# Journeys of the Future

Introducing Mobility as a Service

#AtkinsMobility

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# Introduction

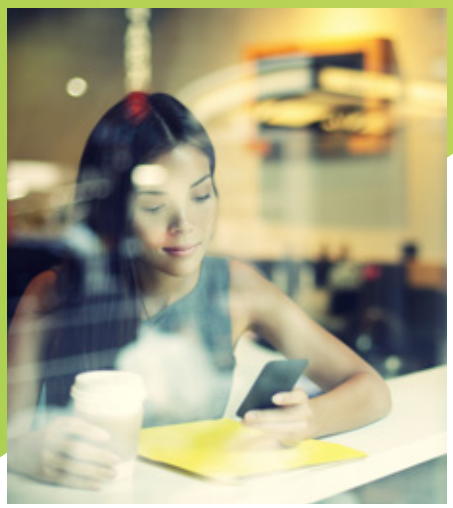
The transport sector is at the beginning of a period of significant disruption, with new technologies, products and services fundamentally shifting customer expectations and opportunities. The market for Intelligent Mobility is rapidly-developing as customers, transport authorities, businesses and governments understand the huge potential for unlocking major opportunities and improving a wide range of outcomes by taking a user-centric approach to looking at mobility opportunities for customers as part of a wider, integrated system.

Perhaps the most exciting emerging development within the Intelligent Mobility space is that of Mobility as a Service ('MaaS'). MaaS focuses on providing a single platform for combining all transportation options and presenting them to the customer in a simple and completely integrated manner – the emphasis being on how to get from A to B rather than the individual transport modes and services. In this paper we explore how Intelligent Mobility and MaaS are rapidly developing and the exciting opportunities they provide for customers, authorities and businesses.

In the last 10 years we have seen technology introduced that has either directly delivered, or enabled, significant disruption across a number of sectors.

The arrival of the smartphone has potentially been the most significant as it has enabled us to be permanently connected to an ever growing range of services and huge quantities of up-to-date information. In the UK, the number of adults with a smartphone grew from 51% at the start of 2013 to 61% (roughly 65% of all mobile phone users) at the start of 2014[1]; likewise the number of households owning a tablet grew from 24% to 44% in the same period.

This is hugely significant to the transport sector – as new technology is increasingly adopted by customers, it enables new services to be developed that are bringing real benefits to customers. We can now check live bus times or buy train tickets on our phones as well as plan our journeys and keep an eye out for any issues on the transport network, such as congestion, as it arises.





[1]OFCOM, Communications Market Report 2014, http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr14/uk/

## The transport sector is ripe for disruption

But somehow the transport sector has not yet seen the disruption to its longstanding service provision model that other sectors, such as the media and telecommunications industries, have experienced. The transport sector does have a particular set of circumstances that have helped avoid major change up to now – the cost and time to develop transport infrastructure, the cost and complexity of entry into the market, the regulatory environment and the difficulty of taking on relatively large and (usually) well-established businesses.

However we are now seeing the evolution of technologies that can help break down these barriers. One of the best-known examples is Uber, a company born from innovative technology (in this case big data analytics) that is now challenging the taxi industry globally. There are many more start-up businesses whose ideas have the potential to reshape how we see transport and to fundamentally change the expectations of customers. Key to this is the recurring theme of innovating with a focus on putting the customer at the centre of the transport service.

> Huge disruptive changes are happening quickly in the mobility sector. Smartphones have become ubiquitous and are being used heavily in the everyday lives of consumers and fast, agile and relentlessly driven SME companies such as Corethree are driving business change in the market. We are taking the game to the traditional 'big boys' and on many occasions beating them to contracts because we're simply able to offer a more advanced solution whilst being able to adapt and evolve so much quicker and more efficiently as we don't have their level of inertia.
>
> Add to this the desire of transport companies to welcome these new smart, innovative solutions with open arms and the future for the consumers continues to look very bright as the products they are using are constantly being upgraded to deliver even more user focused solutions based upon feedback and the data being harvested live from the wild.
>
> **Ashley Murdoch, CEO, Corethree**




## Disruption will be positive, especially for customers

Traditionally, the transport sector has been about the provision of a relatively inflexible service to passengers who can, ultimately, take it or leave it. Train and bus routes are fixed, the stops are in fixed places, and run to a fixed service timetable. It has been for the customer to purchase and use these services by their own calculations and try to make them best fit with their own individual requirements and preferences. This focus on provision of fixed transport services also meant passengers always had to plot their whole door-to-door journey, with the 'last mile' element always seemingly being outside of the system and therefore requiring separate planning and information from the main part of the journey itself.

There has also been a clear, established range of transport modes. But the evolving transport sector is starting to look very different: customer-centric with the blurring of boundaries and less commitment to one particular way of getting around. Where car ownership and long-term season tickets were the norm, we now see a trend towards the provision of access to mobility opportunities and the emergence of the sharing economy bringing a new mind-set to customer expectations. Customers now require much greater flexibility in line with wider social trends around part-time working, working from home and more flexible journey choices.

Intelligent Mobility is a new way of thinking about how to connect people, places and goods across all transport modes. It is about how we utilise a combination of systems thinking, technology and data across the transport network to inform decision making and enable behavioural change.

Intelligent Mobility combines a strong focus on putting the customer at the heart of the service offering with the requirement of integrating all transport opportunities into a whole system.

We are seeing a number of trends shift the focus of policy-makers and funders towards the field of Intelligent Mobility, both in the UK and across the world.

The rise of the sharing economy, access over ownership, mobility services on-demand, the convergence of modes and types of transport, the blurring of the boundaries between public and private transport, the arrival of new entrants challenging the market and regulators to respond to a new world.

## Intelligent Mobility

The transport sector can meet these trends head on and it is starting to do so. This new thinking in the sector is often referred to as 'Intelligent Mobility'. There is no clear, agreed definition of Intelligent Mobility but we define it around two central tenets:

1. **The user and their experience and requirements must be at the centre of mobility provision.**
2. **The system must be integrated and focused on the outcome of providing a complete journey as easily and efficiently as possible for every user.**

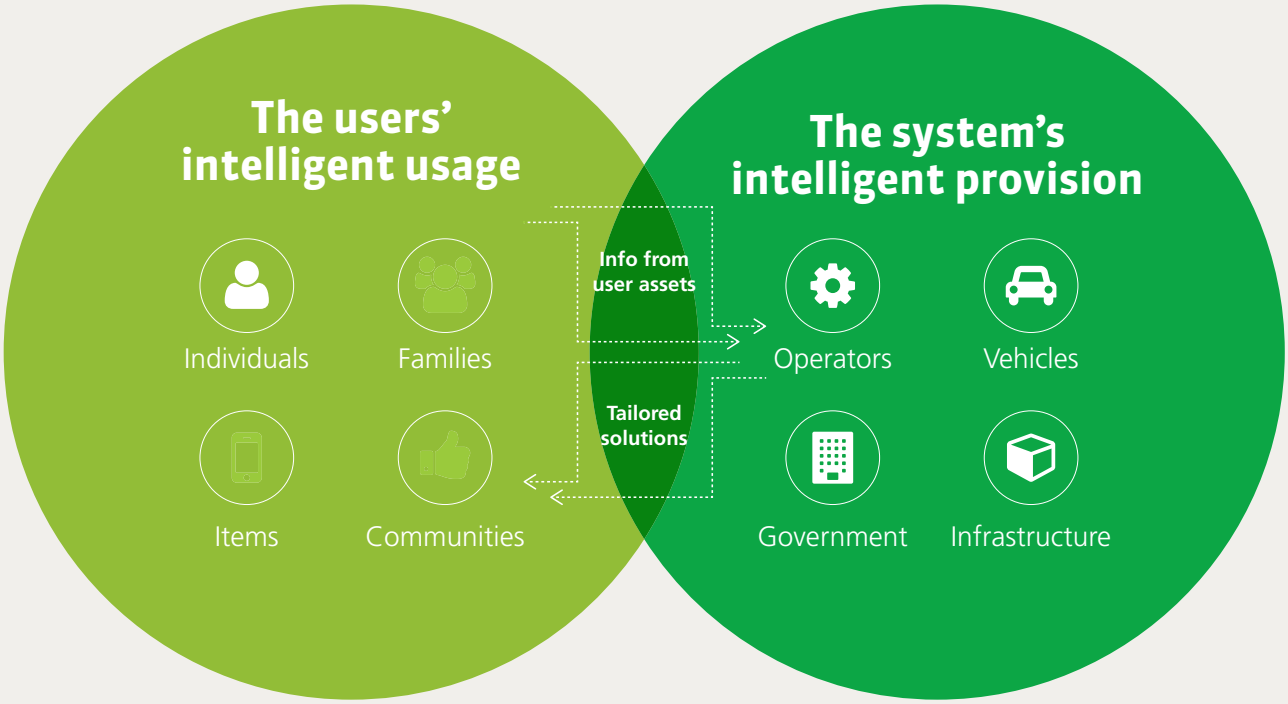
Within these two central tenets are a number of critical points:

1. **The provision of mobility opportunities must be personalised to meet the expectations of every user on every journey;**
2. **The provision of mobility must be available on-demand;**
3. **The user experience must improve and look at the whole journey experience for all customers;**
4. **We can, and should, be ambitious about using mobility as a service to explore behaviour change and the wider role of transport in supporting more positive outcomes**

# What is Intelligent Mobility?

Opportunities: portable across places, people, communities and sectors; opens up the market to new entrants; flexibility to serve all users.

Increasing levels of information highlighting changing user needs - increasing levels of enjoyable travel




Increasing innovation and intelligent provision of supply, new business models and innovative financing

Barriers: sector fragmentation; funding opportunities and methods; regulatory flexibility; proprietary solutions; vested interests.

In this paper we will explore these new opportunities and investigate how the transport passengers of today will become the much-happier, much-better-served mobility users of the future. We have identified a number of trends and have analysed them to understand how businesses need to react now in order to meet changing customer expectations as the transport sector sees major disruption from new technologies and new business models. We will then set out our concept of 'Mobility as a Service' and how organisations across the transport sector can use this to provide a win-win solution for their own businesses as well as their customers.

# How is the world changing and why will it change transport?

We are seeing a number of mega trends having an impact on the design and provision of transport.  Urbanisation and climate change are the two key drivers that are having a huge impact on areas such as public transport capacity and priority, fuel efficiency and the increasing use of active travel modes.
>

## Urbanisation

### TRENDS

**CONGESTION**

**DEMAND FOR NEW INFRASTRUCTURE**

**AIR QUALITY**

**CHANGING MARKETS AND HABITS**

**PRESSURE ON TRANSPORT NETWORKS**

**INVESTMENT REQUIREMENT**

**REGULATION TO LIMIT POLLUTION**

## Climate Change and Sustainability

### TRENDS

**AIR QUALITY**

**RESOURCE DEPLETION**

**REGULATORY ACTION**

**GREATER FOCUS ON RESILIENCE**

**FUEL EFFICIENCY**

**MULTIPLE ENERGY SOURCES**

**REGULATION TO LIMIT POLLUTION AND/OR INCENTIVISE NEW TECHNOLOGY**

**CHANGED BEHAVIOURS**

# Megatrends

## Demographics

**POPULATION GROWTH**

**AGEING POPULATION**

**MILLENNIALS**

## Technological development

**PERSONALISATION**

**ON-DEMAND SERVICES**

**INCREASING PENETRATION OF SMART PHONES**

## CONSEQUENCES !

**MORE PRESSURE ON TRANSPORT CAPACITY**

**RISK OF ISOLATION, LACK OF ACCESS TO MOBILITY**

**LACK OF FUNDING TO SUPPORT MORE SERVICES FROM THE PUBLIC PURSE**

**ACCESS OVER OWNERSHIP**

**DEVELOPMENT OF INNOVATIVE NEW SERVICES AND PRODUCTS**

**NEW BUSINESS MODELS**

**DATA ANALYTICS**

At the same time we are seeing social and economic trends starting to change behaviours and attitudes.  Fewer young people are regular drivers and, in particular, if they are driving then it is in a hired or shared car rather than one they own themselves.  Indeed this trend has emerged at the same time as bike hire schemes have also taken off across the world.
>

# Growing trend in access over ownership – the rise of the collaborative economy

A rapidly expanding social trend having a major impact on businesses and regulators






**Music streaming service with 60 million subscribers globally**




**Challenging the hotel industry with over 800,000 places to stay listed across 33,000 cities and 192 countries; the business was valued at $10bn in 2014[1]**

zipcar
wheels when you want them

**GLOBAL CAR SHARING BUSINESS WITH MORE THAN 810,000 MEMBERS AND 10,000 VEHICLES; IT WAS BOUGHT BY AVIS IN 2013 FOR $500M.**

Zipcar research found that 53% of millennials consider car ownership out of their reach[2]. In fact, more than half said they would drive less if other transportation options were available, such as public transportation, car sharing, and ride sharing and 35 percent said they are actively looking for alternatives to automobiles. There is similar evidence in the CarPlus Annual Survey[3] of car club members where 64% said they were less likely to buy a private car in the next few years as a result of their membership.

**EACH ZIPCAR REMOVES 15 PERSONAL VEHICLES OFF OF CITY STREETS AND OUT OF CITY PARKING SPACES AND MEMBERS DRIVE 60-80% LESS THAN PEOPLE WHO OWN THEIR OWN CARS[4]**

[1]http://en.wikipedia.org/wiki/Airbnb
[2]http://www.forbes.com/sites/michelinemaynard/2014/01/24/millenials-in-2014-take-my-car-not-my-phone/
[3]Carplus Annual Survey of Car Clubs 2013/14 Summary report England and Wales (excluding London) (Carplus, 2014)
[4]http://thecityfix.com/blog/innovating-smart-sustainable-cities-qa-zipcar-founder-robin-chase-carsharing-ttdc15-ryan-schleeter/

## These trends are encouraging new approaches

Several cities are taking this thinking further and developing new solutions that reflect these trends, recognising that population growth and climate change mean it is essential to try out new and radical ideas.  At the same time there is also acknowledgement that these ideas, often using new technologies, can not only mitigate these trends but actually deliver major improvements in terms of delivering more integrated transport, or more capacity, or new and greater efficiencies.

As the table below illustrates, the last 10 years have seen a significant increase in the availability and adoption of new approaches in cities across the globe.

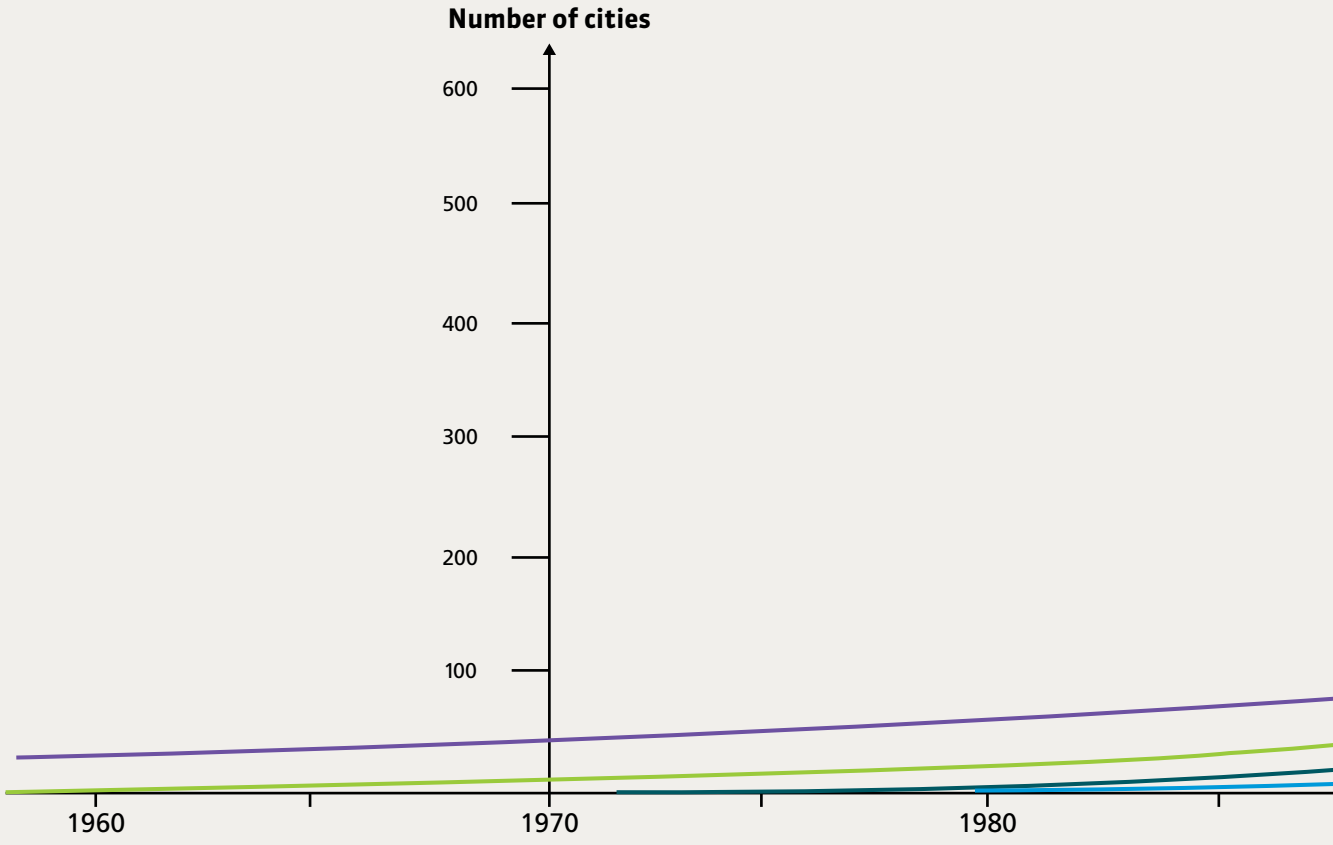
The introduction of new modes into city transport networks, such as Metro or Bus Rapid Transit, have been eclipsed by the introduction of supplementary services, such as car sharing and bike sharing, that can be more quickly and easily introduced, developed and integrated into the wider transport network.

> There is an increasing focus on mobility opportunities beyond the fixed transport network.

Public transport remains critical for supplying significant capacity for large numbers of people, the positive development is the greater focus on integrating the journeys at either end to make the experience as easy as possible for the user without the need to spend time and effort planning and choosing how to make the whole journey.

It is not just cities that are taking steps to offer better transport services that either integrate multiple mobility opportunities or that actually blur the boundaries between different modes to assist customers.  A number of businesses are moving into this space, explicitly recognising that the sector is evolving and early mover status will provide a significant competitive advantage in the longer term.

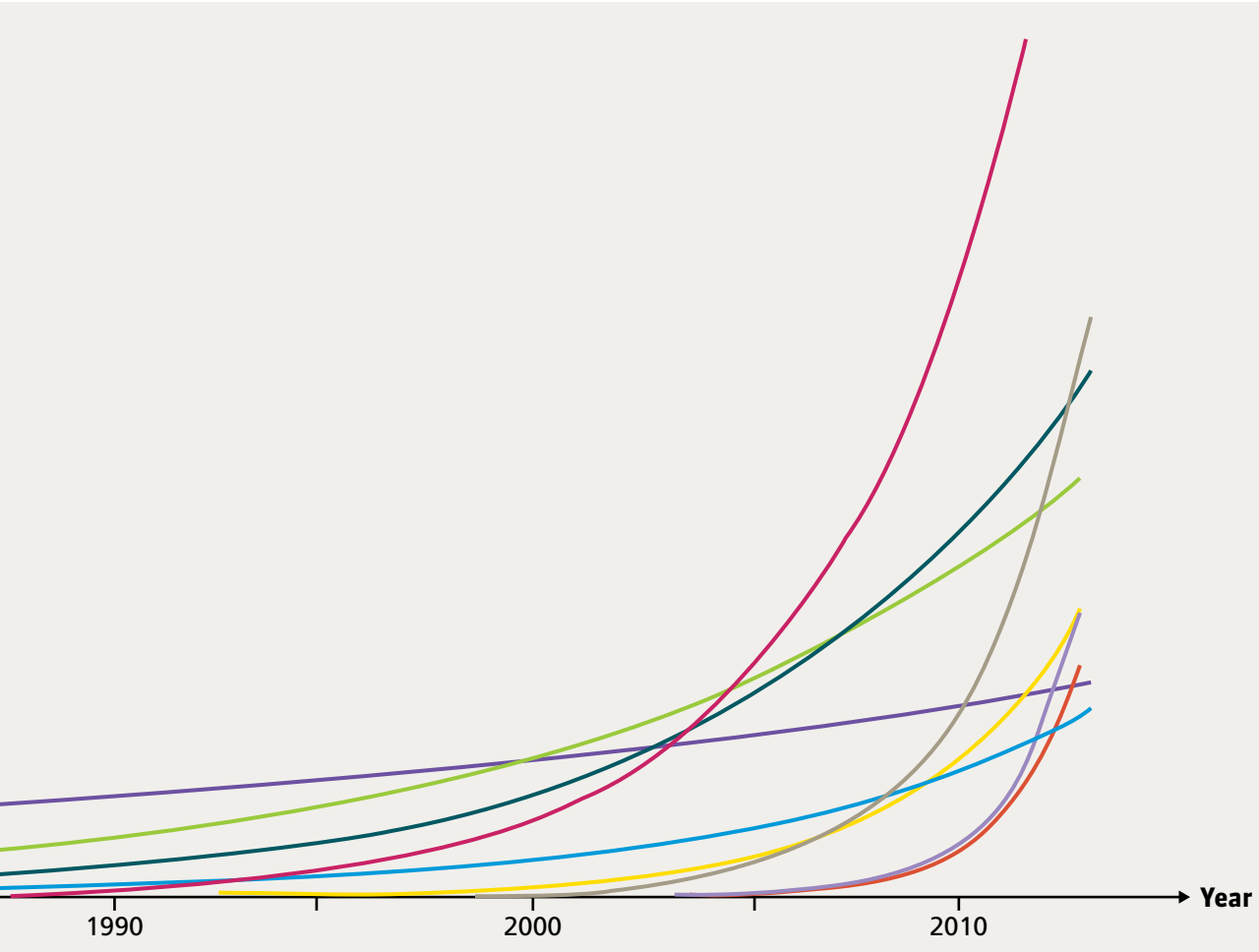
Sustainable Transport Adoption



The 21st century is seeing a huge shift in how mobility is provided – across the world, we are seeing the rapid adoption of broader, more sustainable approaches such as bike and car sharing, as well as an increasing emphasis on public and active travel modes.
>

**KEY** - This graph illustrates the rate of adoption of sustainable transport systems/schemes across the globe (in brackets is the first major example of each)

- Metro - 188 (1863, London, UK)
- Low emission zone - 210+ (2003, Tokyo, Japan)
- Bikesharing - 500+ (1998, Rennes, France)
- Carefree zones - 360+ (1953, Rotterdam, NL)
- Smart Card - 250+ (1992, Oulu, Finland)
- Google Transit web apps - 250 (2005, Portland, US)
- Complete Streets - 455 (1953, Rotterdam, NL)
- Carsharing - 1,000+ (1987, Zurich, Switzerland)
- Bus Rapid Transit - 160 (1974, Curitiba, Brazil)

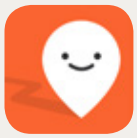



Source: http://www.embarq.org/media/sustainable-mobility-trends-around-world



**Citymapper**

- Since launching in London in 2010, CityMapper has reinvented journey planning by supplementing service timetable data with real time information to provide accurate and up-to-date journey planning options.
- The service covers multiple modes including bus, rail, metro, walking, cycling and HailO Taxis (on demand, app based taxi service).
- CityMapper now covers 10 cities across Europe and the Americas.



**Moovit**

- Similar to CityMapper, start-up Moovit uses real-time data in its journey planning tool. Moovit is set apart from other journey planners as it collates crowd sourced data for its users to improve the accuracy of route information.
- This edge has led to Moovit being recently valued at $450m[1].
- Currently operating in 500 cities across 14 countries, the company has big expansion plans – including expansion beyond London into other UK cities.



**Waze**

- Mapping and navigation start-up, Waze, was acquired by Google in 2013 for in excess of $1bn[2].
- The company focuses on journey planning and navigation for car users, with a particular focus on its community of users sharing information to help one another – everything from congestion to fuel prices and road works.
- Waze also integrates major events, such as sporting events into its journey planning tool to ensure users aren't caught out.

## These new approaches must reflect what people are doing and require

Social trends such as more flexible patterns of working alongside increased customer expectations and sophistication are creating what can be seen as either an imminent shift away from traditional modes of transport, or as a huge number of potential opportunities to provide more and better services to customers.

There is clear and growing demand for simplifying journey planning options as well as the means of purchasing these options. These journeys must be available more flexibly and the ability to make them on-demand is opening up the market to alternative services and products that meet the expectations of users.

A lot of these new services could not exist without recently-developed technologies. The use of big data analytics to understand patterns in behaviour, provide better monitoring of service and vehicle performance, as well as better predictive power, has enabled both established and new companies to develop new services using business models that simply could not have existed less than a decade ago. The transport sector needs to look afresh at their operations and their business models to assess whether they are ready to adapt as the sector experiences ongoing disruptive change.

## Enhancing the customer experience benefits everyone

Customers are now using new and multiple channels to communicate and to keep informed. Additionally, we see a growing requirement for personalisation of services. The current transport sector provides a bulk supply of homogenised mobility opportunity i.e. seating and standing capacity on public transport, road capacity and so on. But that offer is fragmented and impersonal – anyone could be using it, there is little effort to tailor the service and to integrate it in a way tailored for every customer. The transport sector is missing a trick – it is not that providing such a service would be expensive for little reward; by improving the service in this way, the sector would be able to generate a significant number of new commercial opportunities as well as reducing the cost of providing the services and encouraging greater use of more of their services.

There is a value in bringing seamless integration to customers across their entire journey. That entire journey will more and more frequently combine traditional modes of transport with the new opportunities and services being created as well as new methods of purchasing mobility. Customers are looking for ways to make their journeys easier both in planning and undertaking them – we only need to look at the uptake of new services such as online journey planning and ticket purchasing; the use of social media to communicate with operators; and the growth of apps like Citymapper, Moovit and Waze, to see that customers have an appetite for new ideas, it is now for the transport sector to respond.



[1]http://www.techworld.com/newsapps/moovit-navigation-appraises-50m-help-it-take-on-citymapper-in-uk-3593975/
[2]http://techcrunch.com/2013/06/11/its-official-google-buys-waze-giving-a-social-data-boost-to-its-location-and-mapping-business/

## New Approaches



### Paris
**redefining urban mobility**

Vélib' is the very successful cycle share scheme launched in 2007 and is the largest scheme of its type outside China with more than 20,000 bikes in service. Users get free access for the first 30 minutes of use, only paying for any additional time. Popular with locals and tourists alike, one Vélib' bike is hired every second of the day across the city.

Building on the success of Vélib', the city launched Autolib', an electric car sharing service in 2011. Autolib' has proven just as successful with plans to expand into London in 2015.

In a 2013 survey, 70% of non-car owning Autolib' members said that the scheme had allowed them not to buy a vehicle of their own – revealing the success of the scheme in reducing the number of cars on Paris' streets[1].



### Helsinki
**using mobility on demand to replace car ownership**

In 2014, Helsinki announced plans to remove the need for car ownership in the city by 2025. Rather than forcing drivers out of their cars (think congestion charging in central London), Helsinki is improving public transport and adopting a new 'mobility on demand' model[2].

Harnessing the potential of smartphones, the city sees mobility being purchased as a subscription model with an app-based journey planner providing options for navigating the city.

Helsinki has already quietly started trialling such a model in the form of Kutsuplus – an on-demand minibus service which allows users to specify a pickup and drop of point, summoning a vehicle through an app. Priced higher than a bus but lower than a taxi, the service is similar to that provided by Bridj in Boston, using algorithims to match users to minibus rides. Plans are in place to see the serice expand from 15 buses today to 100 by 2017 and up to 2,000 by 2020[3].



### Moovel
**providing an integrated mobility solution**

Based in Germany, Moovel is an innovative new service from Daimler integrating a journey planning comparison tool with the ability to book journeys across the whole of the country.

It covers all public transport modes, private cars, as well as cycle share schemes, Car2Go – the leading German car hire service and part of Moovel - and mytaxi, the original taxi app and forerunner to Uber.

Moovel has also integrated their two Car2Go services (which combine car sharing for urban areas and car rental for interurban journeys) along with the Park2gether service to deliver a seamless whole journey mobility product.



### DriveNow
**demonstrating the principle of access over ownership**

DriveNow marks BMW's entry into the car-share market in a joint venture with Sixt. The service began in Munich in 2011 and now covers five German cities as well as San Francisco and most recently launched in north London at the end of 2014.

The service is targeted at spontaneous, short trips in and around north London and is competitively priced against other modes (such as Uber or a black cab) at 39p/minute and capped at £20/hour.

DriveNow provides members with access to a car on demand without the need for planning in advance and specifying a set time for booking as well as an all-inclusive service and complete flexibility for dropping off the car when it is no longer required.

[1]http://www.theguardian.com/cities/2014/jul/09/electric-boris-car-source-london-how-work-paris-autolib
[2]http://www.theguardian.com/cities/2014/jul/10/helsinki-shared-public-transport-plan-car-ownership-pointless
[3]http://www.businessweek.com/articles/2014-05-16/helsinkis-uber-for-buses-is-stuck-in-first-gear

# The Old vs The New

New technologies, ideas and demand from users' needs are jointly driving change in the transport sector.
>

We have already investigated the trends that are shaping the demand on the transport sector from customers, in response how is supply being influenced by new products and services?

One new technology often referred to is big data analytics - but what is it and what impact is it having?  Big data is quite literally the term used for a volume of data sets of such size and/or complexity that to analyse them and use them meaningfully requires much greater processing capability than standard database systems. So it is what you do with big data that matters, the power used to perform detailed analysis makes big data 'big', but the results you can get are telling.




WHAT CAN WE DO WITH IT?

HOW CAN WE MAKE IT?

HOW DO WE DO SOMETHING NEW?

**TECHNOLOGY PUSH** SUPPLY

**WEIGHT**

WHAT IS STOPPING IT FROM HAPPENING?

**MARKET PULL** DEMAND

WHY IS IT NEEDED?

WHO WANTS IT?

HOW MUCH ARE THEY WILLING TO PAY?

**SMARTPHONE OWNERSHIP**

**70%** OF LONDONERS REGULARLY USE SMART PHONE **TRAVEL APPLICATIONS**[2]

**201** **51%**

**201** **61%**

IN THE UK, THE NUMBER OF ADULTS WITH A SMARTPHONE

**24%** **44%**

IN THE UK, THE NUMBER OF HOUSEHOLDS OWNING A TABLET

YEARS TAKEN

76

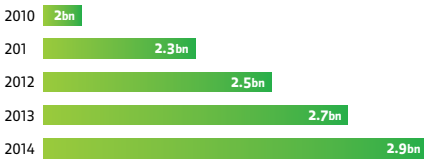
TO REACH HALF OF US HOUSEHOLDS

**DATA GENERATION**

**90%**

OF THE DATA IN THE WORLD TODAY HAS BEEN CREATED IN THE LAST TWO YEARS ALONE[4]

THERE ARE OVER **bn INTERNET USERS GLOBALLY**[5]




**Every minute of every day:**[6]

Google searches total **4,000+**

**227,000** tweets

**216,000** uploads

The volume of data now being generated is staggering but also of increasing value. Analysis can support much-improved decision-making as well as generating new market opportunities by creating completely new products and services not previously available. For example, an operating system for urban mobility has recently been developed in Mexico City to reduce the crippling congestion[2]. The system uses anonymised data from vehicles to monitor the movement of traffic around the city, allowing authorities to more efficiently manage the highway network by assessing congestion, identifying problems and understanding how traffic moves around the city - information is fed back to users via an app to help them plan their journey and to avoid congestion.

The key trend supporting the potential for big data analytics is the ongoing uptake of smartphones and other smart devices that generate usable data and at the same time open up new channels to customers. Location and navigation services can help people undertake their journeys more easily. Live network information can give people a clearer idea of whether the trains are on time or whether there is road congestion that may have an impact on their journey. At the same time, integrating data such as live weather information can help provide new services both to customers and to transport providers to help them predict and manage disruption more effectively.

[2]See http://audi-urban-future-initiative.com/blog/data-collectors-from-mexico-city-win-audi-urban-future-award-2014

[1]OFCOM, Communications Market Report 2014, http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr14/uk/
[2]Rode,Hoffmann et al. 2014) http://static.newclimateeconomy.report/wp-content/uploads/2014/11/Transport-and-urban-form.pdf
[3]https://twitter.com/robpvw/status/554642061149097985/photo/1
[4](http://www-01.ibm.com/software/data/bigdata/what-is-big-data.html)
[5]http://www.internetlivestats.com/internet-users/)
[6](http://www.domo.com/blog/2014/04/data-never-sleeps-2-0/)

# What does this new world look like?

The following case studies highlight how the transport sector is being opened up by start-up companies who are creating innovative new products and services such as Bridj's 'pop up transit' or Uber's take on taxis and lift-sharing.

Previously, new entrants into the transport sector needed significant investment in vehicles and infrastructure to even try to break into the market. However we now see a growing number of start-ups identifying new opportunities created by technology and entering the sector and disrupting long-established companies and practices:

- Journey planning and comparison can now be personalised and use a wider range of metrics and geolocation to deliver an improved, and more integrated, service to customers for example apps such as Citymapper, Moovit and Waze (see above);
- Tickets and fares can be purchased and used securely through smartphones and contactless bank cards, now even rendering smartcards obsolete. Increasing numbers of operators are now offering mobile ticketing and payment solutions in place of cash and paper tickets. For example, Transport for London are now offering contactless payment and have stopped using cash on buses;
- Live travel information is now more readily accessible with nearly all transport providers having their own services to provide customers with better information at the point of use. A popular development is train operators using twitter to communicate in real time with customers, Virgin Trains in particular have raised the profile of this new channel of communication between operators and customers[3];
- Further to engaging directly with customers through social media, sentiment analysis of customers' social media activity can highlight network problems as they happen in real time. This can help identify both performance problems and at the same time improve customer engagement. A good example is the commute.london service[4] which shows a live view of rail services by listening to the people using the railway and identifying the common themes and sentiment expressed;
- Transport authorities can undertake more sophisticated transport planning and asset management using data analytics, for example the partnership between Detroit DOT and Transit Labs.

While the transport sector has been able to evolve up to now, significant disruption has started to happen with a number of new businesses entering the sector and challenging the existing businesses to look again at how they operate. There are a growing number of challenges to existing products, services and operations. This has come about as opportunities in the transport sector have been identified for products and services that had previously been developed in other markets and that are able to transfer successfully into this market.



## Technology is also helping us to act differently and make new choices

It is not just new technology that is carving open the transport sector and bringing disruption. The collaborative (or sharing) economy is a recognised global phenomenon that has brought about new means of connecting people to share opportunities such as lift sharing, car clubs, bike hire and so on. This has emerged in tandem with the trend we identified earlier of access to mobility becoming a greater priority than ownership of a car or a long term (and expensive) season ticket.

In the past, such informal arrangements could only be enabled through existing relationships (such as commuting with a colleague), now the use of technology can enable much greater reach for sharing opportunities. This is often a more cost effective and efficient solution for a great number of people, evidenced by the growth in demand for such services.

[3]Virgin Trains have illustrated this with coverage of 3 incidents where staff on twitter directly engaged with passengers in real time – see http://www.huffingtonpost.co.uk/2015/01/06/toilet-paper-delivery-twitter_n_6423760.html and http://www.theguardian.com/uk-news/2014/feb/12/virgin-trains-tweet-passengers-abandon-travel-storm and http://metro.co.uk/2014/03/09/pleasehelp-virgin-trains-stop-service-after-tweet-from-passenger-4500226/ (and yes, that last piece refers to one of the authors of this paper!)
[4]See http://www.commutelondon.com/Commute/

## Uber

Set up in 2009, valued at $40bn in 2014: Uber provides a taxi on-demand service - with five distinct elements: UberX (value), Taxi, Black (mid-range chauffeur), SUV, Lux (high-end chauffeur) – as well as UberPool (ridesharing) and Ubercargo (taxi on-demand for goods).

One of the first taxi on-demand services and probably the best-known, it has reached over 250 cities across 50 countries and continues to expand rapidly. This expansion has come with controversy over driver earnings, surge pricing as well as multiple regulatory challenges. Ultimately Uber has been a trailblazer in showing how new technology and innovation can create new services that customers want and are challenging established businesses and regulatory systems to work out how to catch up.

## Shift

Recently launched in Las Vegas and looking to expand to other cities soon: Shift is a mobility-on-demand membership service.

Shift aims to eliminate the need to own a car by providing an all in-one journey planner and package of transport services – ranging from small city cars and high end vehicles to bikes and taxis. Users plan their journey through the app, which determines the best route and mode to use to reach the destination. If a car is the best option, then you can pick up a shared electric vehicle from the street or take a valet service. The service operates as a monthly subscription with users buying travel minutes.

## Transit Labs

Washington DC-based start-up: Transit Labs is a cutting-edge transport analytics company using data to pioneer a smarter public transport system.

By harnessing multiple data sources, Transit Labs has built a model that can report on over a hundred performance metrics which can be used to monitor a transport system and assess and diagnose problems in both real time and modelling scenarios. In 2014 Transit Labs partnered with the Detroit Department of Transportation (DDOT) to bring data visualisation and analytics, as well as cloud computing, to turn the public transportation system into a truly integrated and modernised 21st century regional transportation network.

## Bridj

Boston-based start-up: Bridj is an app-based dynamic bus service.

Bridj is delivering dynamic, data driven bus routes. Rather than static bus routes, Bridj uses big data and user demand to determine appropriate bus routings. Targeted at commuters, the service allows users to specify a start and end point for their journey along with an arrival time. The app then identifies an appropriate route, based on the needs of other users and allows the user to pay in-app. During the journey, the service monitors traffic and changes the route as necessary.

# So how is this changing the journeys happening today?

## TODAY



Wake up at standard time




Check work diary



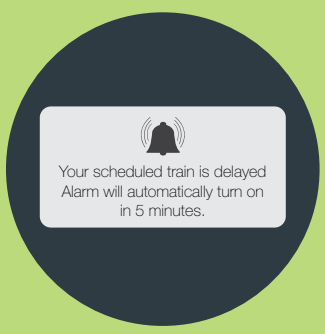
Walk to station, train is delayed and arrives packed




## FUTURE

Alarm automatically goes off 5 minutes early due to alert




Alarm gets alert to say train is delayed




Organiser recommends leaving earlier to catch a slightly earlier train than usual




Get to station and catch earlier train and get a seat




Get into city centre late for first meeting



Need to get across the city for second meeting, try to work out a walking route

Walk, get soaked in the rain shower and lost trying to read the map off phone







Get to city center early for first meeting




Need to get across the city for second meeting, planner checks weather and recommends best travel option

Organiser recommends bus as quickest mode of transport. Clear map and route is available and a discount code for a coffee on the way



# Mobility as a Service: Win-win?

Mobility as a Service can be defined as:

> The provision of transport as a flexible, personalised on-demand service that integrates all types of mobility opportunities and presents them to the user in a completely integrated manner to enable them to get from A to B as easily as possible.

## Mobility as a Service: Putting the customer in control

At the heart of MaaS is the enabling of every user to be able to choose how to undertake any journey, along with the flexibility to alter their journey if necessary while on the move. This is a key shift from the block provision of transport to a much more flexible and customer-centred means of providing mobility within a dynamic system.

To date, the ability to manage such a complex system in this way has simply been too difficult to do responsively and reliably. This has been due to the lack of the requisite channels to give customers accurate live information to help them make decisions while on-the-move.

The advancement of technology and its penetration into our everyday lives has opened up a raft of new opportunities to reshape the provision of transport and management of the transport networks in real time. This means that mobility opportunities can be provided in a much more personalised manner for every customer and can reflect their particular needs and preferences.

These mobility opportunities are also (crucially) available on-demand – the starting point is not a timetable and a map but the journey the customer seeks to make, whatever time and wherever it is, with the MaaS approach delivering the means for the customer to make that journey as they require.

## Changing behaviour

By using the MaaS approach of looking at the system as a whole, we can present a single unified platform for every customer. The range of transport options available and the complexity with which it is presented means that choices tend to be habitual and constant. For example, in a recent survey people were asked whether they could undertake a journey just as easily by switching from their car to other options for journeys of less than two miles. The results are striking: 33% agreed or strongly agreed that they could switch to making the journey by bus just as easily, 37% to the bike and 40% could walk[5].

This reliance on habitual behaviour creates a number of issues:

- Lack of flexibility: Customers commit to long-term behaviour ie purchasing a specific season ticket with minimal flexibility;
- Inability to adapt transport services to respond to demand changes: Operators and customers struggle to adapt to changed service patterns;
- Network disruption is very hard to cope with: In times of disruption the easiest thing to do is wait and complain, there is no system to help customers get around disruption on the network;
- It is hard to encourage people to travel more sustainably: car drivers will stick with driving.

These are the areas of opportunity for the MaaS approach. By providing an integrated service for customers, the task of getting customers to their destination can be more flexibly delivered. This is done by matching customers with live network capacity and performance. But for the customer, it is undertaking their required journey according to their individual preferences be that speed, cost or comfort; it is also to help provide alternatives when problems arise on the network.

[5]British Social Attitudes Survey, page 10

# What Mobility as a Service looks like for customers

Integrating the transport system as a whole in order to connect up the various modes of mobility and all related information is one thing but the customer requires a single interface with the whole network in order to easily understand their options for any particular journey. Our key aim for MaaS is to provide a simple, integrated platform for customers to use to be able to travel. A key part of this is how travel is paid for.

In this respect, we see mobility as analogous to communications and utilities. In particular, we have a vision that mobility will develop a model like mobile phones, which means that:

- Pay monthly and pay as you go options for travel – catering for all types of traveller, be they daily, occasionally, or visitors;
- Different service contracts will be used to target particular types of users such as commuters and students;
- Bolt-on extras will be easily available to supplement your service contract such as additional bikes hires, peak time trains or car club access.

These monthly service contracts could be developed further. We could use these contracts to incentivise particular behaviours such as time of travel, mode of travel - they could even be tailored to promote active travel which could be supported with public health funding. Likewise air quality and public health funding could support zero emissions transport over any form of polluting mode.

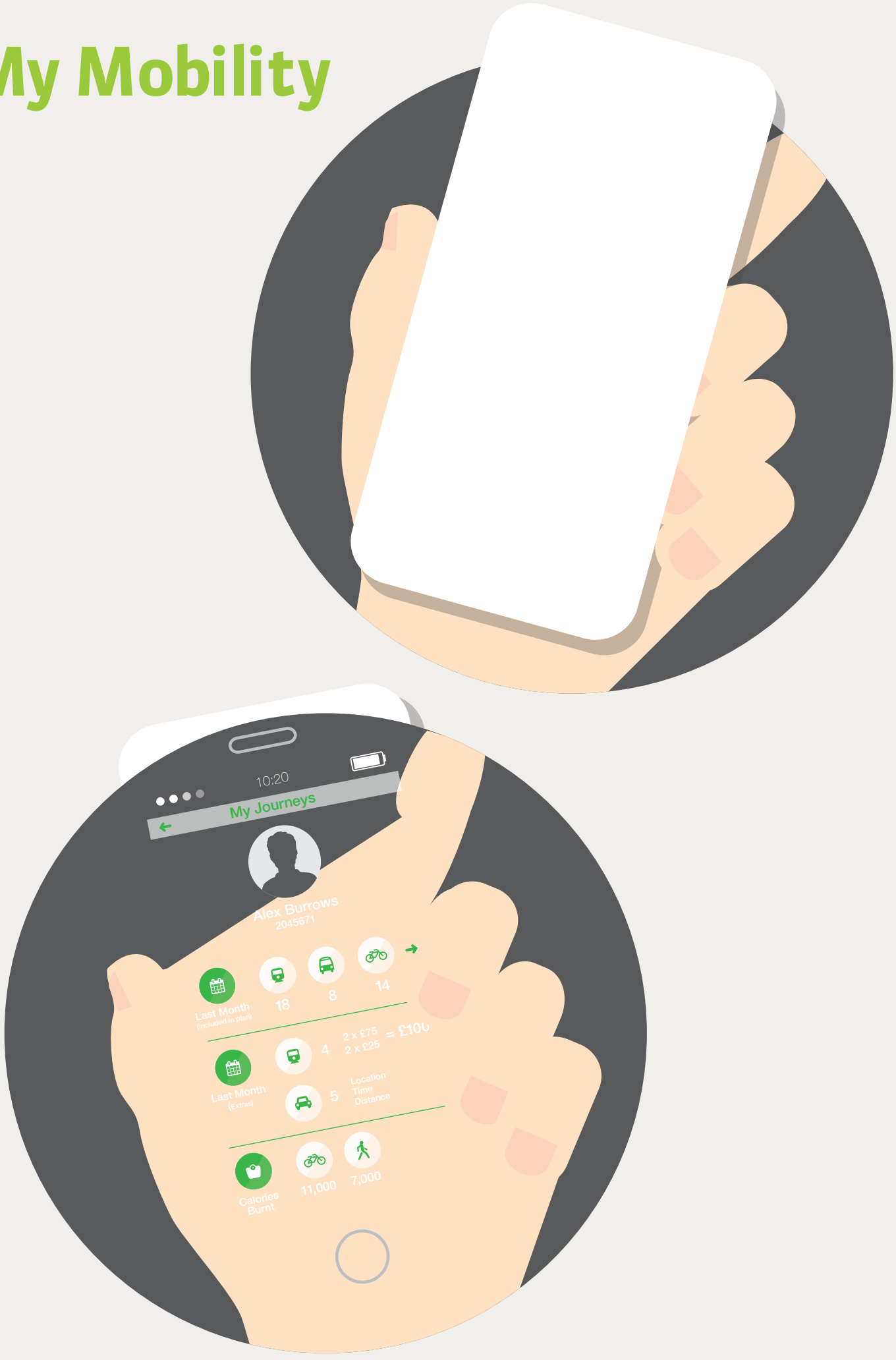
The ability to incentivise individuals through better knowledge and more effective channels for targeting of incentives is also key. Singapore has recently tried this approach with a trial of free and discounted travel on the metro before 8am for journeys into the key destination stations - the trial saw a 7% shift across from peak to pre-peak, illustrating the potential for incentivising behaviour change[6].

Another example of using incentives to change commuter behaviour was a successfully trialled in Bangalore in 2008/09. The aims of the programme were to reduce journey times and increase traveller comfort for bus commuters to a large technology company in the city whilst also reducing congestion, fuel consumption and pollution. To encourage commuters to travel at less congested time (i.e. pre-peak), an incentive scheme was developed whereby for each day a commuter travels outside the peak they qualify for a monetary reward, paid out through a raffle mechanism. Rewards ranged from Rs. 500 (£5) to Rs. 12,000 (£128). The more often a commuter travelled outside the peak, the higher their chance of winning a reward. The scheme proved highly successful, with the number of commuters arriving outside rush hour doubling and the average morning commute time for employees travelling by bus falling from 71 to 54 minutes[7].

There are a number of other well known examples of using cost to effect behavioural change with the money being used to fund improvements to the alternative, more sustainable transport options. These would include congestion-charging schemes, such as in London[8] and Milan[9], or the workplace parking levy in Nottingham[10].

[6]See http://www.citylab.com/cityfixer/2014/07/singapores-early-morning-free-transit-program-has-been-a-huge-success/374909/
[7]See http://web.stanford.edu/~balaji/papers/NetEcon_final.pdf
[8]See http://www.tfl.gov.uk/modes/driving/congestion-charge and http://www.london24.com/news/transport/london_congestion_charge_a_success_10_years_on_1_1936089
[9]See http://www.worldhighways.com/EasySiteWeb/HandleRequest/categories/traffic-focus-highway-management/news/milan-wins-prestigious-itf-transport-award-for-its-urban-road-pricing-scheme/ and http://www.sietitalia.org/wpsiet/WPsiet_Danielis_Rotaris_Marcucci_Massiani2011.pdf
[10]http://www.nottinghamcity.gov.uk/wpl and https://www.transportxtra.com/magazines/parking_review/news/?id=40098

# My Mobility


10:20
My Journeys
Alex Burrows
2045671
Last Month
(included in plan)
18
8
14
Last Month
(Extras)
4
2 x £75
2 x £25
= £100
5
Location
Time
Distance
Calories
Burnt
11,000
7,000

## Mobility as a Service




## Supporting wider social, economic and environmental policy goals

There is also the opportunity with such a system to recognise the wider public service of mobility as an enabler for a much greater range of policy uses. Additional public services and benefits can be integrated into this model, for example helping people into employment through subsidised journeys to interviews or enabling access to hospital or college to improve access to health and education services.

The MaaS model fits with the recognition of transport as a vital function providing the means for all of us to go about our daily lives – what is frequently referred to as transport being a means to an end.

The next logical step is to integrate our view of transport and mobility within a much wider perspective. If the MaaS model can help bring about beneficial behaviour change, then it can also potentially deliver greater changes to communities and sections of society rather than just individuals.

With the ability to enable individuals to make better choices about how to move about and to help us all move about, the MaaS model can also help provide more and better opportunities to particular transport requirements. For example, see opposite page:

→

These examples all share a number of common traits. They are all mobility requirements that do not fit easily with the commercial supply of scheduled, fixed transport services. The first three (access to health, education and employment) fit into a much wider social requirement where significant savings could be made for the public purse through a smarter and more integrated approach. The fourth one illustrates the point that where the demand is not sufficient, then traditional transport thinking and planning fails people and communities.

An integrated approach using MaaS thinking could start to open up the possibility for generating better outcomes by looking at how mobility opportunities could be delivered within a much wider context.

For example, parallel public transport services and feeder services could connect isolated communities with the public transport network or serve major trip generators such as schools and hospitals directly. In the alternative, these services could be generated by organisations or communities using the ideas and principles of the collaborative economy.

This could be particularly vital in addressing the question of how to ensure our vision of mobility-on-demand is available for everyone including the ageing population. There is pressure on community and voluntary organisations to continue providing a ring-and-ride service for users who are unable to take advantage of the public transport network as easily or who cannot drive. This is a huge potential market for mobility-on-demand services that could combine the principles of the collaborative economy with smarter use of technology to provide services to ensure everyone has access to the mobility opportunities they require[16].

# Mobility as a service

## Doctor and hospital appointments

The MaaS platform could integrate access to health by automatically providing a journey plan and booking to correspond with a health appointment when it is booked. Additionally, if the platform could also warn of any potential disruption to the user as well as warning the hospital or surgery if a patient is delayed on their journey, to minimise cancellations and the number of missed appointments.

MISSED APPOINTMENTS

2012/2013

**12m** AT THE DOCTORS'

**6.9m** AT THE HOSPITAL

ESTIMATED COST TO THE PUBLIC

**£162m**

**£108** PER APPOINTMENT[11]

## Helping people into jobs

The MaaS platform could be used to provide subsidised journeys and support to enable people to get to job interviews and for the first few weeks travelling to work by public or active transport modes. Centro have been active in this field, providing support since 2003 that has helped 13,000 people get back into work[13]. This sort of programme is vital, as research has found that 77% of jobseekers do not have regular access to a means of transport other than public transport[14].

**77%** OF JOBSEEKERS **DON'T HAVE THEIR OWN MEANS OF TRANSPORT** OTHER THAN PUBLIC TRANSPORT

## School transport

Term time travel could be actively supported in order to reduce the impact of the school run by providing better alternatives including walking bus clubs, lift sharing and school bus initiatives. At present the school run is responsible for 24% of traffic at peak times creating significant congestion as well as safety and public health risks. Sustrans found that if all schools used the interventions they are putting in place, this would generate a 14% reduction in car use which would equate annually to 167,000 fewer car journeys and a £66.2m saving[12].

AT PEAK TIMES **24%** OF TRAFFIC IS DUE TO THE **SCHOOL RUN**

**14%** REDUCTION IN CAR USE IF INTERVENTIONS USED

## Community and demand-responsive transport

Community and demand-responsive transport – by using new technologies, including data analytics, more flexible services could be delivered centred around user requirements. This could be particularly centred on improving social inclusion by providing new mobility opportunities for the elderly or isolated areas or other users with specific requirements that cannot be easily met by traditional transport interventions. The Bridj service in Boston (referenced earlier[15]) provides a dynamic transport service using mini buses and varying pick up and drop off locations to provide a hybrid between a bus and taxi service. A similar shared taxi solution using technology could be appropriate to connect communities flexibly and ensure they are connected to the wider transport network.

[11]See http://www.england.nhs.uk/2014/03/05/missed-appts/
[12]See http://www.sustrans.org.uk/press-releases/reduced-school-run-congestion-could-save-economy-billions
[13]See http://www.centro.org.uk/about-us/news/2014/workwise-expansion/
[14]See Institute for Transport Studies (2013) Buses and the Economy II: Survey of bus use amongst the unemployed.
[15]See http://www.bridj.com/#connect
[16]For more on this discussion, see http://www.citylab.com/commute/2014/04/why-ridesharing-way-bigger-deal-suburban-seniors-urban-millennials/8930/

## Improving the information available to policy-makers

The MaaS model can provide even more than just a vastly improved set of opportunities to improve the users' experience. It can provide a step-change in the information that policy-makers along with transport strategists and planners can use to understand user requirements and demand.

Traditionally, transport has provided a fixed level of supply (eg road, rail capacity) to meet a forecast of demand that has sought to understand and model a range of factors to predict the demand in future years. The opportunity with the MaaS model is to invert that link by tracking user demand in real time and optimising user experience by matching demand dynamically with the available capacity on the network. For example, the MaaS model would aim to encourage behaviour change by incentivising users to move to buses or bikes if rail services were reaching capacity at a peak time. Alternatively, incentives such as dynamic pricing could be deployed to encourage users to avoid peak time services and spread demand over a wider period of time.

This would generate huge quantities of data that could be used to plot how mobility is used, how well it works, how efficiently the network is being managed, how to plan for improvements and consequently how to prioritise work and, crucially, funding.

That data can also be used to demonstrate the wider benefits from improved mobility opportunities. As we saw earlier, lack of access to mobility can have significant direct and indirect costs to employers, to healthcare providers, to education providers, and ultimately to the public sector and society as a whole. This is starting to become more widely acknowledged – for example a recent report by the UK Government Public Accounts Committee stated that Education Ministers should intervene if transport policy acts as a barrier to further education, training or employment[17].

A more efficient transport network that is also generating clear, usable data would be able to prove the wider benefits of good mobility and show how additional value can be generated, for example by using health spending to support traditional transport interventions such as encouraging active travel.

It would work both ways. Businesses would also be able to take advantage of this improved understanding in order to improve their asset management, or scheduling and routing, or staffing.

Suppliers to the sector would be able to target products and services that could create real value for operators. The greater integration would enable innovation and collaboration as the focus shifts away from just providing services to the user and how to deliver mobility opportunities in the most efficient and effective manner.

> We are also very much investing in business intelligence. One of the things that we're learning out of the work we've done right now—and we have 16,000-odd bicycles on the streets—is how we are going to utilize that data to become much more effective as a company.
>
> Both in terms of the ability to present ourselves for sponsorship and other things of that nature, but also in the means and manner in which we're able to understand what works for our customers. And then finally how we utilize that data to be able to drive at the cost structure of what's there, so you become the most efficient and effective operator.
>
> **Jay Walder, CEO, Motivate (formerly Alta Bike Share)[18]**



[17] See http://www.transport-network.co.uk/Whitehall-should-intervene-if-local-transport-is-a-barrier-to-NEETs-MPs-warn/11312
[18] From http://www.citylab.com/commute/2015/01/a-conversation-jay-walder-the-man-running-motivate-the-nations-biggest-bike-share-company/384534/



# What can we expect in the future?

We are seeing a much greater focus on the term 'mobility' in its wider meaning – that of an enabler, as providing the means to multiple ends.
>

The debate is shifting, particularly in the context of cities (and smart cities), from the provision of urban transport networks i.e. buses, trams and trains, to a focus on what urban mobility means, what people actually require, and how a more considered and integrated approach could produce far better outcomes.

There are five key trends that are manifesting this shift in thinking and emphasis:



## 1 INTEGRATION AND CONVERGENCE

More modes are being considered as an integral part of transport networks - walking and cycling are now recognised as key parts of the whole system[19]; furthermore, there is recognition that the modes may start to expand or the distinctions become blurred such as bike- and car-sharing as well as with new services such as Uber, Lyft and Bridj.

## 2 USER EXPERIENCE

The user and their experience is now mission-critical. Transport is redefining itself as mobility and is centred around the customer rather than as a provision to the customer. This is a profound shift in emphasis brought about by an increase in information and the ability to share information, as well as by new business models becoming possible thanks to technology and a greater willingness amongst customers to try new things.



[19]See http://www.citylab.com/commute/2015/01/a-conversation-jay-walder-the-man-running-motivate-the-nations-biggest-bike-share-company/384534/



## 3 ACCESS OVER OWNERSHIP

Access to mobility rather than ownership of (and long term commitment to) the means of mobility is changing the landscape. The focus on customer experience and the new business models emerging in the transport sector have established a lot of new space for market entry where previously it was much more difficult. Customer expectations and requirements have changed with a greater emphasis on flexibility and on-demand services. Furthermore, the collaborative economy and technological developments will jointly enable customers to be more selective thus continuing this trend.

## 4 TECHNOLOGY

New technologies are now bringing significant disruption to the established transport sector. It is now possible to integrate journey planning across modes and to provide live, accurate information that customers can rely on. It is also providing new opportunities that are lowering the barriers for businesses and innovators to enter the transport sector.

## 5 SYSTEMS THINKING

The whole journey approach, centred around the user, is the underlying driver in these changes. Users themselves are now looking at transport as a whole network and understanding the full range of opportunities available in a more seamless manner. Technology is enabling tools such as Citymapper and Moovit to provide solutions that give users the ability to navigate the transport network more easily.

By tying these points together we can see how a range of concurrent factors are working together to support and drive these trends across the transport sector. The development, and uptake, of technology is supporting new opportunities for existing businesses as well as allowing new entrants to come into the transport sector. The customer now has greater access to better information as well as more channels for keeping informed and to communicate with transport providers as well as other customers. The transport system as a whole, and those who have a part in it, is becoming more integrated as we see a shift of focus from solely providing the supply of transport to focusing on what and where the demand is and how to cater for it more effectively.




## 1 Mobility as a service will create a new model for how we buy travel

Travel will be purchased using service contracts. Season tickets will disappear and fares will instead be paid for like mobile phones on pay monthly or pay as you go service contracts with bolt-on extras available to users as needed.



## 2 The transport sector will split in two

The transport sector will provide more and more integrated, customer-focused services and products. But to do this a distinction will emerge between customer-facing service businesses and the infrastructure and hardware providers supplying the capacity. The model of utility businesses is instructive, customers might have a monthly service contract with company A who may or may not be the actual provider of the service but is purchasing capacity separately from companies B, C and D as required. So the transport system itself could be seen as the equivalent of the national electricity grid with non-customer-facing businesses providing the supply of capacity and services; while customer-facing businesses detach themselves from service provision and instead focus on meeting the customer demand effectively and innovatively.

## 3 More new business models

Car manufacturers' primary customers will be themselves, or subsidiaries and other partners, who provide car clubs and car sharing schemes. This is already emerging with **Moovel** and the **DriveNow** scheme in North London.

## 4 The transport network, and the price of using it, will be actively managed

The transport system as a whole will be more actively managed and dynamically priced based on demand, measured in real time. By recognising that we have limited supply of capacity for travel at certain times and in certain places, there needs to be a greater emphasis on managing that capacity to best effect. This means using technology to provide dynamic pricing based on, for example, the level of congestion, capacity or air quality at a particular point or place in time. This should create better use of the network and free up more capacity by incentivising users to choose when and how to travel based on their various priorities.




## 5 The end of public vs private transport

Car owners and users will be better connected and integrated with the whole transport system rather than the current 'us and them' and 'war on motorist' approach. This will enable drivers to connect in with the much wider transport network. It also opens the door to connecting in road use with transport use more broadly and incentivising change.

# Future long term trends

So what does that mean for the future? We have identified seven long term trends that we consider will become norms for the transport sector:

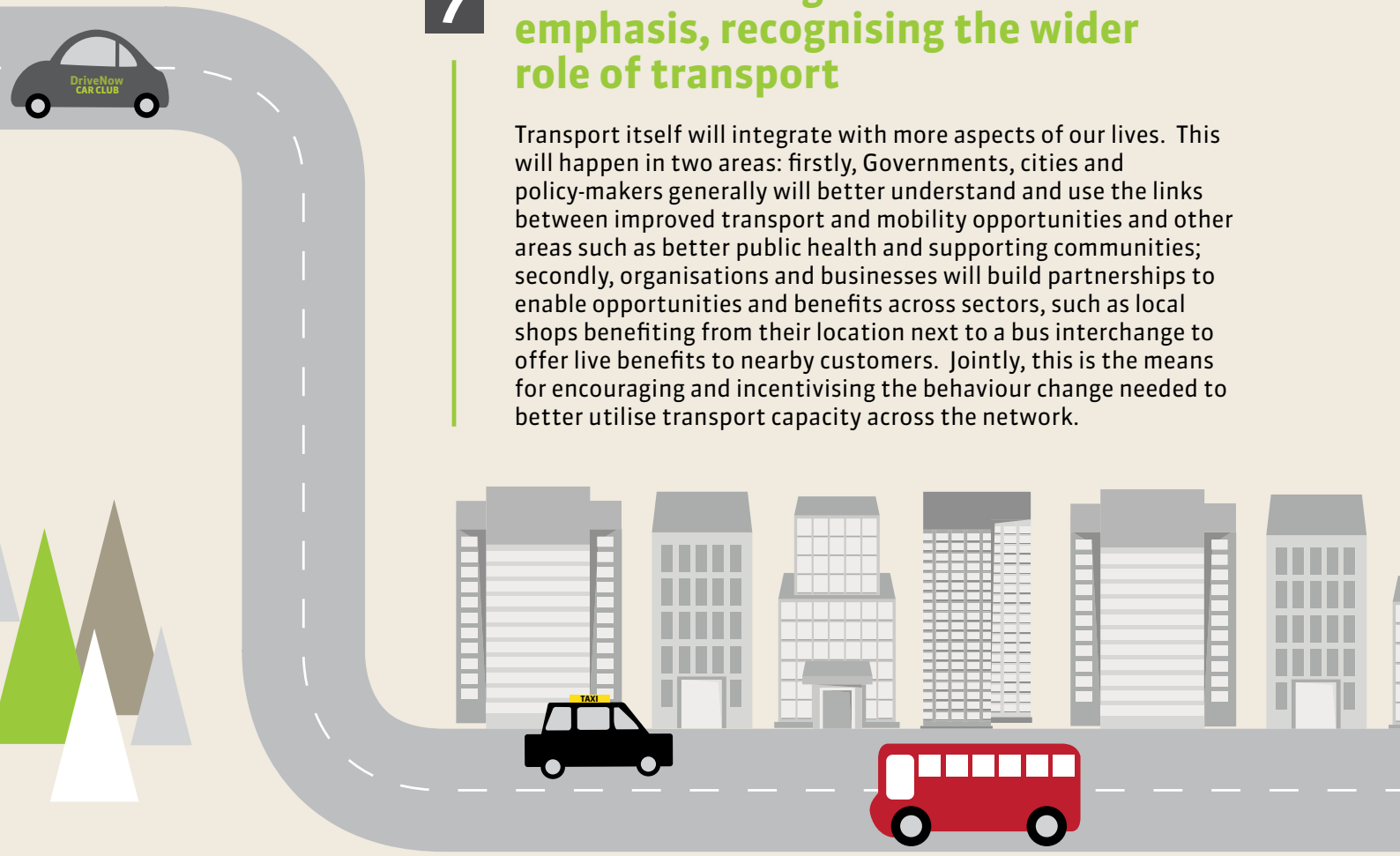
## 6 Convergence of different transport modes

Transport modes (i.e. bus, train, tram, taxi) will become more blurred as hybrid services develop that cross the distinctions between them. This will be reinforced by customer demand for flexibility that will see more emphasis on switching between modes as well as using the collaborative economy to greater effect.



## 7 There will be a greater cross-sector emphasis, recognising the wider role of transport

Transport itself will integrate with more aspects of our lives. This will happen in two areas: firstly, Governments, cities and policy-makers generally will better understand and use the links between improved transport and mobility opportunities and other areas such as better public health and supporting communities; secondly, organisations and businesses will build partnerships to enable opportunities and benefits across sectors, such as local shops benefiting from their location next to a bus interchange to offer live benefits to nearby customers. Jointly, this is the means for encouraging and incentivising the behaviour change needed to better utilise transport capacity across the network.



# Conclusions

The transport sector is at the start of a period of major change. As we see a much greater emphasis on the user experience and the corresponding integration of mobility opportunities, there will be more use of technology to generate the means for improving services and developing new products that meet the customers' requirements. The pace of change will accelerate as the sector goes through a period of significant disruption.
>

1. The transport sector will radically change – existing companies will have to adapt their services (like Daimler, Ford and BMW are already doing now) and new entrants will come into the sector using new ideas to introduce new mobility products and services.

2. This new mobility sector will provide better integrated services for users – across all types of transport and also beyond to wider services such as health, education and social inclusion.

3. Increasing use of smartphones and data will empower users to enjoy better services and a better user experience by providing much greater integration across the whole system.

4. A new breed of Mobility Service Providers will provide these integrated services for users – these companies may not provide any specific services directly but instead integrate the offerings available for the user to access the full range of available mobility opportunities as effortlessly as possible.

Mobility as a Service is the platform for bringing all of this together for the user. Perhaps the key to this is for everyone involved in the transport sector to focus on supporting the demand for mobility and understanding it far better instead of relying on the simple provision of traditional forms of supply to meet that demand. Customers are showing their enthusiasm for new approaches, the transport sector now has to step up and meet that demand.

# Atkins and Intelligent Mobility

At Atkins we are passionate about the role intelligent mobility can play in supporting a wide range of positive social, economic and environmental outcomes.
>

Intelligent Mobility is a new way of thinking about how to connect people, places and goods across all transport modes. It is about how we utilise a combination of systems thinking, technology and data across the transport network to inform decision making and enable behavioural change. Intelligent Mobility combines a strong focus on putting the customer at the heart of the service offering with the requirement of integrating all transport opportunities into a whole system.

Our team brings together a wide range of experience and knowledge from across the industry and covers four broad, strategic themes:

- Mobility as a Service – focusing on the customer-centric approach to mobility and how to deliver an integrated transport system;
- Data Exploitation – understanding how new technology can help us to analyse data to generate new insights and uses;
- Journey Management – looking at ways to deliver a more seamless customer experience across the whole journey;
- Roads of the Future – at the forefront of how autonomous vehicles and smart infrastructure will look and develop in the near future.

For any queries on Intelligent Mobility please contact **andrew.flood@atkinsglobal.com**

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ATKINS

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