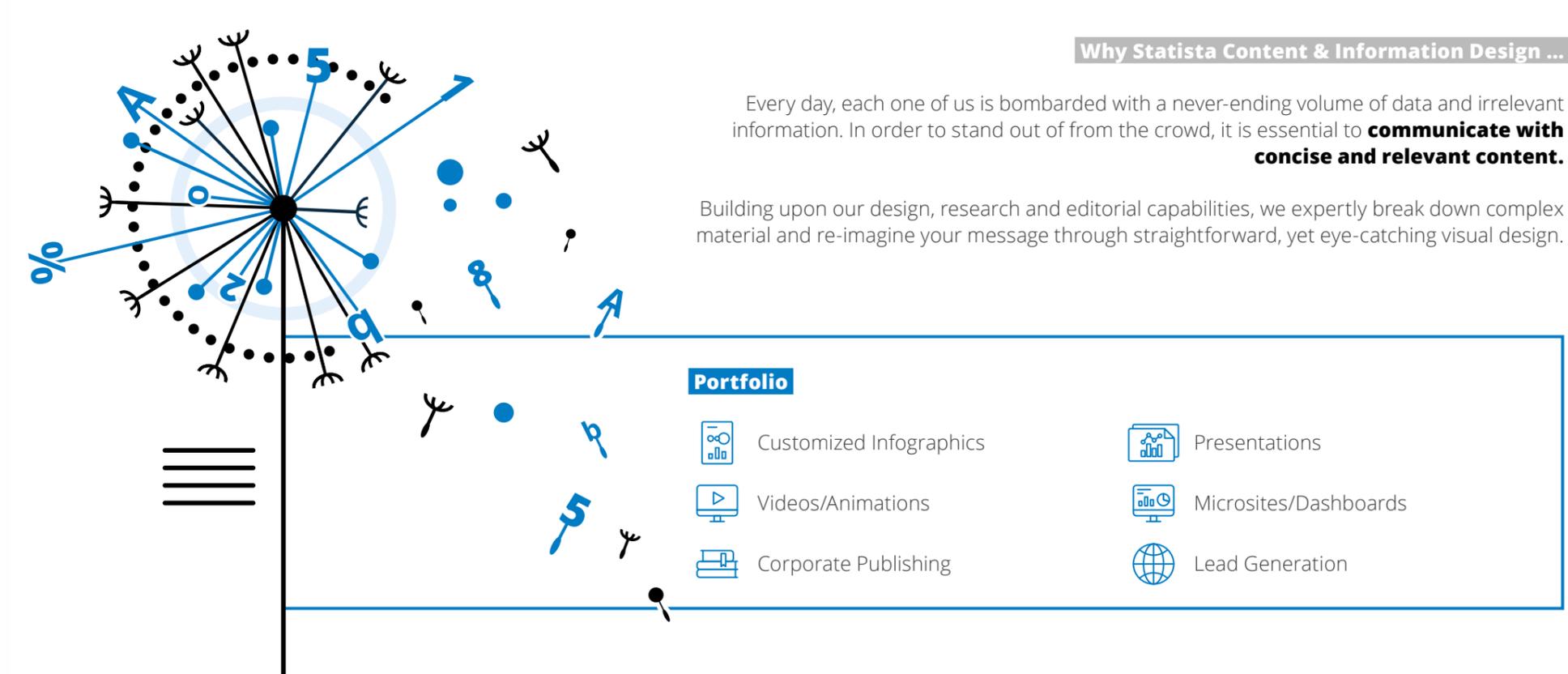


Your contact: thilo.loewe@statista.com

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Authors

Melani Adam

Researcher & Analysts

Alena Breikopf

Bruna Ribeiro Mello Alves

Ella Doan

Isabel Wagner

James Cherowbrier

Jennifer Rudden

Jessica Clement

Lea Lorson

Philipp Henrich

Philipp Wegner

Raudhah Hirschmann

Shanhong Liu

Simon O'Dea

Victoria Pawlik

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Hedda Plecher

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Katja Schönemann

Statista GmbH
Johannes-Brahms-Platz 1
20355 Hamburg

www.statista.com

Contact

UNITED STATES



Esther Shaulova
+1 212 419 57 70
support@statista.com

LATAM



Andrea Romero
+1 212 419 57 73
andrea.romero@statista.com

EUROPE



Lodovica Biagi
+44 203 709 99 60
eu.support@statista.com

GERMANY



Jens Weitemeyer
+49 40 28 48 41 0
kundenservice@statista.com

ASIA



Audrey Liu
+65 66 79 62 29
asia.support@statista.com

statista 