

THE eSTORY: UNDERTAKING THE MOBILITY CHALLENGE

**BREAKTHROUGH ALTERNATIVES TO
LEAD THE CHANGE WITH FORMULA E**

Sustainable Development fueled by innovation





CONTENTS

Welcome	5		
Section I. A changing environment - a source of challenges and opportunities	8	Julius Baer's commitment to the future with the "Next generation approach"	52
Strong waves of urbanization and population growth	11	Off setting the impact on climate change	53
Increasing international flows of trade, capital, people and information	16	Efficient sustainable logistics model for a high speed quality event	55
Mobility needs to evolve – rapidly	18	A sustainable approach driving DHL's operations	56
The changing consumer – greener and more connected	26	Lever 3 - Change management and communication	60
Situational analysis	28	Certified International Specialist Program enables Innovation Deployment at a Global Scale	62
Section II. Efficient Formula E levers - nothing can replace taking action	30	A sustainable logistics conference in London	64
Lever 1 - Technology	35	Sparkling innovation through the younger generations	65
The secrets behind the first electric Formula E car ever	36	The fan boost: helping drivers connect with the public	68
Interesting perspective from an OEM - BMW going beyond the vehicle	39	From monitoring driver's performance to... the driver's	68
Towards always ready electric vehicles	40	The eVillage, a privileged communication platform	69
Hybrid technologies developed and transferred to the wider automotive sector	42	'Mobility Oxford': a giant laboratory	72
Aerodynamics boosting car performance	44	EY report on Formula E championship	73
The 'Race to Road' program, paving Mahindra's way to electric mobility innovation	45	Section III. Open innovation and work in the ecosystem for sustainable developments	74
Lever 2 - Infrastructure and business models	46	Open innovation as a success factor in the long run	77
The 'leave it like you found it' concept is obsolete	47	People as the backbone for successful innovation	80
Road Safety: A \$100,000 grant to increase teen tire safety awareness	48	Measuring innovation	84
Formula E life cycle thinking as a driver for sustainability practices	49	How to collaborate successfully in the ecosystem	86
An alternative fuel for clean electricity – the power of glycerine	50	Conclusion	90
Tire recycling program - sustainability from cradle to grave	51	Partners and Contributors	92
Incorporating life cycle thinking into the BMWi brand	51	References	94

WELCOME TO A WORLD OF INSPIRATION

WHAT WILL YOU FIND IN THE COMING PAGES?

Dear Reader,

This white paper... is not a white paper. There are numerous studies on Mobility and Innovation and the purpose of this document isn't to offer yet another one!

The eStory Business Initiative is an invitation to a place where the concept of 'Impossible' doesn't exist.

*Humans are infinitely resourceful.
By working together intelligently,
we can create truly great things
- as big as we want them to be.*

The Founding Partners of Formula E decided that the event would be a platform to boost sustainable innovations, a gateway to the cities of tomorrow and alternative transport. After the very first Formula E season in 2014-2015, this dream is already becoming a reality – and the best is yet to come.

Without fear or favor, we start the second Formula E season with a critical and (more importantly) enthusiastic attitude. You will find in here examples of innovations developed at Formula E, or for which Formula E is a fast-track to growth. The set up of such a race is in itself an exceptional event. Here we chose to focus on what is happening behind the scenes. As you will see, Formula E is (much) more than a race. Year after year, we will update this paper with new innovations and new exciting partnerships.

*We are not documenting history, we are
writing it... enthusiastically!*

Manoëlla Wilbaut
DHL



ALEJANDRO AGAG INTRODUCTION

Dear Formula E enthusiasts,

The second season of the world's first fully electric series is about to begin. I am incredibly proud and happy about everything we have achieved so far and I am excited to see what the new season will bring.

Throughout the whole first season we have shown that Formula E is more than just a race. The championship has the potential to serve as a framework for electric vehicle R&D, accelerating general interest in these cars and promoting clean energy and sustainability.

The race towards sustainable mobility has just begun.

In the future we plan to bring Formula E to more cities. Only by developing new ways of entertainment can we spark interest in new technologies and achieve a lasting impact.

Technology will always be at the heart of Formula E and there are many exciting opportunities ahead. We see wireless charging and battery developments as the potential exciting new elements of the future in Formula E. Imagine a race where the whole track has dynamic pads under the surface allowing the electric cars to race for an infinite distance.

Our ambition is to drive the change towards an electric and more sustainable future. We launched the eStory business initiative to further accelerate innovation and sustainable mobility. On behalf of Formula E and its partners, the eStory which is led by Official Logistics Partner DHL, has recognised the strategic importance of innovation for the logistics industry.

This white paper entitled Undertaking the Mobility Challenge is just the first step of the eStory initiative. We wish to explore business development opportunities and design frameworks for mutually beneficial cooperation.

I am truly grateful that so many partners have responded to our invitation to explore the limits of sustainable innovation and have contributed to this important document.

Alejandro Agag
CEO, Formula E

eSTORY TRUSTED CO-PILOT



Julia Pale
Sustainability
Manager,
Formula E



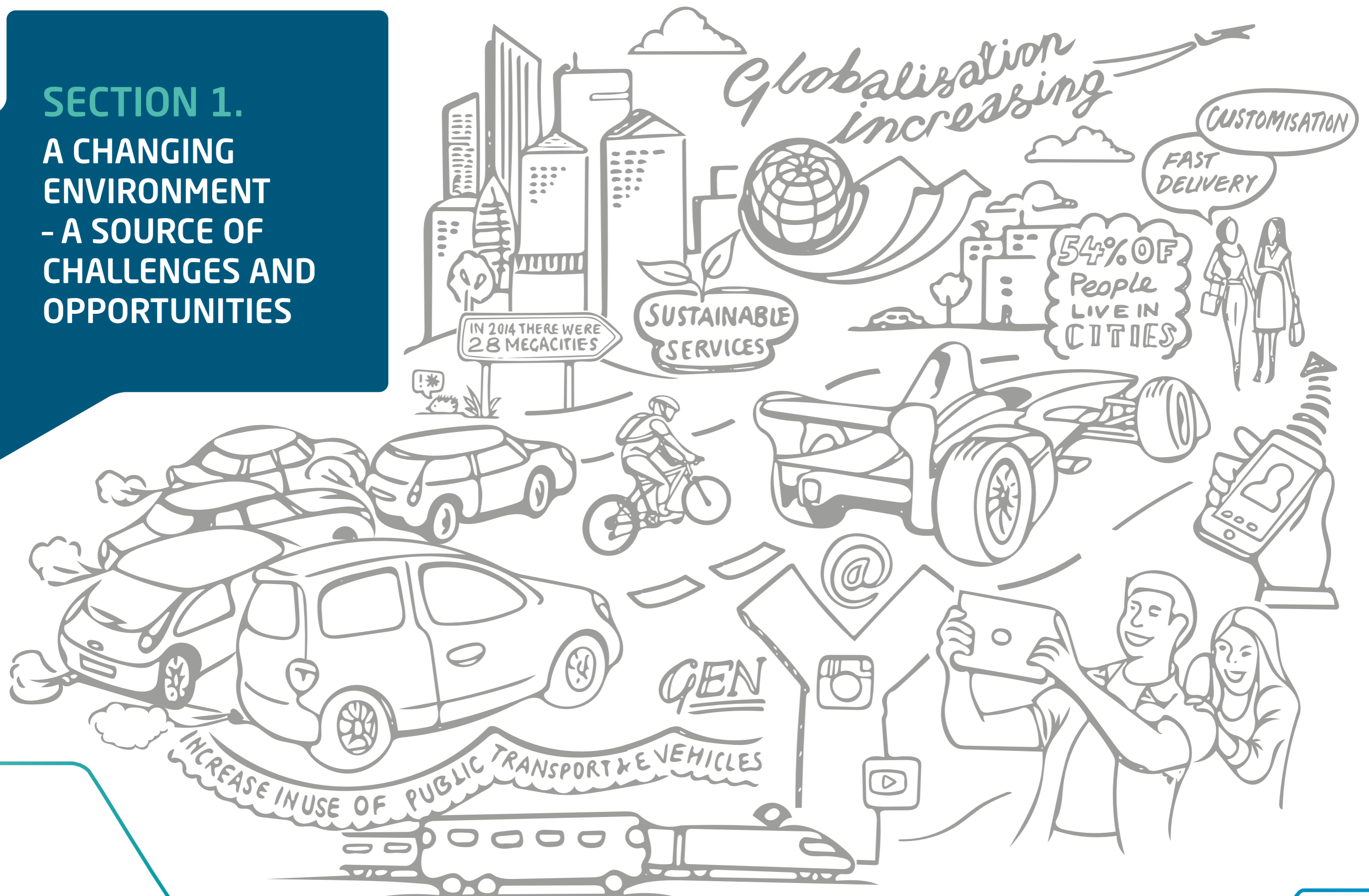
ABOUT THE AUTHOR AND eSTORY LEADER



Manoëlla Wilbaut
Head of Global
Commercial
Developments
and Sustainability
for DHL

Manoëlla Wilbaut is an expert in Innovation Management, International Management and Marketing. DHL Customer Solutions and Innovation is a management organization supporting the 100+ biggest global customers of the company. She leads diversified international development programs all around the globe with the ultimate aim to connect the world in a more sustainable and efficient manner. She has held several management positions and strategically decided to cover multiple sectors to allow a stronger reach through cross sector fertilization. Throughout her career, Manoëlla has developed expertise in several sectors including Engineering & Manufacturing, Aerospace, Automotive, and Technology. She is a well-known researcher, Professor at HEC Brussels, lecturer in several European organizations, and a recognized author. Her latest books focus on International Negotiation, Time Management and are published in French, English and Chinese.

SECTION 1. A CHANGING ENVIRONMENT - A SOURCE OF CHALLENGES AND OPPORTUNITIES



By **2050** more than **66%** of people will live in cities



2.5 BILLION forecast increase of the world's urban population by **2050** with **Nigeria, China, and India** responsible for **37%**



Globalization generates an increase in 4 kinds of flows
Trade, Capital, People and Information

Individuals born between early **1980s** and the early **2000s** already represent **over a quarter of the world's population**



We are observing a clear shift towards the use of **public transport, shared mobility platforms, bicycles, and electric vehicles**



Europe is the world's **most globally connected region**, but the shift of economic activity is pushing it towards emerging markets.

GREEN **NON-GREEN**
In the US, more than **50%** of consumers choose 'green' products over 'non-green' products of similar quality and price

In **2014** there were **28 megacities** (>10M)



STRONG WAVES OF URBANIZATION AND POPULATION GROWTH

Multiple trends shape our environment. Discussing each in detail would pull us away from the main objective: inspiring concrete and relevant actions to create value for our society, now and in the future. We choose deliberately to focus on how changes affect the individual's experience of the world.

Accelerated urbanization. For the first time in human history, more people live in cities than in rural areas. In 1950, only 30% of the world's population was urban; this figure reached 54% in 2014 and the United Nations estimates that by 2050 more than 66% of people will live in cities. This rapid process of urbanization is fueled by the desire for better life: people seek to live in cities in search of greater opportunities, including improved amenities, education, and transportation solutions.

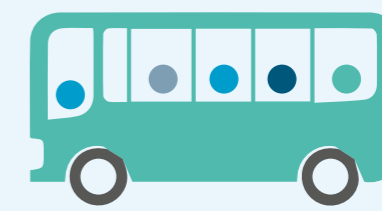
Rates of urbanization vary across regions. In Asia the rate of urbanization fluctuated widely; Europe and Northern America have experienced a period of stabilization; and in Latin America the rate has actually declined over the past six decades. Africa is the fastest growing region in terms of urbanization and the rate should further increase in the future.

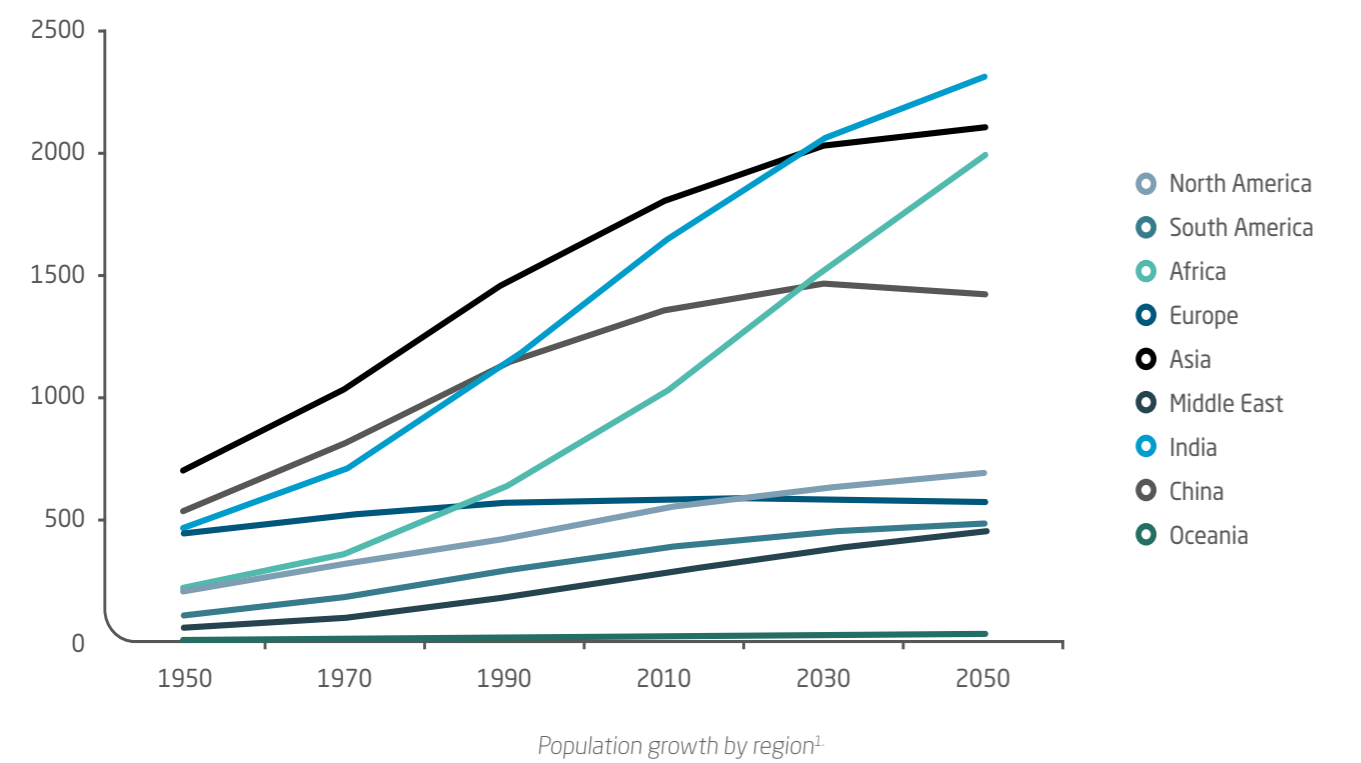
Population growth is expected to add another 2.5 billion people to the world's urban population by 2050, with varying impact across different regions. The fastest growth is projected to take place in Africa and Asia, where just three countries – Nigeria, China, and India – will be responsible for 37% of the projected global increase in urban population. As the majority of growth is happening in emerging markets, this will have significant implications on the size and distribution of the world's population.

Annual sales of **Last Mile delivery services worldwide** are projected to **increase from \$2.6 billion (USD) to \$6.0 trillion (USD) between 2011 and 2020**



Urban Mobility Demand (measured in kilometers per person) will increase by **2.6 times in 2050 compared to 2010**

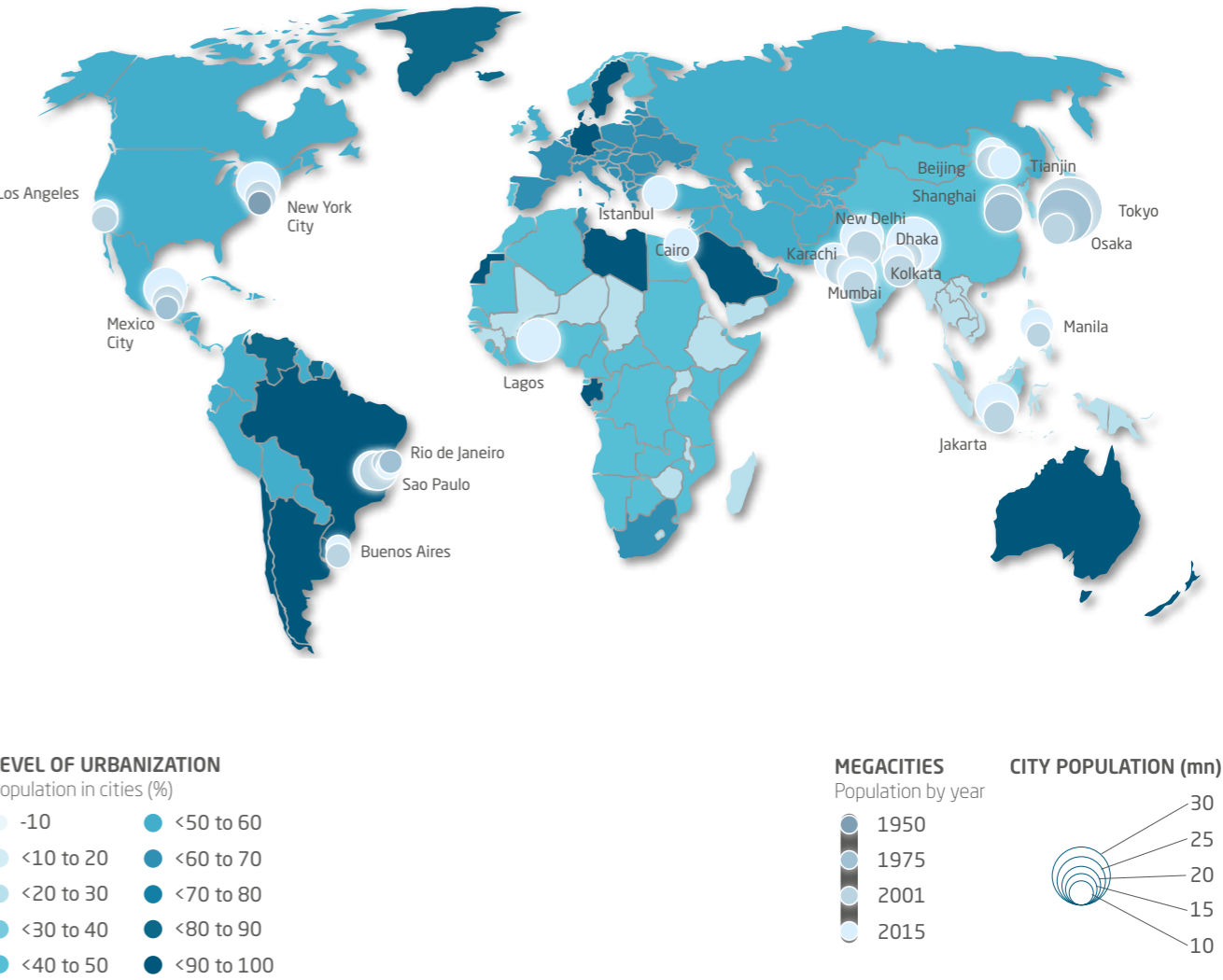




REGION	URBAN POPULATION			PERCENTAGE		
	1990	2014	2050	1990	2014	2050
Africa	196.923	455.345	1.338.566	31%	40%	56%
Asia	1.036.247	2.064.211	3.313.424	32%	48%	64%
Europe	505.991	545.382	581.113	70%	73%	82%
Latin America	313.876	495.857	673.631	71%	80%	86%
North America	212.935	291.860	390.070	75%	81%	87%
Oceania	19.059	27.473	41.807	71%	71%	74%

Changes in urban population per region (population in thousands)²

Megacities and urban areas. Demographic changes are pushing the boundaries of city limits, and megacities – cities with a population in excess of ten million people – are on the rise. In 1950, only New York and Tokyo qualified as megacities; in 2014, there were 28 megacities. About 13% of the world’s urban population (one in eight people) lives in a megacity. Tokyo is the world’s largest city with 38 million inhabitants, followed by Delhi (25 million), Shanghai (23 million), and Mexico City, Mumbai, and São Paulo, which are each home to around 21 million inhabitants³. Megacities aren’t just notable for their size – they’re also hives of tremendous economic activity.



Emergence of Megacities⁴

Changing landscape. Urbanization is closely related to economic development, social development, and environmental protection. As a result, the changing landscape has profound implications on a wide range of issues including health, safety, food, water, transport, and energy consumption.

To achieve sustainable urbanization, cities must generate better employment opportunities, expand the necessary infrastructure, ensure equal access to services, and preserve the natural assets within the city and surrounding areas.

Governments, businesses, and citizens are increasingly recognizing they can only meet these challenges when people work together, towards a shared goal⁵. There are several examples of how solutions are implemented in cities. One approach is to address sustainability issues with long term development planning.

For example, the congestion charge in London took several years to be fully implemented. The system discourages drivers from driving in the city during peak hours, and works with technology that automatically reads the license plates of vehicles entering the congestion zone. As soon as the license plate is recognized, the owner receives the bill. Since the congestion tax was put into effect in 2003, traffic has been reduced without negative effects on business in central London.

Another approach is to use advanced technology and digital information to improve citizens' everyday lives. In the LIVE project, authorities in Singapore aim to use real-time data to track and affect the city's activities and tackle urban problems⁶: participants effectively serve as sensors in a network of communication devices. The project provides Singapore's residents with access to a range of useful real-time information about their city by developing an open platform to collect, distribute, and elaborate on real-time data that reflects urban activity⁷.



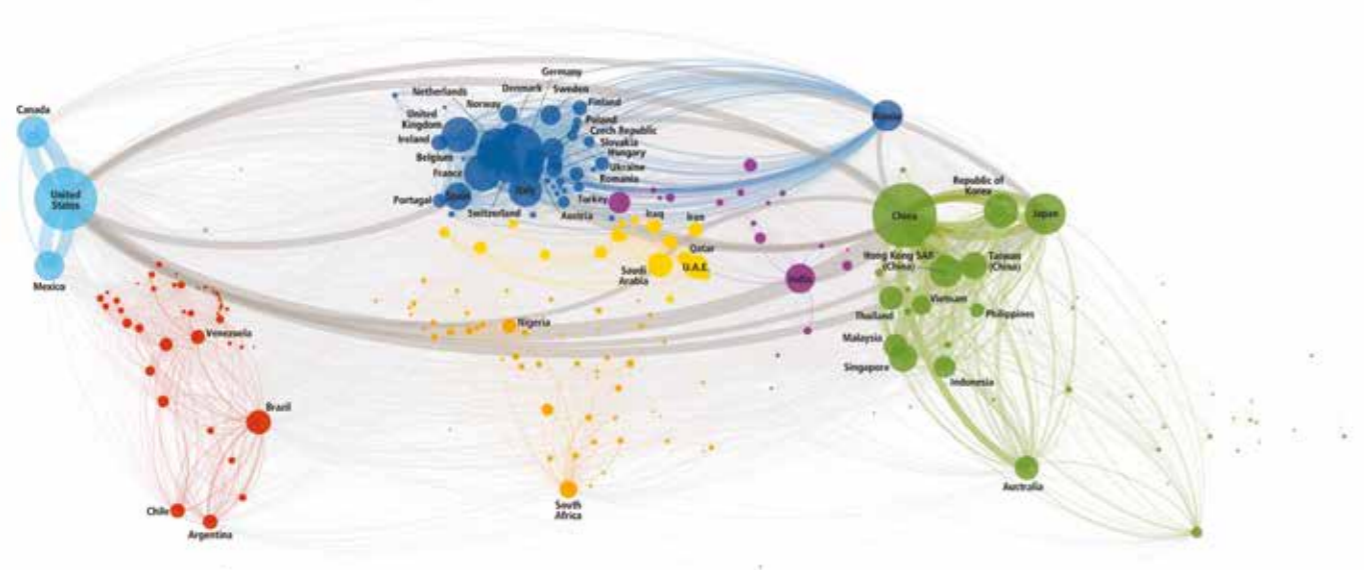
INCREASING INTERNATIONAL FLOWS OF TRADE, CAPITAL, PEOPLE, AND INFORMATION

Globalization. Demographic changes invariably contribute to global connectedness: the degree to which the world is interconnected through flows in trade, capital, people, and information. This relates to a frequently used and often misunderstood term: globalization.

The global financial crisis significantly reduced trade and capital flows and raised questions over whether globalization has stalled or even gone into reverse. Now, after years of stagnation, globalization has resumed its upward trend and international flows are again increasing in terms of size and number⁸.

Also, benefits of trade that were once highly concentrated among the largest developed economies are now spreading across the developing world. As a result new global hubs are emerging in Eastern Europe, South America, and South East Asia.

Connectedness. The fast-changing nature of international flows calls for objective measures of global development and connectedness. One such measure is the DHL Global Connectedness Index (GCI), a detailed analysis of the state of globalization which compares and ranks countries in terms of both depth and breadth. “Depth” measures countries’ international flows relative to the size of their domestic economies (e.g. total gross exports as a percentage of GDP). “Breadth” assesses the distribution of countries’ interactions relative to what those would be in a world where cross-country differences and distances have no impact at all. This means that a country would earn the highest possible breadth score for exports if these were distributed among destinations in exact proportion to the rest of the world’s imports.



How Globalized is the World?

LEARNINGS FROM THE GLOBAL CONNECTEDNESS INDEX

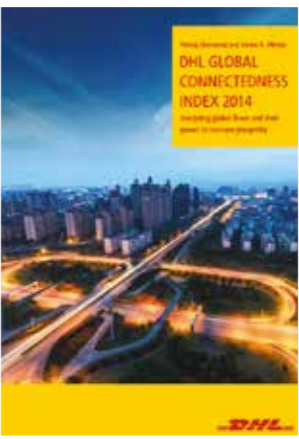
The index shows that Europe is the world’s most globally connected region. The Netherlands is the top ranked country, followed by Ireland, Singapore (the only non-European country in the top 10), Belgium, Luxembourg, Switzerland, the United Kingdom, Denmark, Germany, and Sweden.

Emerging economies typically lag behind advanced economies in terms of connectedness.

The least connected regions are Sub-Saharan Africa and South and Central Asia. Whereas emerging economies are about as globally connected as advanced economies in terms of international trade flows, they are not as deeply integrated into international flows of capital, people, and information.

The picture of the globalized world presented in the latest GCI continues to evolve as more emerging economies participate. The 10

countries where global connectedness increased the most from 2011 to 2013 are all emerging economies, and they are involved in the majority of international interactions⁹. This shift of economic activity is reshaping global connectedness as it pushes the world’s economic centre towards emerging markets.



The report, which covers 140 countries, shows that global connectedness, measured in terms of cross-border flows of trade, capital, people, and information, has recovered most of the losses incurred during the financial crisis. In 2014, DHL released the third edition of the Global Connectedness Index.



MOBILITY NEEDS TO EVOLVE - RAPIDLY

Demand for mobility continues to be on the rise. With growing international flows and accelerated urbanization, cities struggle to absorb new residents and provide the supporting infrastructure. Urban mobility demand increased from 25.8 trillion kilometers per person in 2010 to 67.1 trillion in 2050¹⁰. Rising mobility has serious environmental, social, and economic implications, and simply scaling up existing solutions is not viable¹¹. Transportation is already responsible for 23% of global CO₂ emissions from fossil fuel combustion¹². If we continue to use motorized transportation in the same way, by 2025 worldwide

transport-related emissions will increase by 30% compared to the 2005 baseline¹³. Because transportation is essential to economic progress, we need to develop sustainable solutions for both people and goods. A study by the Texas Transportation Institute on urban mobility in the US shows that congested traffic is responsible for increasing delays and related losses in economic activity¹⁴. Across cities in the study, the yearly hours of delay per commuter have increased on average by more than 200% between 1982 and 2011.



The Arthur D. Little Urban Mobility Index 2.0 shows that Stockholm belongs to the above average group, Beijing and Buenos Aires score is close to the global average; and Atlanta is among the cities with the lowest score.



URBAN AREA	YEARLY HOURS OF DELAY PER AUTOMOBILE COMMUTER					CHANGE IN HOURS
	1982	2000	2005	2010	2011	
Washington	18	65	74	66	67	49
Los Angeles	37	72	78	61	61	24
San Francisco	24	72	89	60	61	37
Nashville	23	48	57	46	47	24
Denver	11	42	48	44	45	34
Orlando	13	55	51	44	45	32
Honolulu	19	34	43	45	45	26
Baton Rouge	10	36	43	42	42	32
Bridgeport	13	51	54	42	42	29
Worcester	13	40	40	33	33	20
Cape Coral	10	29	36	29	30	20
Columbia	5	20	24	30	30	25

Increase in commuting

ONE SIZE DOES NOT FIT ALL - ASSESSING MOBILITY SOLUTIONS

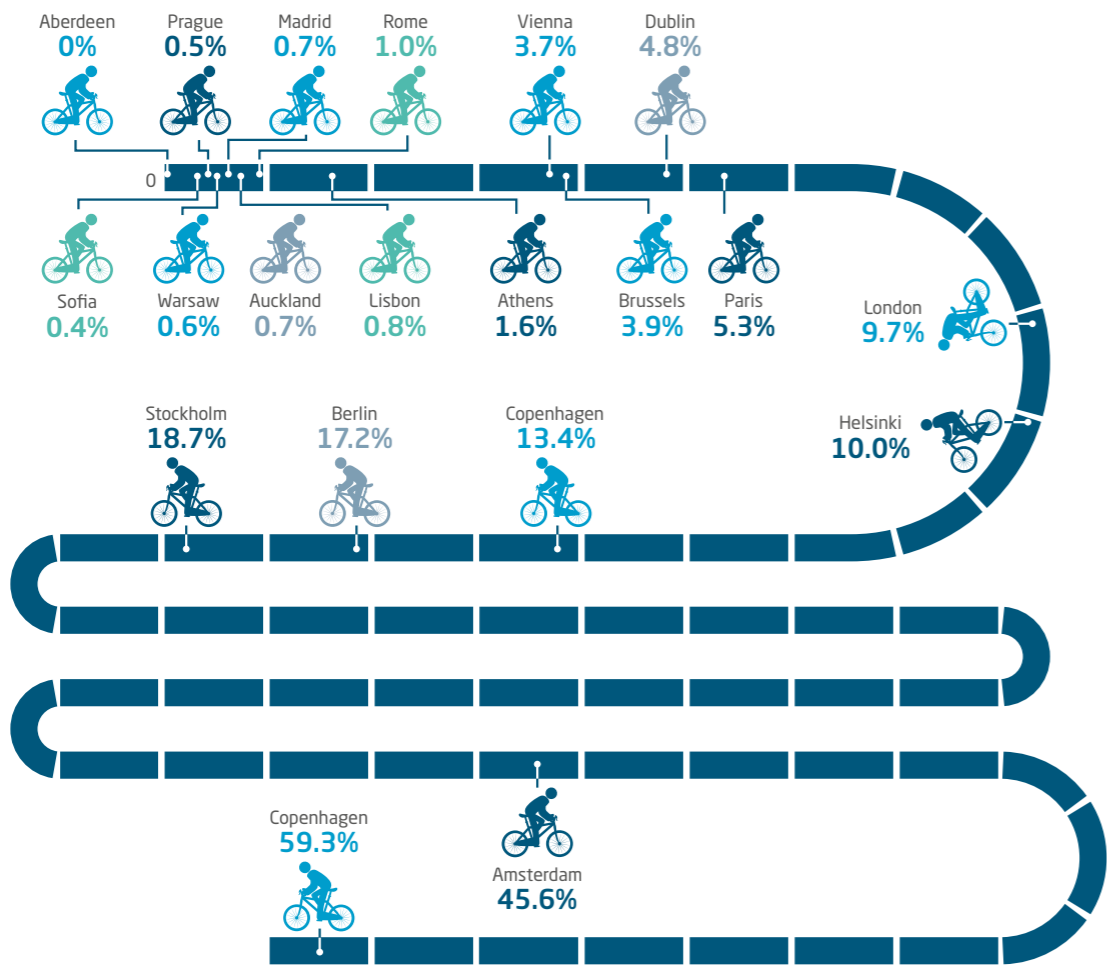
Urban mobility has become one of the toughest challenges for authorities in urban areas. The Urban Mobility Index 2.0 for 2014 by Arthur D Little finds that most cities are not equipped to deal with future challenges. The average score of 84 cities included in the analysis is 43.9 points out of 100, and only 11 cities score above 52 points. Results of the study indicate that when it comes to implementing efficient mobility solutions, the city's size is fairly irrelevant: mature cities are not necessarily a model. Innovation is the key to improvements¹⁵. Current mobility services can be improved by combining different ways of travelling and these need to be driven less by improvements in single transport modes and more by integration. Governments, businesses, and citizens need to collaborate on the system level and develop innovative business models.

MOBILITY OF PEOPLE

Changing travel habits, an increased need for speed and predictability, and evolving customer expectations with regards to sustainability are changing business models. We are observing a clear shift towards the use of public transportation, shared mobility platforms, bicycles and electric vehicles.

Public transportation solutions. The use of advanced technologies and network capabilities enables cities to develop smart mobility platforms. One example is the SMART platform in Vienna, Austria, that allows users to inform themselves about all available means of transport. The system integrates different mobility solutions into multiple unified travel options, taking into account unique customer needs¹⁶. The advantages of classic public transportation systems act as the backbone of the transportation ecosystem and are combined with the values of individual transportation.

Bicycles. Riding a bicycle for daily commuting is increasingly becoming a popular choice for people living in dense urban areas in different regions around the globe. In cities like Copenhagen and Amsterdam, half the people who travel to work use bicycles. Use of bicycles is further supported by shared services. Velib, a bicycle sharing service launched in 2007 in Paris, encompasses around 18,000 bicycles located on more than 1,200 stations across the city and surrounding municipalities¹⁷.



Percentage of people who travel by bicycle to work¹⁸

Car sharing. What started as a community-based activity between environmentally conscious individuals has evolved into a significant business opportunity. High growth is expected in regions with mature urban mobility systems, such as Western Europe, North America, and some Asian cities. The trend has attracted innovative original equipment manufacturers (OEMs), which are starting to provide middle segment or premium cars to user communities who can identify available vehicles and their locations via smartphone apps. Examples of such services include BMW’s DriveNow, Daimler’s car2go, and Volkswagen’s Quicar¹⁹.

Electric vehicles. The gradually increasing adoption of electric vehicles (EV) suggests that electric powertrains could play an important part in the future of mobility. This represents a promising pathway to increased efficiency, reduced environmental footprint, and a decarbonized transport sector²⁰.

After decades in which the traditional internal combustion engine has been the dominant option, the automotive industry has started to diversify. Today’s electric powertrain portfolio consists of plug-in hybrid electric vehicles, range-extended electric vehicles, battery electric vehicles, and fuel cell electric vehicles²¹.

Consumers mainly adopt electric vehicles to reduce their carbon footprint and pollution levels in living areas. Government incentives such as preferential parking permits in dense urban areas also serve as a motivator.



Urban delivery of goods with cubicycles

MOBILITY OF GOODS

Higher urban mobility is leading local governments and private businesses to focus on the delivery of goods. Annual sales of last mile delivery services worldwide are growing fast and are projected to increase from 2.6 trillion USD to 6 trillion USD between 2011 and 2020²².

Solutions supporting future growth need to be integrated, tailored to the environment, and should consider improvements in several parameters including congestion, air pollution, flexibility, and local economic development. Selecting the best mix depends on the local reality and sought objectives.

Solutions for the mobility of goods can be grouped according to their impact on the way flows of goods are organized, on infrastructure and on information systems.



Formula E racing car in London

Managing flows of goods. Several governments have introduced solutions to limit vehicle access to certain areas or during specific time slots, low emission zones, exclusive access permits for one or several transport companies, and logistics zones in urban areas. Shanghai restricts the entry of polluting vehicles, and other Chinese regions regulate access during peak hours²³. More companies are also using shared logistics facilities to consolidate flows of goods. Consolidating goods from different suppliers calls for close cooperation and, if conducted properly, can reduce distances travelled by 30-45%.

In London, DHL and London Authorities formed a partnership to develop the DHL London Consolidation Centre. By using existing facilities for collecting multiple deliveries from multiple suppliers, DHL consolidates goods for final delivery to the city. This achieves higher load density while reducing city miles and emissions.



The DHL London Consolidation Centre project aims to improve mobility, sustainability, and livability in the city.

www.youtube.com/watch?v=gH2ONUGeLh0

The flow of goods are also shaped by crowd-based deliveries. "MyWays" is a service which links recipients of parcels with "MyWayers", individuals who pick up parcels from logistics providers and deliver them to end customers at their convenience.

Infrastructure solutions. A good way to improve urban mobility of goods is to use self-service pick up points for parcel deliveries. Started in 2001 as a pilot project, DHL has developed Locker Systems for the delivery of parcels and oversized letters. Each unit comprises a bank of storage spaces linked to an electronic interface where customers can drop off or pick up their packages 24 hours a day.

The concept of the Locker Systems also offers a possibility to create new business models around sustainable mobility. When Volvo Group launched a pilot bus route in Gothenburg with fully electric buses in 2015, it recognized the potential for combining bus stops on the route with DHL Lockers. Bus stops provide an excellent location for the delivery and collection of parcels and oversized letters, and are well connected by public transport. The cooperation between DHL and Volvo Group shows how new solutions can facilitate carbon free mobility of people and goods.



DHL Locker System

The growth of mobility of goods needs to be supported by freight models in airports. Terminals with restrictive access and insufficient loading bays are currently not equipped to deal with future challenges. To deal with these issues, DHL has developed new urban freight management models for airports that support sustainable growth. In terms of flow management, there is a strong parallel between Airport Logistics and City Logistics: space is limited and there are many restricted areas to circumvent.

Information systems and alternative vehicles. Advances in technology have significant impact on the mobility of goods. Low or zero emission vehicles are increasingly being used in urban areas. Deutsche Post DHL launched a carbon free vehicle concept in Bonn to service the delivery needs of the entire city with zero emission vehicles. The project aims to put about 141 electric vehicles on the road by 2016, and the projected result in decreased CO₂ emissions is over 500 tons per year.



2014 Formula E Car on display in the DHL Innovation Centre with Volvo truck in the background showcasing the Maintenance on Demand project.

Technological advancements have also created new opportunities for businesses to improve decision making through the analysis and application of information – for example using smart sensors and network technologies to monitor and control the structural health of vehicles. To leverage this trend, DHL and Volvo Trucks decided to develop a commercially viable solution that would enable performance measurements and define standards for future mass adoption. The Maintenance on Demand project aims to increase vehicle uptime, achieve cost optimization, and improve road safety as well as energy efficiency. In the future, this technology can be further expanded to develop self-driving logistics vehicles. DHL is already experimenting with automatic guided vehicles in warehouses and distribution centers. This technology is also used to support operations in ports and on manufacturing sites to expedite deliveries to the production lanes.



DHL and Volvo Truck collaboration on the Maintenance on Demand project.

Learnings from Formula E to improve Electric Vehicle technology



DPDHL STREETSCOOTER	
Max. Speed	85 km/h
Battery Capacity	15 kwh
Power	45 kW
Torque	130 Nm
Range	80 km
0 - 100 km	Not possible!

SPARK - RENAULT SRT-01E	
Max. Speed	225 km/h (limited)
Battery Capacity	30 kwh
Power	200 kW
Torque	321 Nm
Range	25 minutes (race)
0 - 100 km	3 seconds

Fleet of zero emission vehicles used by DPDHL.



THE CHANGING CONSUMER – GREENER AND MORE CONNECTED

Sustainability awareness. Changes in the environment are affecting the lives and behaviors of individuals. Population growth is putting pressure on natural resources and citizens are increasingly aware of sustainability issues. Several studies carried out in the US show that more than 50% of consumers have persistently chosen a green product or service over a non-green product of similar quality and price²⁴. This trend has become so important that companies cannot afford to ignore sustainability – it increasingly determines market share and influences brand loyalty across sectors.

Technology. Increasingly, advances in technology and the amount of available information is shaping our world. With the advent of the Internet of Things, internet connections now extend to physical objects and can serve a wide array of purposes. As more analogue information is converted into digital formats, every aspect of life is captured and stored in some way, and we move closer towards the network of everyday objects²⁵.

Generation Y. Individuals born between the early 1980s and the early 2000s already represent over a quarter of the world's population. A main characteristic of this so-called "Generation Y" (or "Millennials") is that they are being formed by the technologies to a much greater extent than any other generation. They are willing to adapt their lifestyles to new inventions, want to access information at their convenience, and expect products and services to be delivered faster²⁶.

A Global Automotive Survey by Deloitte has shown that almost 60% of Generation Y would prefer to use alternative powertrains in the near future. This indicates a high awareness of sustainability issues and willingness to experiment with new technologies.

Mass customization. Consumers are also interested in greater variety and choice. A survey by Bain & Company found that while less than 10% of people have tried customized options, more than 30% are interested in doing so²⁷. In the last years we have seen a steady increase in customized products and retailers of anything ranging from dresses or shirts to handbags are discovering the value of letting customers create their own unique products. A successful example of such a solution is the Nike iD service that enables customers to personalize and design their own Nike merchandise. Mass customization has the potential to help companies increase revenue and gain competitive advantage, and reduce waste through on demand production.

Very much anchored in the Generation Y values, Formula E is targeting young people, families, and groups interested in sustainability to increase the popularity of this new brand of motorsport.



SITUATIONAL ANALYSIS

Urban population growth, rising mobility of people and goods, and consumer trends are changing the ecosystem. To illustrate the speed of change, consider that London only grew by 2% a year during the industrial revolution in the 19th century, whereas Kigali, the capital city of Rwanda, has been growing by 7% a year for the last 60 years. As urban population grows and economic prosperity increases, governments, private businesses, and individuals are under pressure to create fast, safe, and environmentally friendly mobility solutions.

The resulting ecosystem is activated through three components: technology, enabling the development of innovative solutions, infrastructure, that supports connectivity and distribution, and communication, that facilitates interaction between different actors.

National and local governments.

Actions include the introduction of restrictions on emission levels (CO₂, GHG, nitrogen oxides) and the institution of low emissions zones in urban areas. Many promote sustainable modes of transportation with subsidies for public transport and electric vehicles, new traffic routes for busses and bikes, and by developing smart mobility platforms.

However, urban mobility solutions often suffer from a lack of vision, poor integration, limited regional cooperation, and lack of private sector involvement. As a result, many cities do not have a clear vision and strategies as to what mobility systems should look like in the future²⁸.

Businesses. Legislation and consumer pressures have encouraged businesses to start implementing ambitious projects to reduce environmental footprint and improve mobility. Carbon free delivery and alternative fuels are becoming more widely used. We can also observe increased involvement in shared services. Examples like Velib for bike sharing, BMW's DriveNow, Daimler's car2go, or Volkswagen's Quicar suggest that businesses are responding to key consumer trends.

Consumers. Changes in consumer preferences and rising awareness of sustainability issues are pushing governments to introduce new legislation and businesses to develop new product offerings. These developments are particularly visible for Generation Y which encompasses more than 25% of world's population.

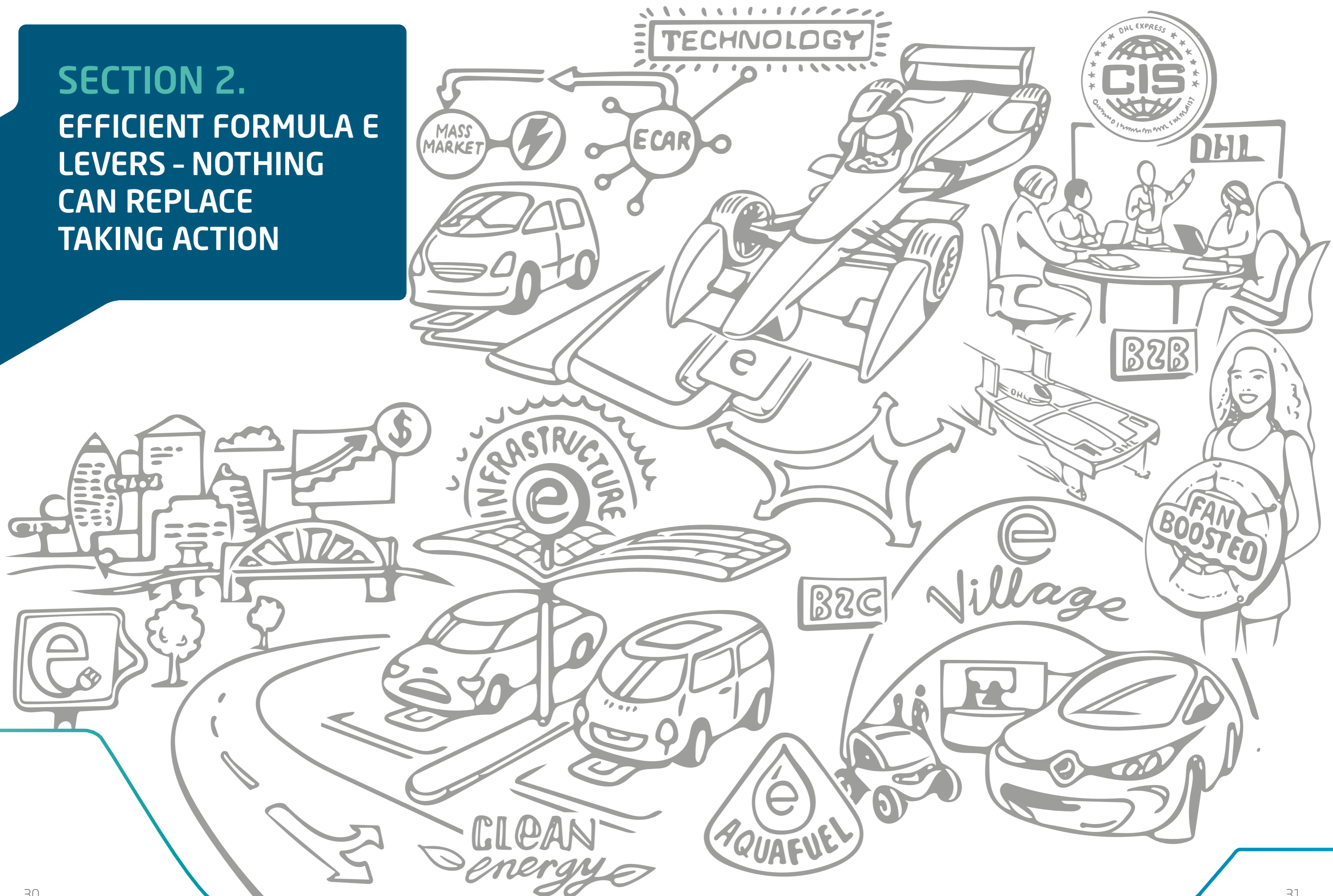
Conclusion. Combined results in the ecosystem are encouraging but there is still room for improvement: specifically, there is limited strategic alignment between the different motives of individual actors. Arthur D Little identified key success factors for setting up integrated mobility platforms that include ecosystem stakeholder management, setting up a profitable business case, and close integration of technologies.

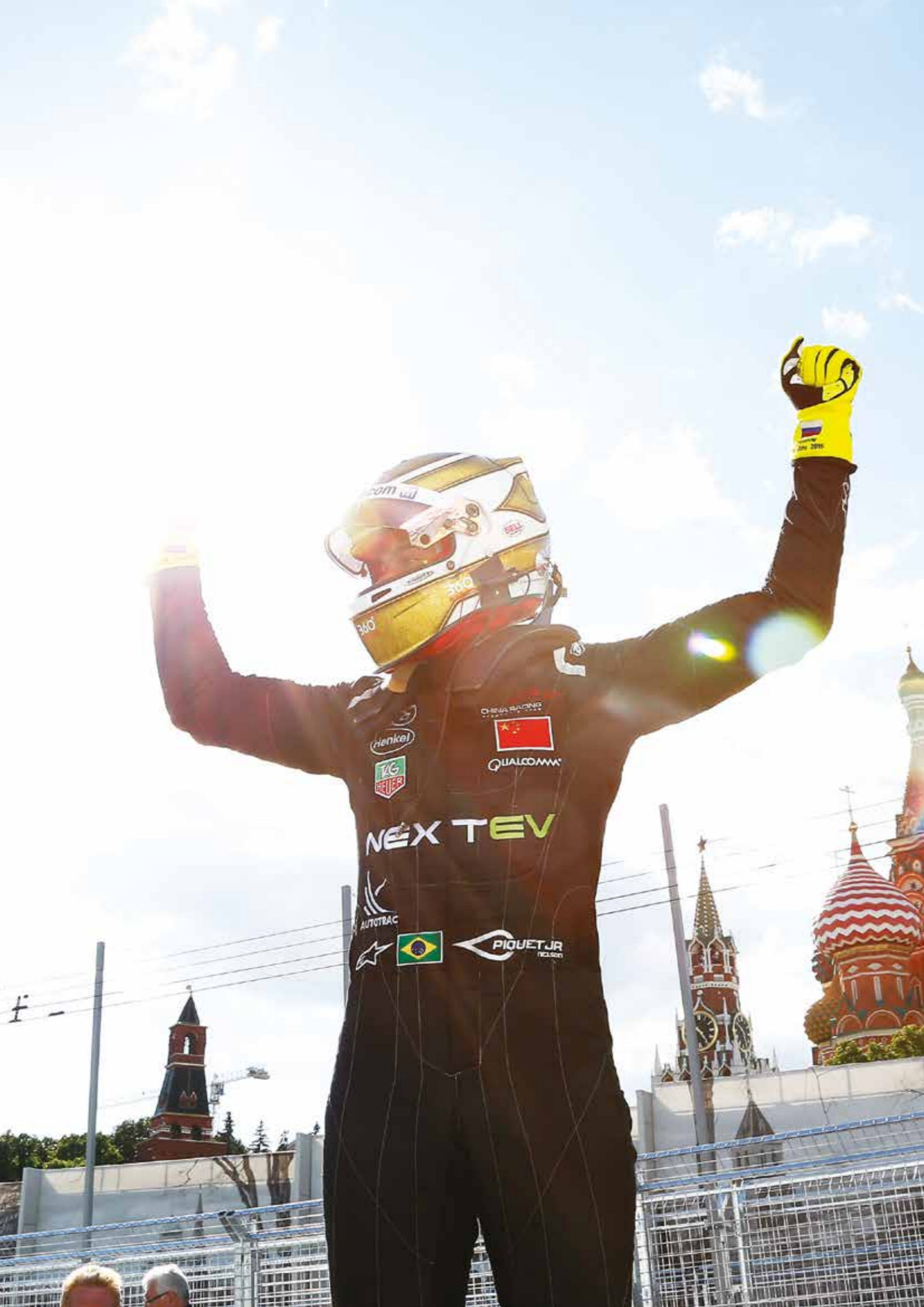
To facilitate the transition to a more sustainable and integrated urban mobility, we need collaborative platforms that truly involve the whole ecosystem. This is easy to say but probably less easy to do. We will now examine concrete examples on how Formula E can be leveraged as a platform for boosting Innovation and Sustainable Mobility.



SECTION 2.

EFFICIENT FORMULA E LEVERS - NOTHING CAN REPLACE TAKING ACTION



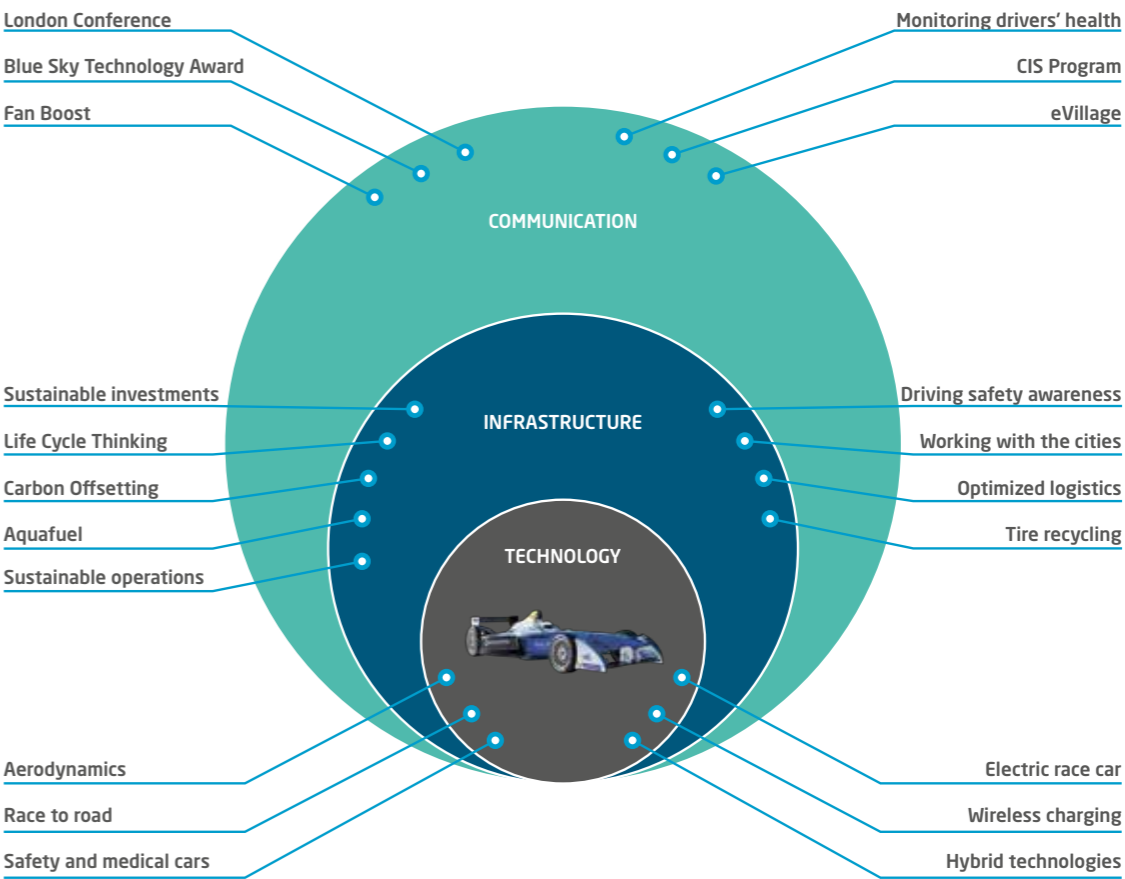


Mobility is associated with economic progress: historically, the most connected regions of the world were richer. Understanding the underlying factors affecting mobility is essential for future development.

To win a race, a team needs the right vehicle, the right support environment, good drivers, and fuel! By analogy these levers of actions correspond to the activation pillars in the ecosystem:

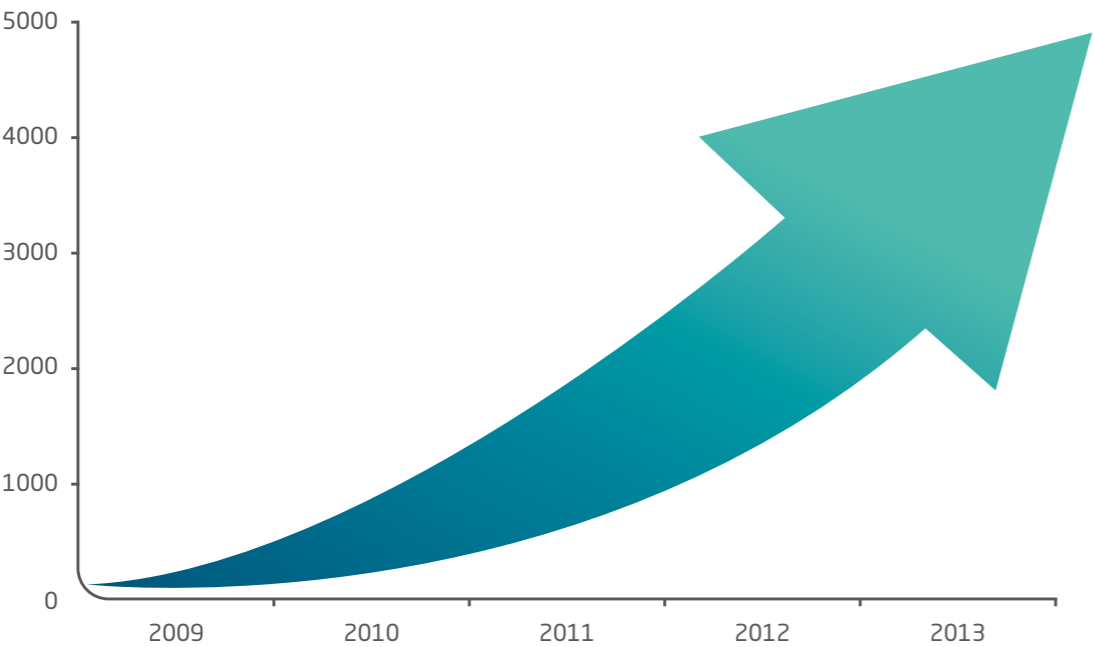
- Technology – the vehicle
- Infrastructure and Business Models – the support around
- Communication – drivers and fuel

We closely examined these three activation pillars that shape mobility. Advances in technology enable development of innovative solutions. Infrastructure supports connectivity and distribution. Communication facilitates interaction between the different actors. Concrete examples in this field illustrate how the Formula E championship can be used as a powerful collaborative platform.



Overview of three activation pillars and related case studies.

One common theme underlying all activation pillars is the increasing speed of innovation. The world is evolving at a much faster pace than 100 years ago and the change continues to accelerate. As we continue to generate more knowledge in the ecosystem, this may translate into better innovation potential – which in turn means more knowledge can be created in the future. Since the start of the industrial revolution in the 18th century, the speed of human innovation has been increasing exponentially. For example in the automotive industry, the number of innovations around the world has been growing by double digit figures over the past five years.



Automotive Inventions by Publication Year.

LEVER 1 - TECHNOLOGY

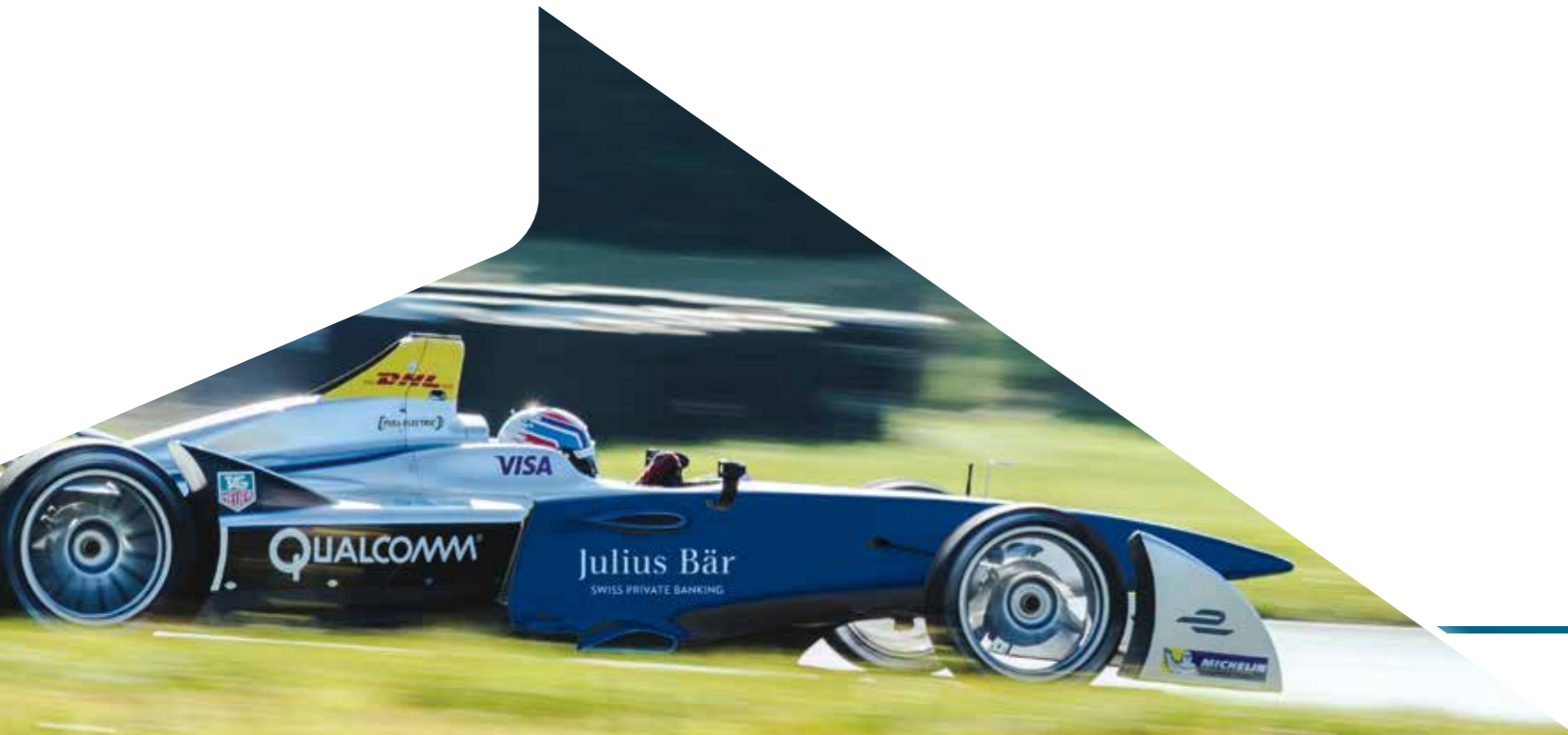
Mobility has always been influenced by advances in technology. The vehicles we drive today would not exist without breakthroughs such as those achieved by Cugnot's Fardier à Vapeur, Benz's Motorwagen, or Ford's Model T.

We can identify two important areas where technology is significantly changing mobility. Firstly, as urban areas are becoming denser and more concentrated, intelligent transport systems offer the possibility to coordinate all transportation means. Driven by data management, such systems act as a connected grid and optimize the flow of people and goods.

Secondly, to meet future mobility needs, current solutions need to become more efficient and use fewer resources. This needs to be supported by the development of alternative powertrain technologies in vehicles and the use of alternative fuels, such as hydrogen and glycerin. Also, we can anticipate enhancements to driver assistance functions and the introduction of autonomous driving.

The selected case studies show the importance of technology. We start with the technical challenges and solutions related to the design of the new fully electric race car. A deep dive into exciting innovations already planned by some partners for the next seasons of the championship completes the picture. These innovations include Qualcomm's wireless charging, implemented in BMW cars and Andretti's powertrain improvements.

Next, we show how technologies developed within Formula E can be transferred to other industries and applications. Williams' innovative developments in electric powertrains are already used in the automotive sector. The racing teams have also gone beyond the Formula E environment when it comes to their respective technologies, as we will see with Mahindra Racing team.



THE SECRETS BEHIND THE FIRST ELECTRIC FORMULA E CAR EVER

In the first season of Formula E, all 10 teams used identical single-seater cars designed and built by Spark Racing Technology (Spark-Renault SRT_01E) together with a consortium of some of the leading companies in motorsport. Dallara, an Italian firm, constructed the lightweight and resistant monocoque chassis out of aluminum and carbon fibre. McLaren Electronics Systems provided the electric powertrain and Williams Advanced Engineering supplied the batteries producing 200kW. Hewland came up with the five speed paddle shift sequential gearbox and Michelin delivered tires offering an optimum performance in any weather conditions. All these modules were integrated by Renault, a leader in electric vehicles and expert in motorsport, thanks to its experience in Renault Sport Technologies and Renault Sport F1 programs.

RENAULT

As one might expect, Renault was amongst the first companies to commit to the Formula E project. When it comes to fully electric powered vehicles Renault is considered as a pioneer and is commercializing four different models. The ZOE model was released in 2012 and is one of the most successful electric vehicles (EV) in Europe, with over 30,000 units sold since it was introduced. The award-winning Twizy, which has been designed for the city and shorter journeys, and the Fluence Z.E. saloon (known as the SM3 Z.E. in Korea), were released in 2011. The Kangoo Z.E., released in 2010, was the first mass-produced electric commercial vehicle and has been elected international van of the year in 2012. The fact that no major incident happened during the first season of the Formula E series also demonstrates Renault's expertise. The company oversaw the systems integration and overall electric architecture of the Spark-Renault SRT_01E prototype. EV technology had never been put to the test in racing conditions before the competition.



Renault ZOE 2012



Renault Twizy 2011



Renault Kangoo 2010

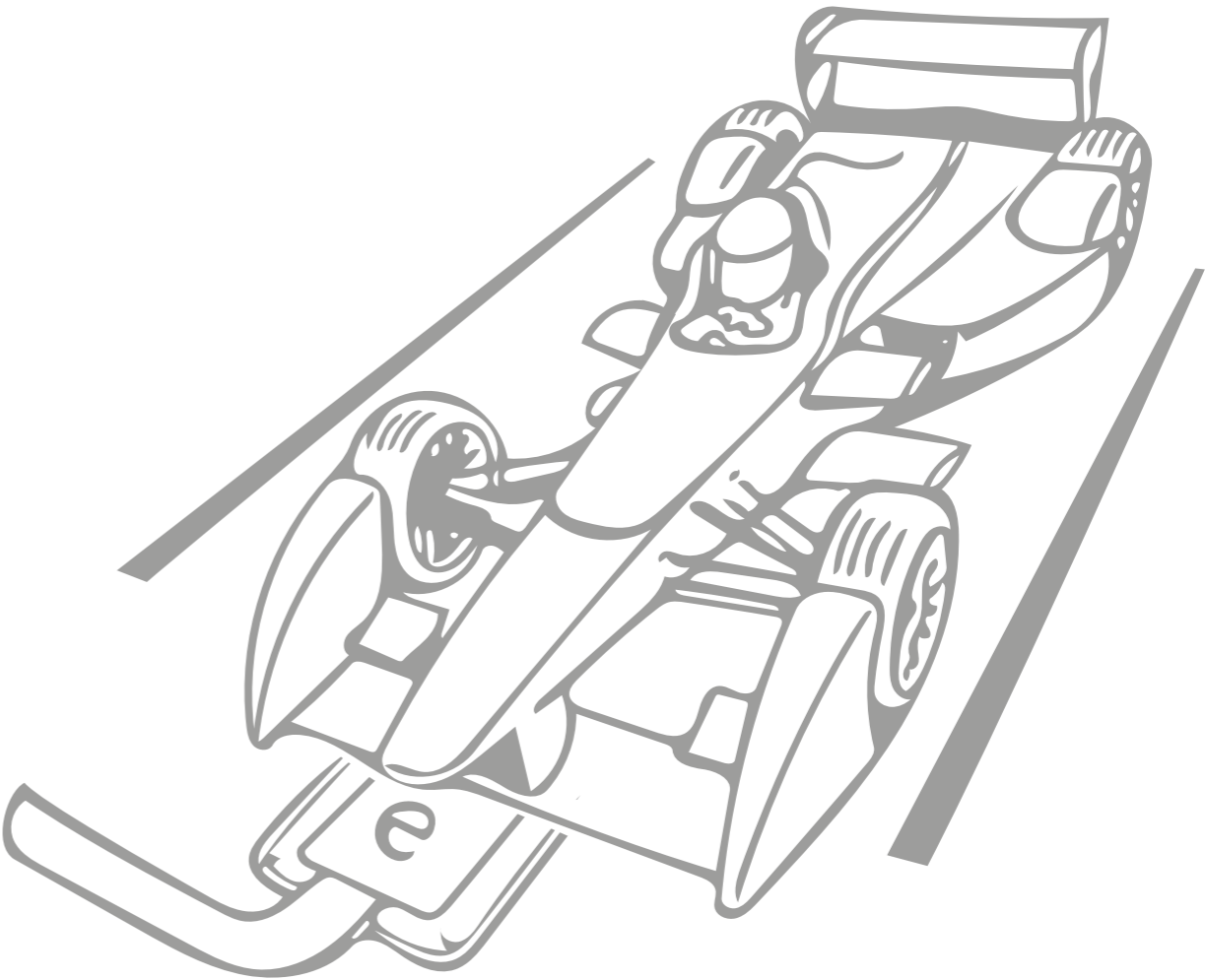


Fluence Z.E. 2011

The Formula E racing car is the result of a collaborative project which reinforces Formula E as a platform for sustainable mobility pioneering. Such a racing car did not exist before, so a combined effort of professional disciplines was necessary to make the best use of the latest technology and to push boundaries further. To meet sustainability goals, compromises had to be made between performance and cost effectiveness. Aerodynamic design facilitates overtaking, and smart dimensions allow a minimum weight of 896kg. Together, they contribute to an impressive performance of 0 to 100 km/h in 3 seconds. The extremely durable tires, able to last throughout each race, also play a

sustainable role. Safety is also essential, as demonstrated by the extinguisher system which can be electronically operated in case of emergency.

For season two, Formula E will become an open championship where teams and manufacturers can develop their own cars. This will begin with the development of new powertrain solutions – incorporating the e-motor, inverter, and transmission – with future regulation changes allowing for battery advancement. In this way Formula E continues to push technological limits into new territories through a competition-driven innovative mindset.



INTERESTING PERSPECTIVE FROM AN OEM - BMW GOING BEYOND THE VEHICLE

Official Vehicle Partner BMW has been involved in Formula E from the beginning, supplying the BMW i8 Qualcomm Safety Car and BMW i3 Medical Car. This commitment has given the company a platform to show millions of people in major cities around the world that electric mobility and driving pleasure can be successfully combined. In the second season of the championship (2015/2016) BMW will supply an extended fleet of support cars:

- The i8 Qualcomm Safety Car (49 g/km combined emissions): Performance oriented modifications have been adapted to meet FIA's technical regulations ahead of the new season.
- The i3 Medical and Race Director's Car (0 g/km combined emissions): The i3 model is BMW's first car solely developed for electric driving.
- The X5 xDrive40e Rescue Car (77 g/km combined emissions): A plug-in hybrid electric car adapted to the technical requirements of the FIA.

BMW Group's commitment to electro mobility goes beyond putting an electric motor into an existing vehicle. "Project i" in 2007, was launched to develop sustainable and future-oriented mobility concepts. BMW has also been working on tailor-made solutions for sustainable, intelligently networked mobility services such as "ChargeNow" (network of charging stations), "DriveNow" (car sharing) and "ParkNow" (smart parking), that can be used independently from the vehicle. BMW Group has been one of the top-rated companies in major sustainability rankings – such as the Dow Jones Sustainability Index – for many years, highlighting that sustainability characterizes the thoughts and actions of the BMW Group and plays a central role in its strategy.



Qualcomm Safety Car supplied by BMW (i8 Model)

TOWARDS ALWAYS READY ELECTRIC VEHICLES

The BMWi cars are equipped with an innovative technology developed by Official Technology Partner Qualcomm.

Qualcomm Halo™ is an exciting new technology that allows EVs and Plug-in Hybrid EVs to charge easily, without the need to plug in. Qualcomm Halo™ Wireless Electric Vehicle Charging (WEVC) is integrated into the Qualcomm Safety Cars, the BMWi8, as well as the BMWi3 Medical Cars. It enables these key support vehicles to be charged wirelessly, and ensures they remain charged at all times, ready to be rapidly deployed in case of an emergency.

Qualcomm Halo™ uses resonant magnetic induction to transfer energy wirelessly from a ground-based pad to a pad integrated into the vehicle. The latest system allows wireless charging of the Qualcomm Safety Cars at an impressive rate: it takes approximately 1 hour to fully charge the BMWi8 using a 7.2kW system.

The technology allows power transfer across large air gaps with a large tolerance to misalignment e.g.

charging plates. The resulting power transfer efficiency is comparable to plug-in charging systems.

This innovative technology broadens electric cars' perspective in an unprecedented way. A major barrier to the expansion of electric powered cars is range, but with such technology, what's to stop cars from being charged while driving? What if the solution to the range problem doesn't lie in the battery technology itself but in an independent technology that could be integrated into the infrastructure, enabling the vehicle to charge while driving? We can also imagine this technology to be applied to the Formula E Championship itself, enabling longer races and no car switching. The Wireless Energy Vehicle Charging's future depends on two important factors: regulation and standardization. Multi-competency collaboration groups will be essential to bring this innovative idea to its full potential.

This example demonstrates why innovation in mobility and sustainability has to be considered along all three dimensions: Technology, Communication and Infrastructure.



Medical and Qualcomm Safety Car Wirelessly Charged with Qualcomm Halo Technology.

ANDRETTI TECHNOLOGIES

The Formula E teams are also looking to innovate for the next seasons of the Erix.

The advanced technology arm of Michael Andretti, Andretti Technologies, sets out to build on the organization's racing heritage and competition to develop dynamic and sustainable clean-energy solutions. With a primary focus on developing a new powertrain for Formula E's third season of competition, Andretti Technologies will play a role in other areas of the Andretti family of race teams, while striving to meet the future transportation needs of an ever evolving world, both within and outside of motorsport.



With an eye to the third season of the Erix, Andretti is developing new technologies with a focus on the eMotor, the inverter, the control systems, as well as on a more advanced transmission system. The partnership with Houston Mechatronics (their powertrain partner) gives them access to technology and processes that come from some of the recent NASA Space Programs. Andretti's relationship with Purdue University in Indiana has provided them with some high level consulting services as well as state-of-the art test facilities.

On the skill management side of things, Andretti Technologies now has an engineer from its TE Connectivity partner working directly with them. The purpose is to help facilitate the direct flow of information between both companies. The idea is also to expose TE directly to the way Andretti works, so they can learn about the challenges of motor racing and how these can positively influence their business. Some new young engineers have also been taken on, with an emphasis on developing their experience and knowledge to provide an on-going career path within motorsport.

HYBRID TECHNOLOGIES DEVELOPED AND TRANSFERRED TO THE WIDER AUTOMOTIVE SECTOR

Some technologies developed in the Formula E context have been leveraged in other environments, starting with Williams' work on electric powertrains.

Williams' hybrid technology was originally developed in 2010 through its F1 KERS (Kinetic Energy Recovery System) program. The Jaguar C-X75 was the first automotive product to which this high performance hybrid powertrain was applied. Williams was the exclusive battery designer, developer, and supplier for FIA Formula E racing series (2014-2015). That accounts for a total of 45 batteries, which were assembled at a rate of 4 per week. The development program started in July 2013 and the first race was in September 2014. They managed by building on the learnings of both F1 KERS and Jaguar C-X75 programs. The final battery is composed of 3459 parts, including of course the lithium pouch cells which are, for safety reasons, individually monitored in terms of temperature and voltage. The battery performs at an average power of 90kW (max 200kW) and withholds a storage capacity of 30kWh.

This technology has echoed beyond the Formula E environment. The specific battery technology is applied to another automotive product which will be disclosed soon. The innovative Battery Management System (BMS), which allows all Cell Monitoring Units (CMUs) to communicate via a Controlled Area Network (CAN), has also filtered down the automotive arena.

Finally, the Formula E Safety cells, which are basically compliant battery boxes that provide efficient high voltage isolation and thermal resistance, have also been applied to the automotive sector.

Ultimately Formula E boosted the innovation process by imposing a short development time frame and fostered innovations that are relevant in the industry in general.



Racing car battery installed in the car.



High performance Formula E racing car battery.



AERODYNAMICS BOOSTING CAR PERFORMANCE

Through its advanced aerodynamics and thermal engineering, a key differentiator in Formula 1, Williams improves cars' performance while minimizing their potential carbon footprint. They have the tools to design optimized car profiles using Computational Fluid Dynamics (CFD), to test them efficiently afterwards with the two wind tunnels in Grove, and to deliver effective solutions. Williams has the skills to support racing teams through dedicated personnel (such as model designers/makers, and wind tunnel technicians), in-house production of the parts for the wind tunnel model, and a fully managed use of the wind tunnel facilities, including data analysis and post processing. Such a support program has been successfully delivered to Caterham F1 in 2012-2013.



Williams' Wind Tunnel.



THE "RACE TO ROAD" PROGRAM, PAVING MAHINDRA'S WAY TO ELECTRIC MOBILITY INNOVATION

The racing teams are developing meaningful technologies that may have a long term support.

Mahindra Racing is a pioneer in Electric Vehicles (EV), producing them since the launch of the first electric car in the UK 19 years ago. The REVA is the company's current flagship. In 2015, they will launch their latest EV, the Mahindra e2o. With gear-less, noise-less, emission-less technology, the e2o aims to lead the global charge to unearth an affordable and green car. Mahindra saw Formula E as a "marriage made in heaven" project, given its vision to grow through sustainable solutions and further expand on-the-ground research and development of EV technologies.

Mahindra's motto "We build products, services and possibilities," emphasizes development towards sustainable, accessible EVs in a growing market, and is aligned with the "Race to Road" program. Mahindra believes in the value of this program to develop technologies on the racetrack which will have a direct function in road cars, for which Formula E offers a great opportunity. With only simple software adjustments, the Formula E powertrain was completely

road ready. The season two electric powertrain in the Mahindra M2Electro racing car will power Mahindra road cars in just 24 months, a fraction of the time it can take for complicated F1 technology to trickle down to road cars.

Mahindra has the means to achieve its ambitions with a presence in over 100 countries including all the world's major cities. The company is building a network of global R&D facilities to put the power of mobility into the hands of more and more people. Engineers in India, the US, South Korea, and Italy all work towards the same vision of the 5Cs of the future of mobility – Clean, Connected, Clever, Convenient, and Cost-effective mobility solutions.

The EV segment is a fast paced, competitive field in which great effort is needed to anticipate trends and emerging technologies. Electric mobility has brought a democracy in mobility: market entry barriers are not too high, given that in these days technology can come from anywhere and obsolescence is just around the corner. Keeping up the pace of technology is also increasingly expensive.



Mahindra's Formula E racing car.



Mahindra's latest Electric Vehicle – e2o.

LEVER 2 - INFRASTRUCTURE AND BUSINESS MODELS

New technologies can succeed only if they are accompanied with the right infrastructure. Cars would not have become the dominant mode of transportation without a developed network of roads, petrol stations, and competitive markets for new and used cars. For electric cars, even the most advanced technology today cannot overcome the limits of battery capacity. Without charging network, adoption is likely to remain low.

Another aspect is the regulatory and legislative framework. In May 2015, the European Commission launched the European Smart specialization platform to promote the efficient use of public investment in promoting sustainable energy. In that context the EU plans to invest about 38 billion EUR between 2014 and 2020, including 2 billion EUR for investments in smart grids. It is important to understand that strong political initiatives can significantly change the infrastructure and business models.

This shows how thinking about infrastructure and business models is fully part of Formula E activities and how Formula E may contribute to boosting related developments.

Firstly, the Formula E Legacy Program makes sure the championship is having a lasting impact on each of the hosting cities both physically and socially. Michelin supports this program with its commitment to raise awareness around road safety. The Life Cycle Thinking program shows how the Formula E championship extends beyond technology innovation. The objective of the program is to minimize the event's footprint across all activities. In line with this objective, British company Aquafuel Research shows how generators fueled with glycerin ensure cars are charged with clean energy. Michelin and BMW also follow that path with a sustainable approach from the production to the end of life management of their products.

Smart investments through DHL's carbon offsetting program and Julius Baer's "Next Generation Approach" can provide game-changing funding opportunities that could be beneficial to development of infrastructure.

The logistics of the Formula E championship is optimized in terms of carbon footprint, and we will give insights into its sustainable operations.

19TH CENTURY



20TH CENTURY



21ST CENTURY



"LEAVE IT LIKE YOU FOUND IT" IS OBSOLETE

In the context of Formula E's Legacy program, the idea is to leave each race venue better than it was before. This is achieved through programs such as investing in the infrastructure where the race took place or installing a social legacy to educate people on sustainability.

A good example is the improvements made to Battersea Park in London where the last race of the first season was held. After the event, Formula E launched a resurfacing operation which encompassed a total area of 10,000 sqm. The Rosery car park was resurfaced in order to create a quieter atmosphere while enhancing parking space and potentially increasing revenue stream. Formerly gravelled areas were replaced by a smooth asphalt surface for travelling exhibitions and shows at the park. Improvements were also made to the park's main event area, the British Genius Site, where the access route was widened and enhanced. Furthermore, the construction work revealed a significant leak in the park's water systems. Formula E repaired and restored this vital element of infrastructure.

The Formula E School Series, which was provided by the UK-based charity Greenpower, held a competition which endeavoured towards the installation of Formula E's social legacy, educating on sustainability and giving back to the community. Throughout the first season, during the following races, 2015 Buenos Aires ePrix, 2015 Miami ePrix, 2015 Long Beach ePrix, 2015 DHL Berlin ePrix, and 2015 Visa London ePrix, ten teams made up of children from local schools, aged 11-16 years were provided with a kit to build their own fully electric mini-car. The teams competed against one another using the full size Formula E race track, also serving as an opening of the actual races. To secure

pole position, the young drivers had to consider sustainable elements, taking into account not only their speed but also their energy efficiency as they raced around the circuit tracked by a special data logger fitted onto the cars. In this way, the Formula E School Series encouraged and promoted sustainable engineering and technology among the younger generations.



Formula E School Series, Long Beach.



2014 Formula E Car in Battersea Park, London.

ROAD SAFETY: A 100,000 USD GRANT TO INCREASE TEEN TIRE SAFETY AWARENESS

Official Partner and Tires Supplier Michelin has partnered with FIA as part of a shared commitment to innovation and road safety.

The grant program is a new initiative to improve the safety of teen drivers by teaching proper tire maintenance. In addition to continue pursuing the goals of Michelin’s Beyond the Driving Test campaign, the first year of the program celebrated the North American debut of the FIA-sanctioned Formula E Championship in Miami and Long Beach, California, by helping to create a lasting legacy in those communities. Michelin and FIA announced at the 2015 FIA Formula E Miami ePrix that ADTSEA (the American Driver and Traffic Safety Education Association) was the winner of a 100,000 USD Michelin/FIA Teen Road Safety Grant.

Automobile accidents are the leading cause of death of teens in America, with more than 5,000 deaths each year. Of the 2.2 million vehicle accidents taking place annually, 12% happened to inexperienced drivers and involved tire-related issues such as insufficient tire tread or improperly inflated tires. In addition to this grant, Michelin and FIA are making resources available at www.beyondthedrivingtest.com to help teens and parents brush up on their car and tire maintenance skills.

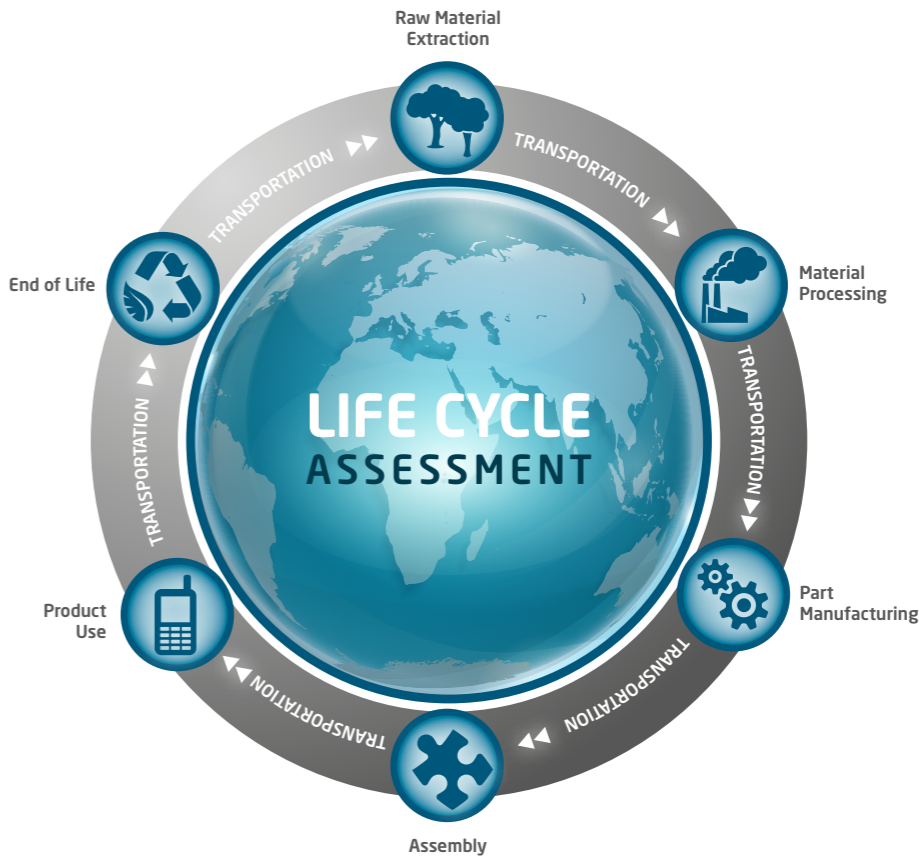
ADTSEA is the professional association representing traffic safety educators throughout the US and abroad. It was chosen to receive the entire 100,000 USD in grant funding for its proposal to develop a tire safety and maintenance training module. ADTSEA will deliver the instruction as part of a one-day workshop for 200 driver education instructors in Miami and Long Beach.



The one-day sessions focus on how to teach tire safety and maintenance and how to incorporate this training module into the ADTSEA 3.0 Driver Education Curriculum. Participants receive a free copy of the curriculum, including lesson plans, learning activities, visuals, and videos. All materials are customized with Michelin tire safety materials. As part of the session, hands-on activities “teach the teachers” how to check tire pressure, tread depth, and tire condition. Teachers are encouraged to take this information back to their own communities and conduct workshops for other teachers. The tire safety and maintenance module is available on the ADTSEA website for free download.

FORMULA E LIFE CYCLE THINKING AS A DRIVER FOR SUSTAINABILITY PRACTICES

Formula E goes beyond promoting electrification. It supports a Life Cycle Assessment to achieve its vision to be as sustainable as possible. The objective is to minimize the event’s footprint, not only in terms of carbon but also considering water, ecosystems quality, natural resources, and human health across all of Formula E’s activities. A leader in Life Cycle Thinking, Swiss-based consulting group Quantis is supporting Formula E to ensure reliable measures are taken. Life Cycle Assessment requires the development and implementation of solid methodologies and processes. The initiative is supported by a scientific team which collect data concerning the event’s management, logistics, car development, and organization activities which they further use to measure the environmental impacts. One of the benefits of the Life Cycle Assessment is that negative impacts are minimized and steps are taken to avoid the transfer of these impacts from one life cycle stage to another.



The 6 key steps of a product’s Life Cycle.

AN ALTERNATIVE FUEL FOR CLEAN ELECTRICITY - THE POWER OF GLYCERIN

One of the main objections to electric vehicles is that the pollution caused by the production of electricity negates its environmental credentials. This argument is valid, particularly in countries where the national grid is supplied by coal-fired power stations. It is therefore essential to find a solution for charging Formula E racing cars with clean electricity produced by low-emission sources.

British company Aquafuel Research Ltd has been commissioned to build clean mobile generators which can be packed inside a shipping container and freighted to each race. Aquafuel patented its own renewable energy generators which run on glycerine. This fuel is clean in terms of emissions as it has no carbon and low particulate and nitrous oxide emissions. The fuel is also clean in terms of physical properties because of its lubricity and its soot/particulates-free output. The fuel has a positive effect on the injection system parts and the exhaust of the car. It is expected that in the next three to five years the production of glycerine from salt water algae will be commercially demonstrated, thus creating a fully sustainable production process.

Alongside GreenEnergy, the generators have been based on and adapted from standard production diesel engines. Surprisingly enough, the engines worked better on glycerine than they did on diesel. The distribution systems have been designed to provide electric power in a very controlled manner to ensure the cars can be charged safely and reliably in just one hour. The Aquafuel generators used by Formula E provide 42kW of electricity per car. This means that

if all 20 cars are plugged in at once, the power generated is equivalent to the amount of electricity 2000 UK homes would consume. In addition, the pollution reduction in comparison to a standard production diesel engine is impressive: in just an hour, nearly half a tonne of carbon emissions and half a kilogramme of poisonous nitrous oxide emissions are avoided.



Aquafuel Generator.

This amazing achievement raises one major question: what's next? The Formula E collaborative platform strives to be a launch pad for game changing developments which have the potential to grow on a greater scale. The next step for Aquafuel is to find meaningful commercial applications for its findings. We could imagine using the Aquafuel generator as fast charging points for EVs in cities or as power generators for facilities including supermarkets or universities, or anything which requires a micro grid.

TIRE RECYCLING PROGRAM - SUSTAINABILITY FROM CRADLE TO GRAVE

Official Partner and Tires Supplier Michelin adopts a sustainable approach at every phase of a tire's lifecycle. When tires reach their end-of-life, they are picked up by professional services and collected by specialized companies. Nearly 100% of the tires collected are now recycled. Michelin's efforts don't stop here: most of the materials used in tire manufacture are also recyclable themselves. The most common uses include anti-noise barriers and in some countries sport pitches. Used tires can also be valorized as an energy source in granule form, another eco-saving as they then replace fuel, oil, wood, and coal.



INCORPORATING LIFE CYCLE THINKING INTO THE BMWi BRAND

With its new BMWi sub-brand, Official Vehicle Partner BMW firmly entrenches the holistic approach on the implementation of sustainability throughout the complete value chain. The company designed a serial production car sustainable from development to manufacture – 95% of the materials used to produce a BMW i3 can be recycled. The all-electric BMW i3 is emission-free and uses energy from renewable sources in the production process while the interior features components made from fast-growing or recycled materials. Another milestone is the innovative LifeDrive car architecture, with its carbon passenger cell and aluminum drive module: BMW is a pioneer in the processing of carbon fibers and their recycling. To the BMW Group, remnants from carbon production and the production of carbon components are valuable materials that are either channeled back into the production process or reused in other areas.

On a plant level, when it comes to protecting the environment and conserving natural resources, BMW has ambitious targets. At its Leipzig location, the company managed to reduce the energy consumption for the production of BMWi vehicles by 50% and water consumption by 70% per vehicle. It supplies 100% of the energy used for assembly of BMWi cars from renewable energy sources. By including sustainability considerations in all its business decisions and making it a top priority, BMW creates added value for the company and its employees. Through its commitment to international conventions such as the Ten Principles of the UN Global Compact, BMW demonstrates that economic viability and environmental compatibility have already become company value drivers.

JULIUS BAER'S COMMITMENT TO THE FUTURE WITH THE "NEXT GENERATION APPROACH"

Visionary Thinking enables Official Global Partner Julius Baer to ask the big questions relevant for today's and tomorrow's investors. One way they do this is through their Next Generation investment philosophy, which focuses on structural changes and fundamental imbalances within the economy and society at large. The objective is to seek out sustainable growth opportunities by identifying competitively advantaged companies within structurally growing markets.

At its core, Next Generation is a holistic approach to thematic investing which places emphasis on a comprehensive risk assessment by incorporating a company's forward-looking strategy, innovation capability, and exposure to social and environmental issues. It provides products, services, publications and information channels which place Julius Baer's clients at the leading edge of investment culture. Julius Baer provides access to investment opportunities that tackle today's social and environmental challenges, as well as the driving trends that are shaping the world.

Next Generation looks at the world from a people, planet, and growth perspective, tracking the consumer to detect new markets and mapping its research and investment ideas into seven key themes:

- Digital Disruption: the phenomenon of digitization, and how it is affecting every corner of our lives.
- Growing Urban: the global megatrend of urbanization, by 2050, over 2/3 of the world's population will live in cities.
- Arising Asia: the emerging structural trends, including growing economies in emerging markets and changing consumer demands.
- Shifting Lifestyles: considering the impacts that the world's increasing ageing population will have.
- Frontier Markets: non-mainstream markets and economies that start from a low base and have not yet been discovered by the broad investment community.
- Feeding the World: sustainable production for the additional 2.4 billion people the world will have by 2050.
- Energy Transition: the shift from fossil fuels to new sources of energy.

In the context of Formula E, which is about changing society's perception of electric cars and promoting new technologies for cleaner mobility, Julius Baer's Research Department has worked on a study focused on energy transition and the future of the car industry.

To a certain extent, sustainable mobility depends on the evolution of infrastructure, for which investments play an important role. From charging stations to "Intelligent Transportation Systems" (ITS) implementation, urban mobility and services is an area that concentrates sustainable growth investments. According to Navigant research, the market for smart urban mobility and services is expected to exceed 25 billion USD by 2024.²⁹



Julius Baer's Headquarter in Zürich.

OFFSETTING THE IMPACT ON CLIMATE CHANGE

On top of optimized logistics services, Official Logistics Partner DHL offers climate neutral services. Customers have the option to offset greenhouse gas emissions generated by transportation and logistics through investments in internationally recognized climate protection projects. To offset these emissions, DHL has initiated a project to provide efficient cooking stoves to the people in Lesotho; the company also purchases carbon credits from climate protection projects around the world. Thus, customers help to finance carbon reductions around the world through a voluntary emissions trading scheme. The projects are approved based on the UN's Clean Development Mechanism, allowing 100% offset of logistics-related emissions. A third party validates the emissions calculation and offsetting on an annual basis. DHL's offset includes carbon emissions, logistics' major environmental impact, but they also offset other relevant greenhouse gases like methane and nitrous oxide.

DHL is proud to be a part of this "More for the people – More for the climate" project. The environmentally friendly Save80 stoves, which DHL has introduced to the people of Lesotho, reduce carbon emissions from cooking and require up to 80% less firewood. Those reductions also allow them to offset emissions for their customers as part of our carbon neutral GOGREEN shipping service.



Efficient cooking stoves - Lesotho Project.



EFFICIENT SUSTAINABLE LOGISTICS MODEL FOR A HIGH SPEED QUALITY EVENT

DHL has successfully risen to the challenge of handling the logistics of the Formula E championship in a fast, efficient, and environmentally caring manner, minimizing the carbon footprint of the event's logistics. All along the 11 races across 10 countries, DHL has transported racing cars, medical and rescue cars, spare parts, and equipment.

DHL has been involved with Formula E since its early stages and contributed to the setup of the race calendar. The calendar is designed in a smart way, avoiding backs and forths, and minimizing transportation. Moving goods adding up to 450 tons from one continent to the next, including dangerous goods like the high performing batteries which weigh about 300kg, has its challenges. 41 of the batteries have been transported directly in the cars and specific, UN regulations compliant, aluminium battery cases were used to transport the additional ones. Airfreight usage is a necessity, but intelligent dismantling of the

car allows multiple vehicles to fit into one container, thus optimizing the load factor of the boxes and significantly reducing the carbon impact. The boxes are also specifically designed to optimize the load factor of any method of transport.

Airfreight is replaced by ocean freight, train or trucking when feasible and electric forklift handling is used as a standard procedure. In the next season, DHL's Rail Solution, connecting Europe and China, will be leveraged to transport all the required material to Beijing for the first race. DHL's role in Formula E logistics shows that anything, as complex as it might seem, can be done sustainably. An innovative event like Formula E and its sustainable approach requires innovating on the logistics side too. In that sense, Formula E is a driving force for DHL.



Loading of a Formula E racing car into a DHL truck.

A SUSTAINABLE APPROACH DRIVING DHL'S OPERATIONS

Air Fleet

Formula E is in line with DHL's vision and objectives; to improve its carbon efficiency by 30% compared to a 2007 baseline. DHL Express has been very active in that field especially when it comes to its air fleet for a very simple reason: 92% of DHL Express' CO₂ is created by the DHL Express air fleet.

In Europe, DHL has upgraded 18 Airbus A300-B4-200 to Airbus A300-600 which carry higher payloads, fly 900 kilometers further, consume up to 20% less fuel, and generate less noise than their predecessors.

Fuel combustion doesn't only generate Greenhouse Gas Emissions but also other local air pollutants such as mono-nitrogen oxides (NO_x) and sulfur dioxide (SO₂). Replacing older models with new, more efficient ones is one way DHL uses to successfully tackle this challenge. Emissions of local air pollutants have decreased significantly from 2013 to 2014 (3% reduction for NO_x emissions) while aircraft

utilization has increased. But upgrading older models with new, greener ones isn't the only way to reduce emissions. Another simple but clever initiative is the addition of winglets on Boeing 767s which save 4% fuel. This adds up to 6 million liters each year for transatlantic routes. The focus is also on using more alternative aviation fuels. To advance research in this area, DHL has helped found the research and science platform Aviation Initiative for Renewable Energy in Germany E.V. which has an interim goal of achieving a 10% admixture of alternative aviation fuels in Germany by 2025.



Modified Winglets of a Boeing 767.



Real Estate

Real estate is also an area in which DHL is on track to achieve its global CO₂ efficiency target. Using clean facilities for delivering the world’s first fully electric racing car makes sense! The technology revolution also broadens possibilities when it comes to reducing energy consumption and CO₂ emissions of facilities. Smart and reasonable investments can make a difference here. There are three opportunities to implement energy efficient solutions within real estate:

- **New property** – provides an opportunity when a building enters the DHL portfolio for the first time, be it an existing building they take over or a new build.
- **Lease renewal** – the opportunity to encourage a landlord to improve his building.
- **Existing property** – the opportunity to upgrade current energy consuming equipment.

The key factor for DHL is to implement commercially viable energy efficient solutions that burn less and burn clean. New builds offer the best opportunity to install the maximum number of features by incorporating them from the design phase.

Beyond being a driver towards hitting the reduction targets, combining carefully selected solutions with innovative purchasing can have a positive and significant financial impact, especially when considering the complete cost of ownership. However, there is a balance between a commercially

viable energy efficient building and a capital intensive state-of-the-art one. Detailed analysis and knowledge of application to an industrial operation is key and ensures smart investment and smart savings.

The 23 million EUR investment in a large hub extension at DHL East Midlands Airport, which will improve delivery service in the UK, illustrates well how sustainable thinking early in the design process of a new build can make a difference. The planned extension will cover around 20,000 m² and will include energy efficient features such as LED lighting, a solar



DHL East Midlands Airport extension.

Compliance

Investing in compliance is a sustainable move for the future. DHL’s aim is to support sustainable innovation through initiatives such as Formula E and influence the debate on sustainability with key decision makers. To have any influence, the company must maintain a strong reputation for compliance and be seen as a responsible member of the industry in which it operates.

DHL offers compulsory training to all employees, helping help them understand what compliance means, why it is important, and their role in contributing to a compliant culture.

Sustainability within the logistics supply chain is pivotal in the company’s ambition of supporting a healthy population, economic growth, and improving the environment. Without compliance it is hard to maintain a robust supply chain and even harder to deliver the right service level.

Customers expect that once DHL takes receipt of their shipment, their goods will arrive safely and on time. Customers entrust their reputation to DHL, which therefore needs to deliver on its promises in order for customers to deliver on theirs. As one of the companies key customers said,

hot water system, a solar PV array, enhanced glazing, energy efficient heating, ventilation, and air-conditioning. In this case LED lighting, implemented both internally and externally, is forecast to generate impressive energy savings, ranging between 120,000 EUR and 150,000 EUR annually. The solar photovoltaic system will enable on site power generation and save around 25,000 GBP annually. This system will be funded by a third party with DHL Express purchasing the generated renewable electricity at a below market rate. Every little bit counts and the additional investment in efficient technology, around 700,000 EUR, should be amortized in less than 6 years.

Energy efficiency improvements in existing properties often need a different approach. Any changes must interface with the existing infrastructure and the installation must not impact the live operation. To address heating consumption within existing delivery centers in Germany, a retrofit of Combined Heat and Power (CHP) systems has been installed. A CHP unit is a small scale on-site power station that uses gas to generate electricity within the site. It is an energy efficient solution, as waste heat is captured and utilized to provide hot water, which is then used to heat the operational space. These projects will see 25% of a site’s electricity generated by the CHP unit; by capturing and using the waste heat, it will also supply around 50% of the site’s hot water requirements needed for heating. The project to install the CHP units uses an innovative lease model, which requires zero capital expenditure. By applying this model, estimated savings of 50,000 EUR per year per site are expected to be achieved.



DHL new hub in Brussels.

“If a company says it is compliant, it must demonstrate it”.

For DHL, compliance is a key differentiator, in terms of service to its customers, but it also has a responsibility as the world’s most international company.

LEVER 3
- CHANGE MANAGEMENT
& COMMUNICATION

With different actors in the ecosystem, effective communication is vital for achieving common understanding and overcoming resistance to change. Transitioning to more sustainable mobility requires a change of habits and mindset. The question is how to ensure that the right message is received and appropriate actions taken.

“When concentrating, an adult remembers 10% of what he reads, 20% of what he hears, 30% of what he sees, and 80% of what he says.”
J. Dewey

The implication is that to achieve successful communication we should use different communication channels in a manner that takes into account how people retain information.

Case studies in communication portray efforts in delivering sustainability messages to a broader audience. These are envisioned from two different angles: sector perspective and citizens’ perspective.

An example of a successful global communication initiative is the DHL Express Certified International Specialist (CIS) program. Designed as a training program, CIS successfully transmits core values, knowledge and skills to employees in over 220 countries.

The Formula E conference in London, organized for the last race of the first season, served as a platform for connecting people on sustainability topics. Similarly, the Blue Sky Transportation Design Award by DHL aims to engage the public, and attract great ideas on how transport can become more sustainable. In each race, the Formula E championship hosts an eVillage that engages people with sustainability topics.

To really involve people watching the race, Formula E introduced the concept of Fan Boost that gives drivers who received most votes an extra speed boost during the race. Another initiative involves monitoring each driver’s health status. Each driver wears a specially designed shirt that is connected to an electronic

measurement device, and the data is shared with the spectators.

The last case study reviews the potential value of the Formula E championship. A report by Ernst & Young evaluates the ability of Formula E to drive technological innovation, social awareness, and infrastructure investment for sustainable mobility by contributing to the expansion of the market for electric vehicles.

MORSE TELEGRAPH
(1837)



FIRST RADIOS ON
MASS MARKET (1940s)



FIRST TVS ON THE
MASS MARKET (1960s)



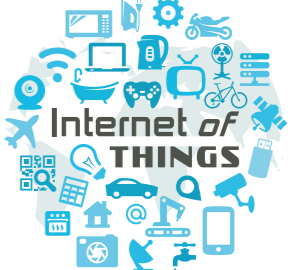
FIRST TELEPHONES ON
MASS MARKET (1970S)



INTERNET
DEVELOPMENTS (1990s)



INTERNET OF THINGS
(2000s)



Development of Communication Network

A SECTOR PERSPECTIVE

CERTIFIED INTERNATIONAL SPECIALIST PROGRAM ENABLES INNOVATION DEPLOYMENT AT A GLOBAL SCALE



The Certified International Specialist (CIS) program is an employee engagement and cultural change program launched by DHL Express in 2010, building on an existing initiative developed in the US. The US CEO at the time, current Global CEO Ken Allen, believed DHL Express and its workforce needed to refocus on the company's core competency of international delivery. Among other things, that meant going back to where it all started in 1969, when Dalsey, Hillblom and Lynn realized that customs clearance could be arranged before the ship's arrival in the port by sending the documents ahead by plane, thus accelerating the delivery of goods. Ken felt that it was important to return to the essence of what made "The Express Business" successful, and create a sense of belonging for his people.



The CIS Foundation course helped employees understand their role in the company's global network and how they contribute to the business' success. The program was rolled out globally, providing experiential learning activities for all 100,000 employees in 42 different languages. The company has since sought to capitalize on the success of the Foundation course with the addition of country-specific and cross-functional modules to the CIS portfolio. A leadership module for its management population, "Certified International Manager", is also included in the program. Globally, the initiative has been deployed and facilitated by DHL employees which is quite an achievement given, that people in 220 countries benefited from the Foundation course in the first year. Partnering with external providers such as NKD Learning, TAG Worldwide, and Maverick Advertising, has ensured consistency, quality, and the continued development of the program.

Deutsche Post DHL is bottom line 'Employer of Choice' and DHL Express' 'Motivated People' pillar are measured through an annual Employee Opinion Survey.

Since CIS has been introduced, Employee Engagement, Active Leadership, Strategy, and Learning & Development have seen increases to over 80%. In 2014, DHL Express delivered global EBIT of 1.26 billion EUR. The FOCUS strategy, of which CIS is a key pillar, has been a key driver in delivering this result (in 2008, the division recorded a net loss of 2.2 billion EUR). While it is not possible to directly attribute income statement and balance sheet metrics to the CIS program or to

calculate a ROI, the company's global management board attributes increased productivity and engagement as key benefits from CIS.

One of the major keys to the success is the development of the program "by the network, for the network". The program is delivered by DHL employees and now the company has 1,200 employees capable of delivering CIS courses, and this number continues to grow. Keeping many aspects of the program in house boosted people's commitment to the project. Facilitators with infield experience, from the warehouse to the global management board, add greatly to the knowledge transfer and overall employee engagement.

CIS is the main knowledge transfer, engagement, leadership development, and strategic differentiator for DHL Express. It is a lever for innovation both within and outside the company. DHL Express believe well trained, engaged employees have more innovative potential.

In April 2014 Deutsche Post DHL Group introduced its new Strategy 2020: Focus.Connect.Grow. Each of the pillars provides clear objectives for the coming years with ambitious yet achievable goals.

The Connect pillar deals with the company's potential stemming from the internal exchange of know-how, expertise, and talent. This pillar will see the introduction of the company-wide Certified program which is based on the success of CIS within DHL Express.



THE SUSTAINABLE LOGISTICS CONFERENCE IN LONDON

At the final race of the Formula E Championship 2015 Visa London ePrix, Official Logistics Partner DHL held a cross-sector sustainable logistics conference to discuss the shared vision of sustainable innovation in logistics and how it can impact the future of mobility.

"Delivering Sustainable Innovation. Fast."



Formula E partners Michelin and Williams, as well as external companies Total and Ernst & Young, shared with the audience how sustainability challenges were embedded in their day-to-day life. Including an international oil and gas company like Total in such a conference surprised some people, but sent a strong message: companies all around the globe and from different sectors focus on sustainability. Total is investing much in solar energy and has a strong sustainability program in action.



The diversity of the topics presented shows the breadth of the sustainability topic and proves that everyone can play a role. From the operator to the top senior management of companies, everyone needs to be engaged. The conference conveys a strong message on sustainable business: it isn't only about being environment friendly, it is about having the right mindset to foster continuous long term growth that doesn't put the environment in jeopardy. It is about building solid developments that will last in the long run. The event is perfectly in line with Formula E's vision – to be a platform for connecting people and foster interest and engagement in sustainable innovations.



A CITIZEN'S PERSPECTIVE

SPARKING INNOVATION THROUGH THE YOUNGER GENERATIONS

In September 2014, DHL launched the Blue Sky Transportation Design Award. Based on the vision of the FIA Formula E Championship – to shape a more sustainable future through transport electrification – the award aimed to address the challenges of urbanization and environmental sustainability. It called on professional or aspiring designers to create an electric transportation device or vehicle for private, public or commercial use. The objectives were to engage the public, promote Formula E's electric agenda, and of course attract great ideas on how transport can develop and become more sustainable in the future.



Philippe Hohlfeld (left), Olivier Lehtonen (right)
and their design: The Water Strider

The response exceeded expectations, with over 50 quality submissions across all five continents. The first screening of the jury, chaired by the world-class designer Paul Priestman, shortlisted six finalists based on criteria such as originality, functionality, aesthetics, commercial feasibility, and the potential to solve the problem intended to address. The finalists then presented their ideas directly to the jury in Berlin. Ideas ranged from self-driving vehicles for passenger or cargo transport and hybrid airships to railway systems integrated with the city's trees.

The winning idea was an autonomous hydrofoil electric boat capable of carrying a van's cargo via existing water systems, designed by two graduating students of the Transport Design of the London College of Art. The prototype was displayed at the DHL Innovation Center in Troisdorf. They managed to create a concept that resolves multiple challenges at once: autonomous delivery, road decongestion, and the use of existing infrastructure. The majority of the world's major cities can be accessed through waterways, this concept could therefore be a game changer in urban last mile logistics. This event also features the increasing importance design will have in the future as it tackles a double sided challenge: tailoring activities to the environment we live in and using the space and resources as efficiently as possible.

DHL BLUE SKY TRANSPORT DESIGN AWARD - FINALISTS

CARGO-PASSENGER AIRSHIP

This hybrid airship features aero-static unloading and is partially powered by the solar panels running along the body. It is ecologically compatible and can deliver both cargo and passengers.



NATURE EXPRESS

Single seated “pods” are lifted up from ground level using cables supported by artificial trees to transport commuters and goods.



LIGHT COMMERCIAL VEHICLE

An eco-friendly and easy-to-use two-seater car designed for small, inner city deliveries. It makes parking easier and reduces running costs.



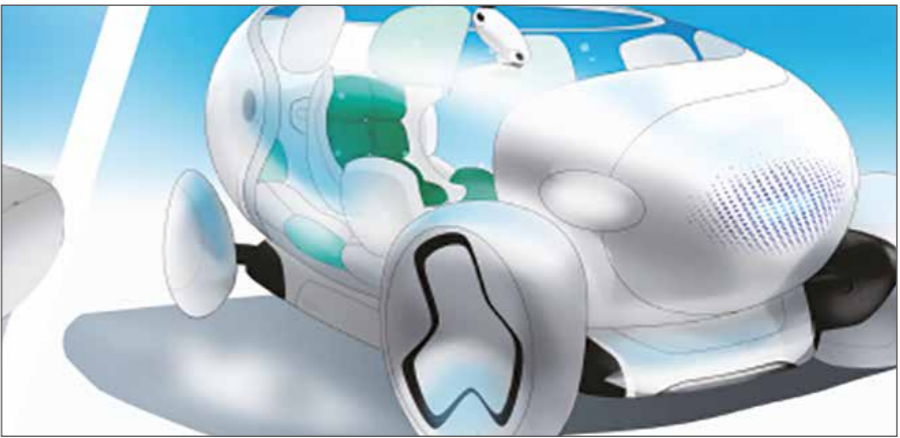
LONDON’S URBAN VEHICLE 2065

Based on the concept of self-driving car technology, this system uses modular components that are stored, maintained and configured in automated service structures across London.



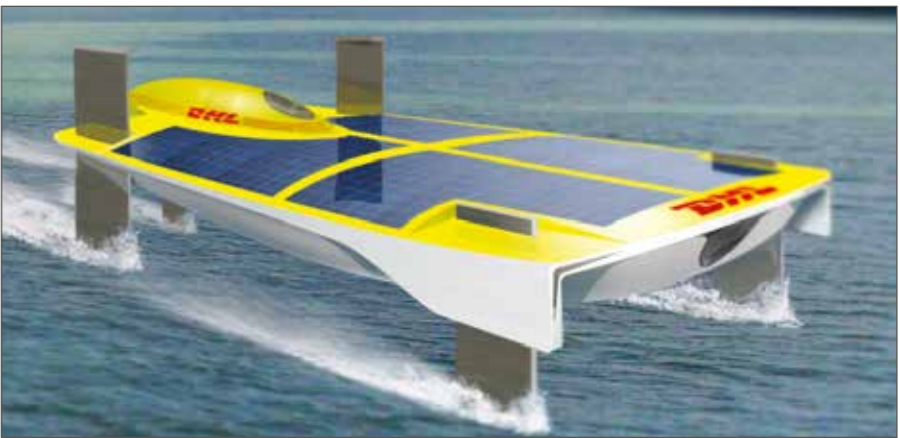
HAPPIE THE SELF-DRIVING CAR

Powered by autonomous driving technology, square element “cushions” are spread on the interior surface of the vehicle to create a dynamic interior appearance.



WATER STRIDER

A self-steering electric boat to enable fast, quiet and clean delivery along rivers and coastal towns. Its spacious cargo bay can store at least as many packages as a standard delivery van.



THE FAN BOOST: HELPING DRIVERS CONNECT WITH THE PUBLIC

The Fan Boost fosters interaction between the public and the drivers. The idea is that fans can give their favourite driver an extra speed boost by voting for them prior to the race. The three drivers with the most votes will each receive one five-second “power boost”, which will temporarily increase their car’s power from 150kW to 180kW. This boost could be the exact speed required for overtaking, adding an element of surprise and excitement to the race. Nelson Piquet Jr, the winner of last season, benefited from numerous Fan Boosts. This pioneering initiative adds a new dimension in an area where fans usually have very little influence on the outcome. This demonstrates that Formula E isn’t only about putting electric powertrains in race cars, but believes in creating innovative ideas which cross all dimensions of the event, including the concept of the race itself.



FROM MONITORING CAR PERFORMANCES TO... THE DRIVER’S

Throughout the first season, drivers tested a special vest, measuring (through a connected electronic device) the pilot’s:

- Pulse
- Breathing rate
- Temperature

The device designed by Hedalgo recorded data over the course of the race to be analysed and used afterwards for performance management purposes.

Formula E season 2 will go a step further with live monitoring. Bluetooth technology will be integrated to the device, allowing wireless data communication and thus real time monitoring of each driver’s vital signs. The driver and the medical teams will have access to the data which gives them the ability to help and manage the driver’s stress levels. The data can also be used to communicate with the audience. Even if it is not yet exactly defined what real-time information will be shared, we can imagine post-race communication around charts for example, highlighting certain moments of high suspense in the race.



THE eVILLAGE: A PRIVILEGED COMMUNICATION PLATFORM

The eVillage is an important part of the Formula E experience. This on-site area features activities and entertainment which showcase and promote the championship’s key messages such as innovation, technology, sustainability, and wellbeing. The eVillage is a privileged area for B2C communication and awareness campaigns on relevant topics such as driver safety and environmental developments. The eVillage gave partners of the event the opportunity to combine their product with promotion, conveying key messages as well as entertainment. The photographs below show how some partners made use of the eVillage experience:

DHL Stand: Entertaining race on electric powered bikes promoting more sustainable deliveries.



Renault Stand: Promoting its electric cars and their sustainable features.



Michelin Stand: 3D mapping showcasing different types of tires in content (Morphing technology). Under the “From track to street” tag, Michelin shows how Formula E is used as a lab to develop technologies that will be transferred to everyday vehicles.



BMW Stand: Showcasing vehicles from the BMWi brand. People can connect to the cars via WiFi to get more information as well as sit in them.



VIRTUAL REALITY EXPERIENCE AROUND eSTORY

“People do not retain information in the same way (through reading, hearing or seeing).”

To reach the broadest possible audience and spread the sustainability message, using different communication tools and channels is needed. This is why eStory will also be told through an animation film and, embracing an innovative mindset, it will be compatible with Virtual Reality (VR). In addition it will be broadcasted to a wider audience through social networks, multimedia sharing platforms, and the Formula E eVillage. Video trailers will also be launched along the way, creating interest and excitement about eStory and Formula E.

One of the pioneers in the growing field of innovative storytelling, and a trusted partner of DHL, has been chosen to create this innovative video and VR experience. Big Bad Wolf is a new kind of agency, structured to embrace evolutions in communication channels and to engage audiences in rising innovative digital ecosystems.

The agency, focusing on transformative digital innovations, bets on the market analysts' predictions that (VR) and Augmented Reality (AR) will all together become a 150 billion USD market by 2020³⁰, calling for a huge amount of innovative content. Big Bad Wolf is leveraging on VR to create engaging customer experiences and business solutions.

The VR movie is a thrilling immersive experience that will bring the audience right into the heart of Formula E. Everyone is invited to experience this fascinating story from the inside!



BIBENDUM CHALLENGE

Creating relevant working ecosystems to tackle current challenges is increasingly seen as the right way to do it. The Bibendum Challenge, focusing on sustainable mobility, reflects that trend.

Since 1998, the Bibendum Challenge has been bringing together political, industry, scientific, and media representatives to discuss the challenges of, and solutions for, sustainable mobility.



“There is a gap between what exists today, the challenges we face in terms of energy, the environment, safety, and widespread access to effective mobility, and the slowness of the decision-making processes around the world,”

Patrick Oliva, Chairman of the Bibendum Challenge.

In that context, experts, scientists, industrialists, as well as representatives from a number of international organizations (European Union, ITF/OECD, WHO, IEA, UNEP, WBCSD, World Economic Forum, GRSP), have been supporting and participating in the Bibendum Challenge for several years. They are the key players of this event.

Through expert debates, meetings among politicians, vehicle tests and test drives, the Bibendum Challenge covers all the topics related to sustainable mobility in one place. And thanks to its neutrality, participants are able to really think about priorities for the future.

The debates at the latest Bibendum Challenge in China (Chengdu 2014) were centred on four major themes:

- Winning technologies that will develop massively and contribute to the transformation of transportation.
- Targeted public policies to facilitate change and growth, improve well-being and security.
- New economic tools, necessary to the success of the changes to be implemented.
- Innovative ecosystems and new business models.

The Bibendum Challenge helps provide answers to sustainable mobility related questions and assists decision-makers in making the investment and regulatory choices that will shape our future.

To help achieve this aim, after Chengdu, a green paper on urban mobility was published, representing a vision shared by all sustainable mobility stakeholders.³¹

TO CONCLUDE

Just like Formula E, an ecosystem fosters innovation around all three activation pillars and creates bonds between them. Finding synergy between these pillars determines the success of such an ecosystem. The following practical examples illustrate the role of ecosystem to strongly foster pragmatic innovations.

“MOBILITY OXFORD”, A GIANT LABORATORY

Team Aguri has a strategic association with the “Mobility Oxford” project (MobOx Foundation). Mobility Oxford aims to improve the experience of transportation in and around the city of Oxford by creating open systems, processes, and technologies that will benefit residents, businesses, and visitors alike. The objective is to create a controlled ecosystem and proving ground that will allow all mobility stakeholders to experiment with new technology concepts, business models, and identify future opportunities for the development of a truly integrated transport system. This objective is compatible with Mark Preston’s (Team Aguri Racing Technologies’ Managing Director) representation of the ideal working environment to innovate in mobility as a service: “We feel that there are a number of partners who fit in that future (mobility as a service): connected vehicles will require partnerships in telecoms and software, OEMs, mobility aggregators, logistics companies, and more”.

The MobOx Foundation may be a facilitator of cross-platform communication and collaboration between all stakeholders which form a joint venture between the universities, local government, and other key private stakeholders. Building on the outcomes of an earlier feasibility study funded by Innovate UK, MobOx will develop solutions that integrate technological and social solutions, based on the premise that integrated transportation is a complex system of interactions between people and technology. This living laboratory will work across all the dimensions of the mobility challenge such as mobility devices, communication, infrastructure, services, and event retail. For example, collecting your shopping at a Park

& Ride location is one concrete action which was considered. Another is to develop an app that gives a cumulative overview of all mobility solutions in the city. The concept and/or outcomes of the project can be leveraged to other UK cities or even overseas.



The MobOx initiative is proof that to innovate successfully in the field of mobility, collaborative platforms do make a difference. Successful implementation of sustainable mobility in highly urbanized areas requires skills in a broad range of fields, from high-tech engineering and design/architecture to marketing and legal aspects. Super Aguri Formula E (SAFE) Racing Technologies has a foot in the Formula E platform and in the MobOx one. This reflects a dynamic that will probably take more and more speed: collaborative platforms generate others because they foster communication between different but complementary actors that have common strategies and focuses. We could be on the brink of an acceleration of this new way to tackle societal and environmental challenges of the 21st century.

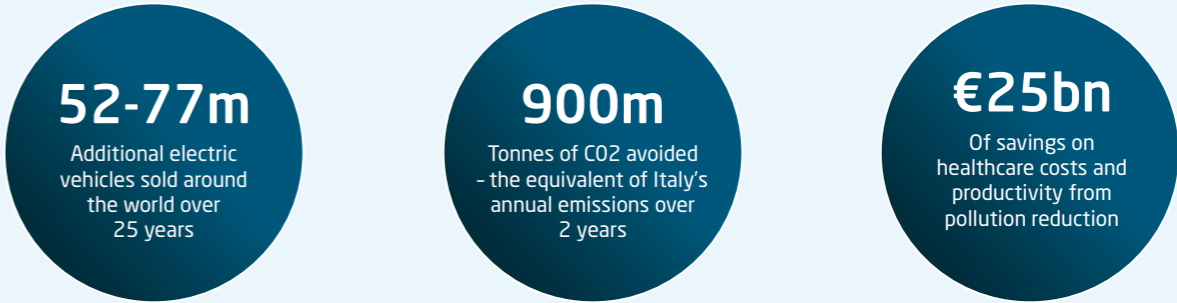
EY REPORT ON FORMULA E CHAMPIONSHIP

Ernst & Young (EY) has had a structured approach to determine the potential of Formula E championship to drive technological innovation, social awareness, and infrastructure investment for sustainable mobility. The value of Formula E is measured by evaluating how the championship will contribute to removing barriers to the electric vehicle market.

EY’s methodology assesses the value creation potential of the championship over a 25 year period, and includes three different scenarios: low, moderate, and accelerated. Based on Green Accelerated Factors analysis, EY was able to determine future externalities, and global impact in terms of green growth, environmental savings, and social prosperity.

- Green growth factors include proceeds from additional electric vehicles sold, savings from fuel energy, extra sales in the industry, and benefits from new job creation.
- Environmental savings encompass reduction in oil, consumption and CO₂ emissions.
- Social factors include savings on healthcare costs from pollution reduction and benefits to the general quality of life.

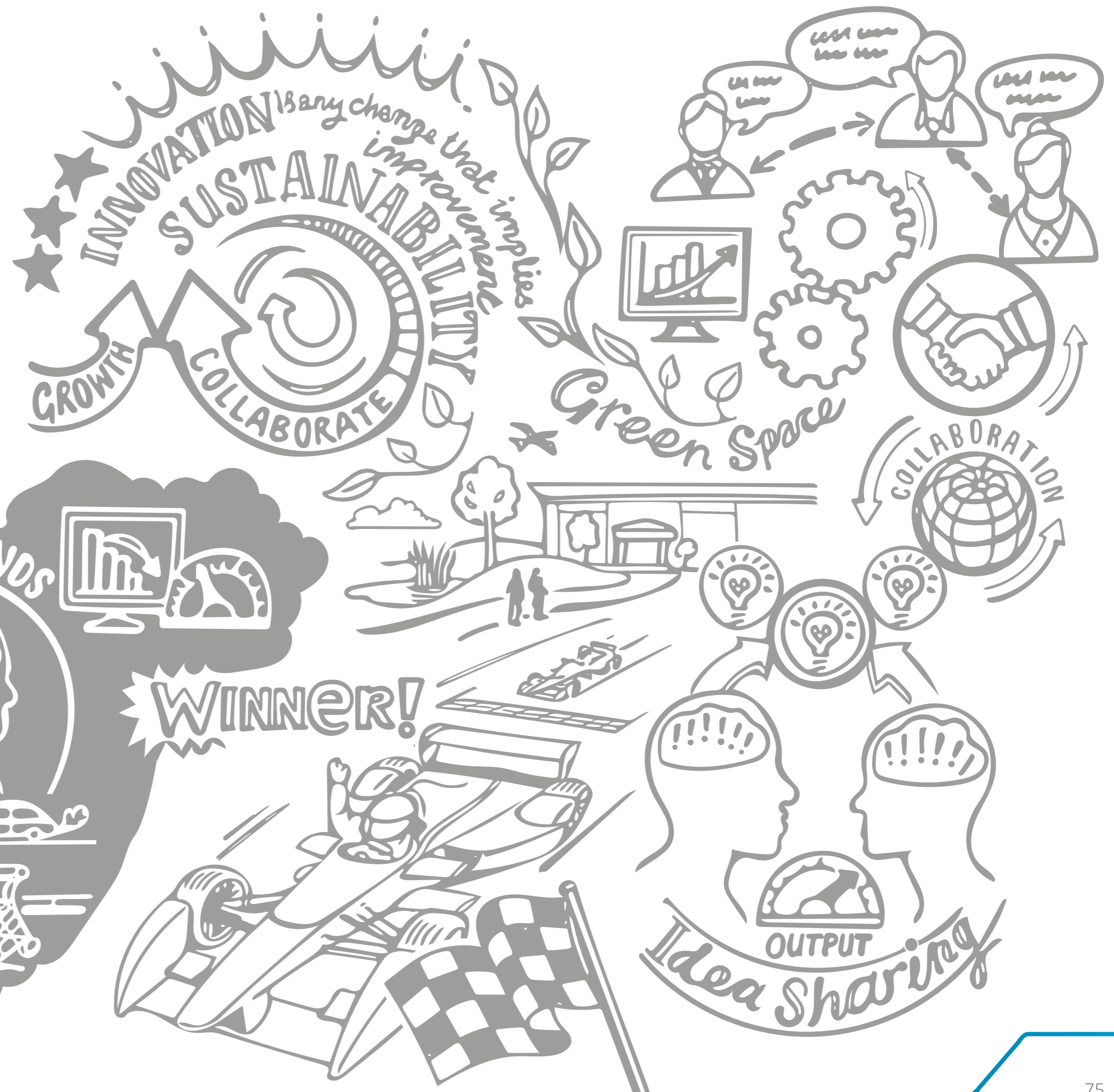
Formula E acts as a catalyst for stakeholders to jointly remove the barriers that block general adoption of EVs.



The main findings measure how Formula E can accelerate the penetration of the electric vehicle market and create value for society, representing the strategic objectives of Formula E Holding and other founding partners.

SECTION 3.

OPEN INNOVATION AND WORK IN THE ECOSYSTEM FOR SUSTAINABLE DEVELOPMENTS



Innovation is in the DNA of the Formula E project. We have raised the need to collaborate in the ecosystem; now, we deep dive into concepts of open innovation. Many would agree that in complex environments, it is helpful or even necessary to collaborate to successfully innovate. This is easy to say but hard to execute. In the following section we present some success factors and best practices identified through our wonderful Formula E project.

OPEN INNOVATION AS A SUCCESS FACTOR IN THE LONG RUN

Knowledge. Firms with more knowledge systematically outperform those with less. This strategic role of knowledge underlies increasing investments in research and development, education and training, and other intangible investments³². A report from Thomson Reuters on the state of innovation in the automotive industry shows that over the past five years, the industry has experienced a period of high growth in the number of innovations filed around the world³³. Similarly a report from the US Patent and Trademark Office states that the number of distributed patents has increased from approximately 197,000 patents in 1994 to almost half a million in 2014³⁴.

Defining innovation. There are many ways to define innovation. We borrow the definition of the Austrian economist Joseph Schumpeter, who claims that innovation is any change that implies an improvement in the following fields: products, resources, production methods, markets, and organizational structures. Innovation is not invention (coming up with new ideas), but is about making ideas work technically and commercially.

Innovation requires deep understanding of what customers desire, how an organization can work with others, and how it could contribute to the business performance of the organization³⁵. It is now widely acknowledged that innovation has become increasingly critical for long term viability of businesses. A study conducted by The Economist suggests that nearly 50% of US economic growth at the end of the 1990s came from business units that did not exist a decade before³⁶. This shows that when properly embedded in the operations, innovation enables a firm's survival in the long run.

Different types of innovation. Companies may work on incremental improvements in features and performance. The incremental innovation results from linear progression where each innovation can be to some extent predicted, such as the innovation sequence increasing the efficiency of the internal combustion engine. Radical innovation is about fundamental changes to the current business practices or markets. Examples include flat screens replacing bulky cathode-ray tube televisions and PC monitors, the introduction of digital cameras that eliminated sales of photographic film, and the Internet that has impacted every aspect of business.



Innovation is hard. Innovation is one of the most popular ideas in business but one of the hardest to accomplish. A survey performed by Bain & Company with over 450 executives around the world, suggests that only one-quarter believe their companies are effective innovators³⁷.

The problem is that innovation often involves a moving target, as conditions in the environment are changing and levels of interactivity are increasing³⁸. Existing technologies, as well as technologies under development, always face the possibility of being pushed aside by alternative developments. The risks are also influenced by market structures, competitors, and business models. Innovation cycles are constantly shortening while development costs are rising due to higher complexity.

It is not surprising that a study on innovation in the automotive industry indicates that only about 20% of innovation efforts are profitable. In addition, around 40% of all investments never make it into the car, 20% are used for necessary serial development, and another 20% are spent on innovations that fulfill legal requirements but do not add to product's distinctiveness³⁹.

The customer's perspective. All too often innovations fail because companies know too little about customer requirements and do not pay adequate attention to how these innovations are marketed. Nowadays, the number of complicated innovations on the market is increasing and customers have difficulties understanding all the features. A good example comes from the automotive industry, where fewer and fewer drivers know about all the functions their cars offer.

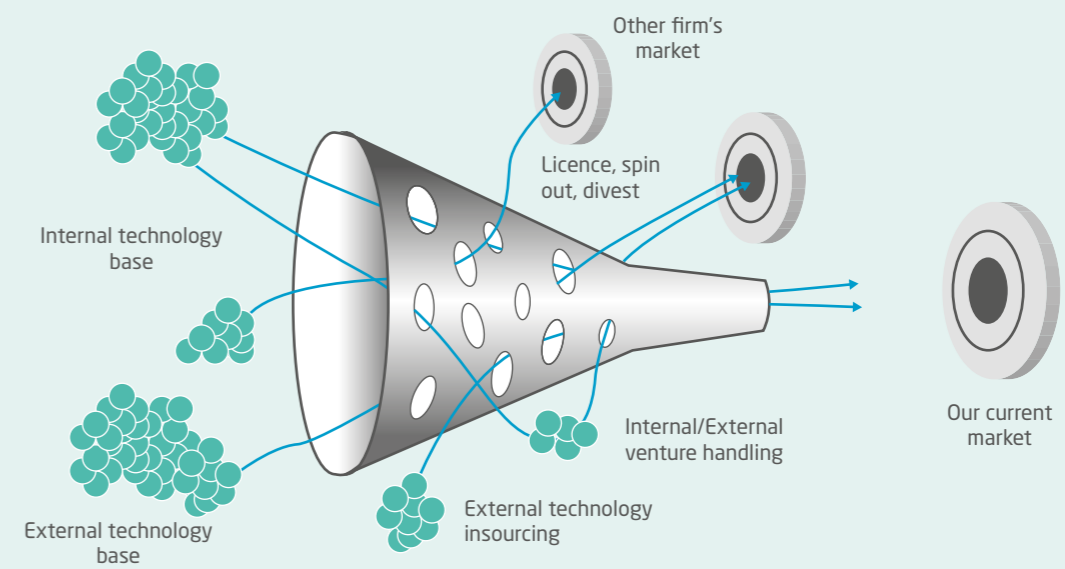
Perception of benefits also varies between different customer groups. Young people are much more receptive to changes in technology and connectedness than any other generation, and the success of innovative features often depends on regional differences.

When is innovation successful? A prerequisite for successful innovation is that people understand why innovation is necessary and how it brings benefits. The new initiative has to be fully aligned with the shared vision of the organization and strategic innovation agenda. In addition, it is important that a company harvests ideas from a wide array of sources. That means bringing in insights and know-how not just from outside parties but from other businesses, and involving partners early in the exploration of opportunities. Economists Wesley Cohen and Daniel Levinthal were among the first to define the concept of absorptive capacity as the ability to recognize the value of new information, assimilate it, and then apply it to commercial ends. This capacity is influenced by knowledge and skills, network permeability, and the attention to different sources of innovation (clients, providers, competition, research institutes, and public information).

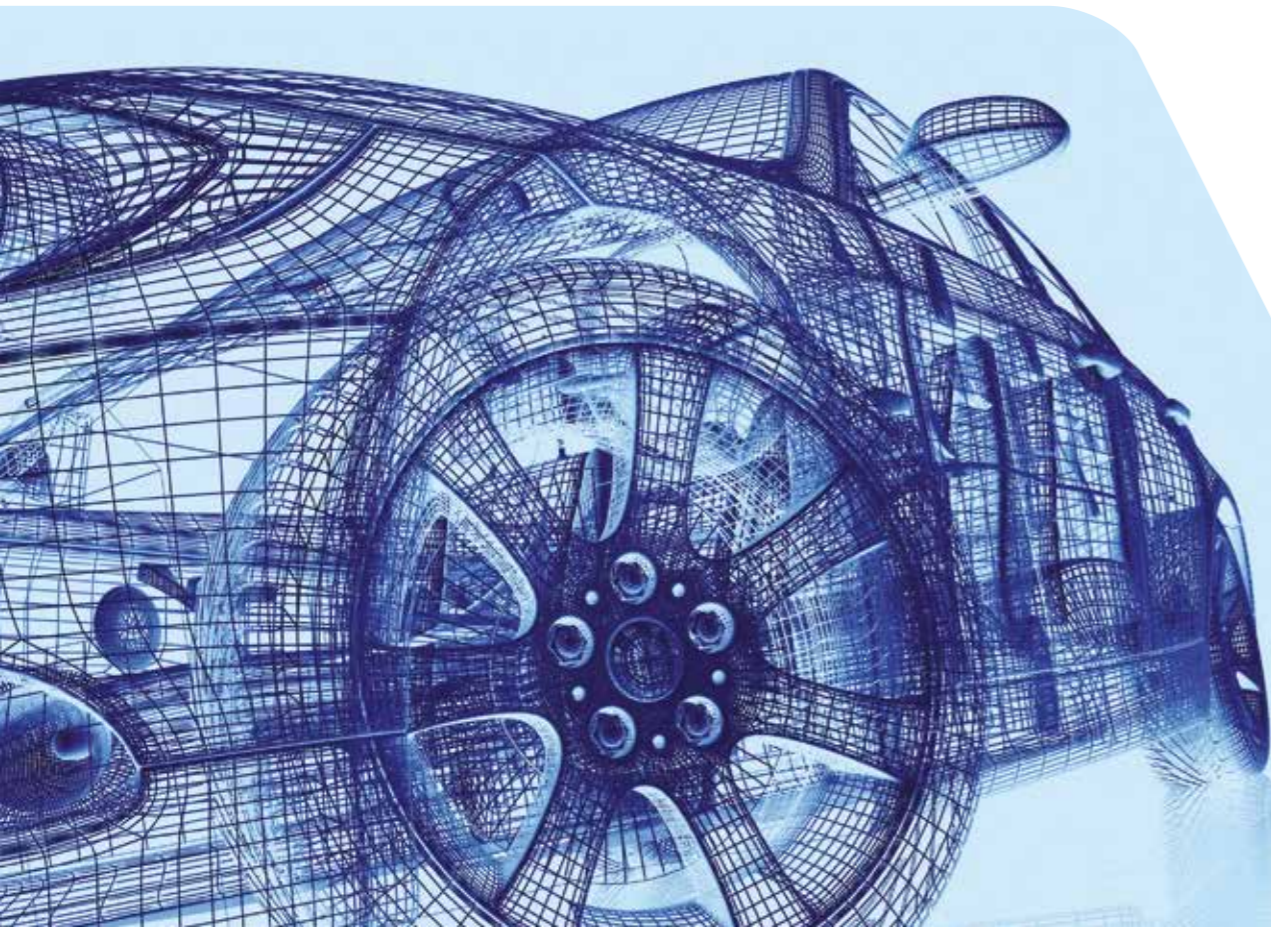
Furthermore, understanding customer preferences enables companies to focus their efforts. The pursuit of innovation often works better when senior managers visibly sponsor and provide support to the innovation team⁴⁰. A key element in achieving successful innovation is also having the right mindset.

OPEN INNOVATION FUNNEL

Traditionally this is perceived as a funnel of ideas. At one end a lot of ideas enter the funnel. As solutions are defined, designed, and developed, only a few exit as new products. The process is run by management, evaluation, and selection practices. However, open innovation changes traditional views and introduces the concept of a porous funnel. Ideas can enter from internal or external sources and can be directed to external recipients. Formula E demonstrates how ideas developed within an open innovation ecosystem fuel internal developments and serve as an inspiration for a broader external environment.



Open Innovation Funnel⁴¹



PEOPLE AS THE BACKBONE FOR SUCCESSFUL INNOVATION

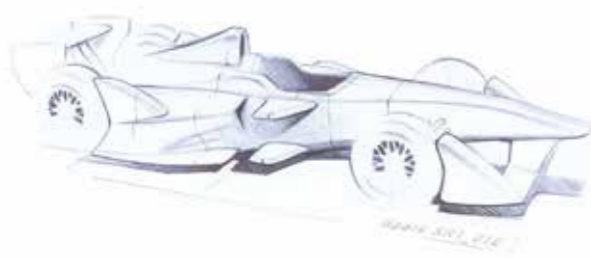
Before discussing the foundations that made Formula E successful in becoming a springboard for industry innovation, let us see how everything started.

From vision to reality. The Formula E adventure started from scratch based on a visionary idea in 2012, when FIA president Jean Todt shared his vision of a fully electric Formula 1™ race with Spanish businessman Alejandro Agag. In August 2012 the Formula E Holding was created by Alejandro Agag and Enrique Banuelos.



Alejandro Agag CEO of Formula E

At the end of 2012, an order of 42 fully electric racing cars was placed to Spark Racing Technologies and the first partnerships around the development of different parts of the car (Dallara, McLaren and Williams) were discussed. In early 2013, the first team, now known as the Trulli Formula E team, joined the project, shortly followed by the China Racing Team.



Drawing of Spark Renault STR 01E prototype

Early success. The preliminary calendar was unveiled in February 2013, together with the racing car prototype built by Segula Technologies. As the project progressed, new partners joined including Michelin, TAG Heuer, and Renault. By the summer of 2013, the IndyCar team joined the series and FOX Sports was announced as the first TV rights holder. Shortly after, the latest prototype (Spark Renault SRT 01E) was revealed at the Frankfurt Motor Show and new strategic sponsors joined the project (Qualcomm and DHL). Just after the provisional calendar was approved by the FIA in September 2013, Amlin Aguri Racing Team joined the series. By the end of the year, 10 teams were engaged with newcomers such as Hans-Jürgen ABT's team, supported by Audi Sport, Mahindra Racing, Virgin Racing (backed by British entrepreneur Sir Richard Branson), and Venturi (with the support from Hollywood actor Leonardo DiCaprio.)



Inaugural Race of Formula E at the 2014 Evergrande Beijing ePrix.

In early 2014 the first 3.44 km, 20-turn circuit was revealed on the grounds of the Olympic Park of Beijing. Later that year, interest from TV broadcasters increased, and deals were struck with ITV, CCTV, Canal+, Sky Deutschland, and Spain's Mediaset. Also, Formula E operational headquarters opened in Donington Park in May 2014, housing all 10 teams and Formula E workforce. One month later, the teams' first ever shakedown occurred behind closed doors, closely followed by a five day test open to media so the people could see what the project had become.

On September 13th, 2014, the five starting lights suspended on a gantry above Tiachen East Road in Beijing Olympic Park went out, and the world's first fully electric racing series had begun.

The dream has come true. There were only two years between the creation of the Formula E holding, and having 10 teams lining up on the starting line of the first fully electric Formula E car race. This shows that sustainable innovative ideas can act as a catalyst. All founding partners brought knowledge, expertise, and enthusiasm for making the Formula E dream come true. Without this enduring involvement, the project might not have happened and certainly not in this time frame.

The second season. For the 2015/2016 season, the series will become an open championship where manufacturers can pursue their own in-house innovations, beginning with the development of powertrains. The gradual opening up of the regulations promotes innovation while keeping costs under control.

Formula E Founding partners. Formula E Official Global Partner Julius Baer and Formula E Founding Partners (BMW, DHL, Michelin, Qualcomm, and TAG Heuer) share more than a vision: they share a passion for innovation, a commitment to excellence, and an ambitious mindset.





#DontCrackUnderPressure



TAG Heuer
SWISS AVANT-GARDE SINCE 1860





TAG HEUER CARRERA CALIBRE 1887
Formula E is the first all-electric racing car that combines the best of motorsports technology and the latest improvements in clean energy. Like TAG Heuer, Formula E is an avant-garde technology which never cracks under pressure.

Official Timekeeper TAG Heuer

Quality and Innovation as a foundation – Perspective from a Time Keeper expert

Since 1860, Official Timekeeper TAG Heuer has been Switzerland's avant-garde watchmaker in terms of both culture and philosophy. TAG Heuer's unique heritage is built on pushing boundaries and breaking rules: harnessing mental fortitude to overcome technology restraints and create daring watches with real racing spirit and a performance touch. The brand has marked the history of watchmaking, especially in the field of luxury chronographs with an unequalled mechanical accuracy. The 2015 models reveal a new dynamic in terms of both the fast lead times and a completely transformed environment: TAG Heuer is the only watch brand to be able to communicate in the worlds of Sport, Art, Lifestyle, and Heritage. As one of the first partners to commit to the Formula E adventure in early 2013, TAG Heuer reflects common core values of mental strength, a disruptive attitude, and ambition. Its slogan #DontCrackUnderPressure is far more than a claim – it's a mindset. In that sense, TAG Heuer is a formidable representative of Formula E founding partners.

MEASURING INNOVATION

Successful innovation needs a system of elements that fit together. To assess how successful Formula E is as an innovation project, we are adapting the measurement system of the consulting company Doblin. Successful innovation institutes a framework that is built around four components: approach, organization, resources and competencies, metrics and incentives.



Approach. At the start of the innovation project, the organization needs to define the phases, activities, and decision rights in the creation process. Teams responsible for implementing an innovation strategy should follow a non-linear path guided by protocols and methods. They should clearly communicate what the innovation is trying to achieve for the whole organization, and how the innovation initiative is linked to the product portfolio.

Formula E is a unique innovation project that combines efforts from several partners. Formula E Holding provides broad guidelines, and partners are empowered to work closely together in several subgroups organized around strategic topics. The first season can be thought of as a business deployment phase where activities were primarily focused on the development of electric cars and powertrain technologies. Partners have instituted their own processes to incubate, sort, and test ideas, but progress is shared within a larger ecosystem. The key factor driving collaboration is common vision and innovation strategy for each partner which reflects the long term objectives of Formula E.



Organization. This component describes different units in the organization and the connections among them. Game changing innovation often balances between separating from and collaborating with existing business divisions in the organization. Support from senior leadership is crucial for securing the financial investment, convincing the broader group of stakeholders, and driving innovation forward. To deliver innovative solutions, organizations must also have mechanisms for identifying and leveraging external capabilities.

Formula E represents a collaborative ecosystem where partners share a common vision and exchange innovations on sustainable mobility solutions. As such it involves the highest level of integration between partners. Each partner is Formula E's own champion of innovation within a specific area but common activities are discussed in subgroups between different collaborators. All innovation efforts are highly supported by Formula E Holding that serves as an umbrella organization for the different subgroups.



Resources. Employee skills, tools, and funding are needed for innovation. Attracting people with the right skills at the right time is the essence of talent management.

Formula E Holding has defined rules that guide innovation but individual partners are fully responsible for contributing necessary resources and finding the right balance between the different needs of their core business. In addition, Formula E is a very exciting innovation experiment that attracts the best people in companies and supports their efforts in advancing technologies related to electric vehicles.



Metrics and incentives. This component encompasses the targets to guide performance, the measures to evaluate progress, and the incentives to drive supporting behaviours.

We devised metrics according to the activation pillars in the ecosystem. Technology efforts are measured with the number of pilot projects that show how technologies developed in Formula E can be transferred to other industries. Assessing infrastructure impact requires a long-term perspective and is difficult to measure. We propose to use the number of initiatives within the Legacy Program that were successful in having an impact on the hosting city. Communication is measured in terms of the number of people reached.

HOW TO COLLABORATE SUCCESSFULLY IN THE ECOSYSTEM

Running a successful innovation ecosystem demands more than just constantly improving innovation culture and process. Effective ecosystems manage to turn outsiders into collaborators, and cultivate profitability by encouraging others to create valuable offerings. In such an environment, enabling external innovation becomes as important as improving internal capabilities.

Different levels of integration. Collaboration within an ecosystem can take several different forms. It starts with simple sharing of information about research discoveries, trends and customer studies, use of technologies, and good business practices. The next step is to embark on a common project that aims to achieve mutually beneficial goals. Partners work closely together but the overall purpose of the project is still somehow distant from the strategic objectives. On the contrary, integrated projects demand from partners in the ecosystem strategic commitment in terms of human capital, desire for wider purpose, and financial resources. Examples of innovation partnerships are especially common in the technology sector, with Amazon Web Services, YouTube’s investments in suppliers of content, and Apple’s App Store leading the way.

Collaboration needs rules. Successful collaboration within the ecosystem depends on several elements. Partners in the ecosystem need to have a common vision of the project and share values. Otherwise they might not have the perseverance to overcome problems, and stick together on the chosen path. Secondly, having clear processes and rules of engagement is vital for everyday activities to run smoothly and facilitates communication between different partners. Before the start of the collaboration project everyone needs to have a common understanding of the areas of collaboration. This is especially important in situations where the line between competition and collaboration is not clearly defined. Lastly, after the collaboration exercise yields benefits in terms of financial gains, development of new processes and technologies, collaborators need to have a system in place that ensures fair distribution of outputs.

Formula E metrics – season 1 evaluation (non-exhaustive list)

CRITERIA	DETAILS
New technologies and products that stemmed from Formula E	<ul style="list-style-type: none">• Electric Formula Racing Car• 300kg, 90kW average power battery• Battery Management System which allows all Cell Monitoring Units (CMUs) to communicate via a Controlled Area Network (CAN)• High voltage isolated, thermal resistant Safety Cells for batteries• 42kW, renewable energy generators running on glycerin• New independent electric powertrain developments• Qualcomm Halo wireless charging using resonant magnetic induction• Tires continuous improvement
Infrastructure improvements	<ul style="list-style-type: none">• Battersea Park
Activites, events & communication around Formula E	<ul style="list-style-type: none">• London sustainability conference• Blue Sky Transportation Design Award• School Series
Innovative concepts created for/within Formula E	<ul style="list-style-type: none">• Fan Boost• Driver Monitoring• eVillage at each race location• Specific engineering training for motorsports• Life Cycle Thinking in events: Total sustainable approach• Sustainable logistics set up
Other projects	<ul style="list-style-type: none">• Report assessing potential of Formula E

MEDIA KEY PERFORMANCE MEASURES	
Cumulative TV Audience	190 million
Number of Spectators	361,500
Global Press Features	2,431
Broadcast TV News Features	507
Social Media	733.7 million
Video Views	2.3 million



CONCLUSION

In 1900, electric vehicles accounted for around one third of all vehicles on the roads in the US. Public interest in electric vehicles at that time was high, particularly for urban driving. But the internal combustion engine revolution took hold not long after. The commercial genius of Henry Ford and his reliable, highly affordable Model T helped petrol vehicles take the initiative and triggered a sharp uptake in private car purchases in the US and around the world, effectively laying the foundations of the modern automotive industry. This tells us that EVs are not new, that the success of an idea or a technology depends much on factors such as context and the drivers behind. In recent years, the interest in electric vehicles has returned, helped by increased awareness of environmental issues and major improvements in electric technologies that have helped increase performance and bring down costs.

Formula E has proven to be a booster for Electrification and for Sustainable Business Practices developments.

Formula E has a bold, specific, concise and consistently communicated mission to: “Represent a vision for the future of the motor industry over the coming decades, serving as a framework for research and development around the electric vehicle, accelerating general interest in these cars, and promoting sustainability.”

All founding partners share this vision and the same underlying values: out-of-the-box spirit, a passion for

excellence, the willingness to create insanely great experiences, and the capability to put their acts together to set the path – each in their own field of expertise.

Focusing on low hanging fruits is the easy option – so we did not. We all joined efforts to build this fantastic and unique championship. This is the beginning of the story and definitely not the end stop, as we all work on joint developments aiming at ultimately boosting Innovation and Sustainability in the Mobility field.

Mobility is a wide transversal topic which covers numerous sectors – Automotive, Technology, Energy, Transport and Infrastructure.

Creativity is much more about connecting things rather than reinventing the wheel. Having a wide scope enables a broader understanding of the human experience leading to breakthroughs that others may have missed – in brief it enables to innovate successfully.

Some innovations are (future) gold, others are just little things that will pass by. One of the keys of success observed is the ability to welcome new ideas, almost without restriction, while still being able to say no to “Nice to Have Projects”. Interestingly enough, FOCUS is the name of DHL Express’ strategy supported by Global CEO Ken Allen for many years.

After the first season of Formula E, the words of the writer John Ruskin are confirmed:

“Quality is never an accident. It is always the result of intelligent effort.”

We hope you learned much about the Championship and about what is happening behind the scenes in terms of business deployment. We would like you to remember that we ALL are a vector of change, that we ALL have the opportunity at our level to create Butterfly Effects. Alejandro Agag opened the Formula E to all partners, leaving them with the opportunity to make their own developments in a spirit of innovation and progress – and so we did! Undoubtedly Formula E is the Linux of the Motorsport and Mobility Industry. What’s most exciting of all, is that the future of motor racing and transportation is upon us, and much of that future is still waiting to be unleashed by our imagination.

Even the sky is not the limit...

Manoëlla Wilbaut



PARTNERS



CONTRIBUTORS

Contributors to the White Paper



INDIVIDUAL CONTRIBUTORS

Contributors to the White Paper

Alejandro Agag	Daniel McGrath
Sabrina Asendorf	Darran Norman
Emma Bearpark	Julia Palle
Kathrin Benz	Naomi Panter
Diana Binks	Marco Parroni
Pascal Couasnon	Bettina Paschke
Graeme Davison	Maximilian Peiker
Yann De La Fouchardière	Huw Philips
Adrien Dedieu	Stefan Ponikva
Gary Ekerold	Steven Pope
Pierluigi Ferrari	Mark Preston
Massimo Foroni	Chantal Rampone
James Francis	Cynthia Ray
Alistair Gates	Pascal Rueff
Dilbagh Gill	Linus Schmeckel
Erik Grab	Keith Smout
Roger Griffiths	Daniela Spiessmann
Serge Grisin	Meredith Taghi
William Hollis	Shane Turner
Antje Jurke	Olivier Vialle
Miles Kirby	Olivier Volery

A special thanks to Gregor Horvat and Benjamin Jehl for their contribution.

REFERENCES

1. UN, World urbanization prospects, 2014

2. UN, World Urbanization Prospects, 2014

3. UN, World Urbanization Prospects, 2014

4. UN, World Urbanization Prospects, 2014

5. DHL, Insights on Urbanization, 2011

6. www.edition.cnn.com/2015/06/24/tech/big-data-urban-life-singapore/

7. www.senseable.mit.edu/livesingapore/

8. DHL, Global Connectedness Index, 2014

9. DHL, Global Connectedness Index, 2014

10. Arthur D Little, Future of Urban Mobility 2.0, 2014

11. Arthur D Little, Future of Urban Mobility 2.0, 2014

12. Michelin Bibendum Challenge (12th edition) Brochure, 2014

13. Arthur D Little, Future of Urban Mobility 2.0, 2014

14. TII, Urban Mobility Report, 2012

15. Arthur D Little, Future of Urban Mobility 2.0, 2014

16. www.smile-einfachmobil.at

17. www.en.velib.paris.fr

18. European Commission

19. Arthur D Little, Future of Urban Mobility 2.0, 2014

20. Evolution, Electric vehicles in Europe

21. Evolution, Electric vehicles in Europe

22. Michelin, Green paper, 2014

23. Michelin, Green paper, 2014

24. Solar City, Consumer trends in Sustainability

25. EY, Digitization of everything, 2011

26. EY, Digitization of everything, 2011

27. Bain & Company, Making it personal

28. Arthur D Little, Strategic Directions and Ecosystems to Address China's Urban Mobility Challenges, 2014

29. www.navigantresearch.com/newsroom

30. DigiCapital

31. ebooks.michelin.com/green-paper-mcb-2014/

32. Oslo Manual

33. Thomson Reuters, The state of innovation in the automotive industry, 2015

34. www.uspto.gov/web/offices/ac/ido/oeip/taf/cbcby.htm

35. Deloitte, In pursuit of innovation

36. HRB, Breaking out of the innovation box, 2002

37. Bain, Taking the measure of your innovation performance, 2013

38. J. Tidd, Managing Innovation

39. Oliver Wyman, Innovation in the automotive industry, 2015

40. HBR, Innovation's nine critical success factors, 201

41. www.slideshare.net/jdpuva/innovation-funnel-version-30

All rights reserved. No part of this publication may be reproduced or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission of the publisher.

© 2015 Manoella Wilbaut



