

FROM CONNECTED PRODUCTS TO SMART LIVES: ARE YOU READY FOR A REVOLUTION?

This white paper examines the now, next and future of the Smart Home, Smart Transportation, Smart Manufacturing and Smart Health sectors.



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INTRODUCTION

Our world is changing. The products and the services we use every day are beginning to be transformed into smart, connected systems. Their language is data and they are starting to speak to each other. A revolution is in the air.

There is potential for these devices and the integrated networks to which they belong to help tackle some of the biggest global issues, from maximising food production to efficiently augmenting healthcare for ageing populations. The development and integration of smart devices into the bedrock of daily life can better optimise the use and distribution of the planet's resources.

However, to achieve the potential of a connected world, governments, policy-makers, regulatory bodies and businesses need to coordinate plans and consider collaboration at unprecedented levels.

Companies will have to make choices about the core nature of their business, what partnerships to pursue and the skills their workforce will require. They will need to understand that the most valuable thing they will produce is data.

This White Paper contains insights from senior directors and thought leaders at the cutting edge of the development of the 'Internet of Things' and includes commissioned research⁽¹⁾ on consumer attitudes to connected devices and smart machines.

Experts working in the areas of smart cities, housing, medical technology, transport and technology infrastructure provide their views on the opportunities presented by a networked world, the steps necessary to fulfil this vision and the obstacles that might prevent it ever being realised.

⁽¹⁾ YouGov online research undertaken between 14th - 15th December 2015 with weighted panel of 2076 GB adults.

— SECTION 01

THE BIRTH OF A NEW WORLD

SECTION 01.1

THE RISE OF THE SMART DEVICE

The term the 'Internet of Things' (IoT) was coined more than 15 years ago and is becoming reality as consumers and businesses acquire devices that can connect and deliver data for analysis.

Consumers are beginning to wear connected fitness monitors like Jawbone and install home heating management systems, such as British Gas' Hive. They are starting to embrace virtual personal assistants, from Apple's Siri to Microsoft's Cortana. **The average UK household now owns 7.4 connected devices with smartphones the most common internet-enabled device (1.7 per household).**⁽²⁾

Nearly a quarter of consumers in a YouGov poll recognised the definition of a 'connected product' when it was described as 'A digital product or piece of technology that is 'smart' and knows who I am/what I want'. However, an equal number did not know which description best fitted when presented with a list of possible definitions.

⁽²⁾ AB/PWC study

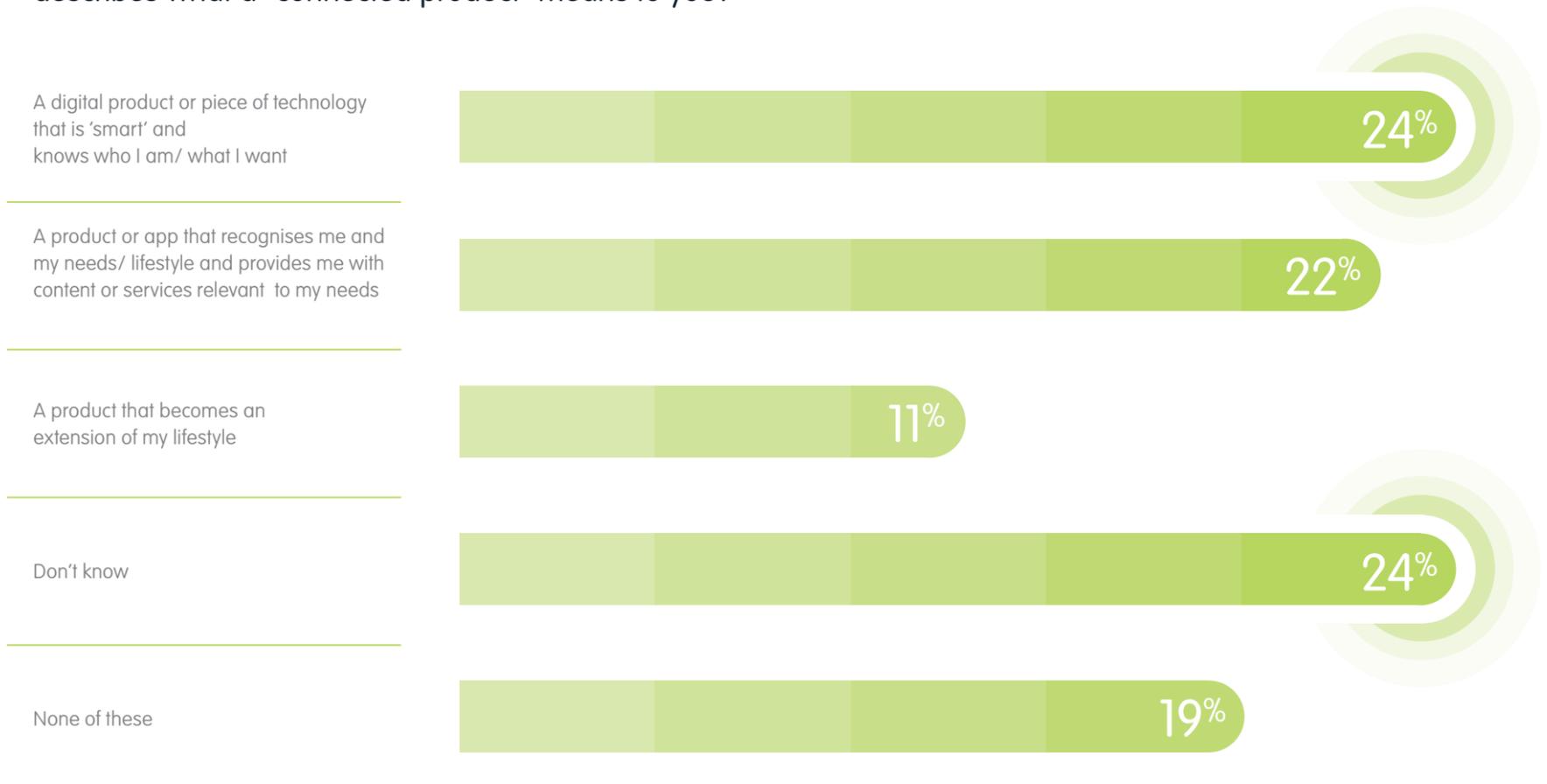
The Internet of Things is already becoming an out-of-date phrase for the description of a connected world. The internet is the channel over which devices can communicate but what makes an object 'smart' is the ability to gather and process data and to 'educate' itself to make decisions and anticipate needs.



For example, the ability to switch on the domestic heating remotely from a mobile app is clever but a truly smart home energy system would use sensors to identify if a house was occupied and raise or lower the temperature accordingly.

Integration of families of intelligent devices into systems will form the bedrock of the smart city concept being explored by governments, municipalities and private enterprise. Globally Gartner predicts 20.8bn connected devices will be in use by 2020⁽³⁾ and their ability to link with city infrastructure will change the way we live, work and move around our environment.

Q: Which ONE, if any of the following do you think best describes what a "connected product" means to you?



▪ SECTION 01.2

HYPER-CONNECTIVITY AND MACHINE LEARNING

We are now moving towards an era of 'hyper-connectivity' where billions of devices across the planet communicate with each other via Wi-Fi, 4G, Bluetooth and other protocols.



Technology that allows basic communication between devices has long been available. Retail has been using Radio Frequency Identification 'track and trace' technology to monitor inventory along the supply chain since the mid-1980s. These kinds of monitoring tools are being integrated into wider workplace systems and all the information gathered is being pumped into sophisticated data management platforms, with the aim of helping managers make better real-time decisions.

Machine learning, whereby smart devices adapt their actions due to the data they are fed, is already evident in the algorithms that drive the personalised recommendations Amazon offers returning customers.



▪ SECTION 01.3

BUILDING BLOCKS OF A SMART CITY

The huge growth in urban populations is presenting local and regional authorities with challenges in marshalling resources for power, housing, food distribution and transport infrastructure.



By 2050, it is forecast that two thirds of the world's population will live in urban areas.^[4] Africa and Asia are urbanising faster than the other regions and are projected to become 56 and 64% urban, respectively, by 2050.

A smart city holds the promise of reduced pollution, efficient management of resources and instant communications – even automated units that can respond to and repair damaged infrastructure without human command.

There are several countries pursuing smart city programmes including India and China. Nearer to home there is pioneering work being done in Santander and Barcelona in Spain and Tallinn in Estonia.

The UK has centres of excellence where smart technology is being trialled to see if it can enhance daily living and offer solutions to city-wide problems. Bristol, Manchester, Milton Keynes and Greenwich are among cities trialling smart city concepts and attracting investment.

For instance, Greenwich is part of a consortium with Lisbon and Milan granted funding by the European Commission's research and innovation programme Horizon 2020, while Manchester was recently selected as a UK demonstrator city for trials of new technology.

Local authorities are collaborating with commercial enterprises in their projects. For example, Milton Keynes is working with The Open University and BT Group to tackle the city's parking problem via a system that identifies free spaces and delivers the information to drivers via outdoor units and smartphone apps in real time. The aim is to minimise the number of new parking spaces the city needs to provide and to reduce polluting car emissions.

▪ SECTION 01.4

HOW DOES THE UK BENCHMARK?

Comparatively the UK is “significantly lagging behind” in smart city development, according to Dr Alex Bazin, Vice President and Head of Internet of Things at Fujitsu.

He says:

“This is partially due to our more mature infrastructure, which makes innovation more difficult; but there is also a lack of coordinated effort when compared to activities such as the Digital India Initiative. The UK Government should be ensuring that smart infrastructure is considered at the planning phase of every new development, be it a new town or a new hospital. At the moment these initiatives are often an afterthought, leading to increased costs and reduced benefits.”

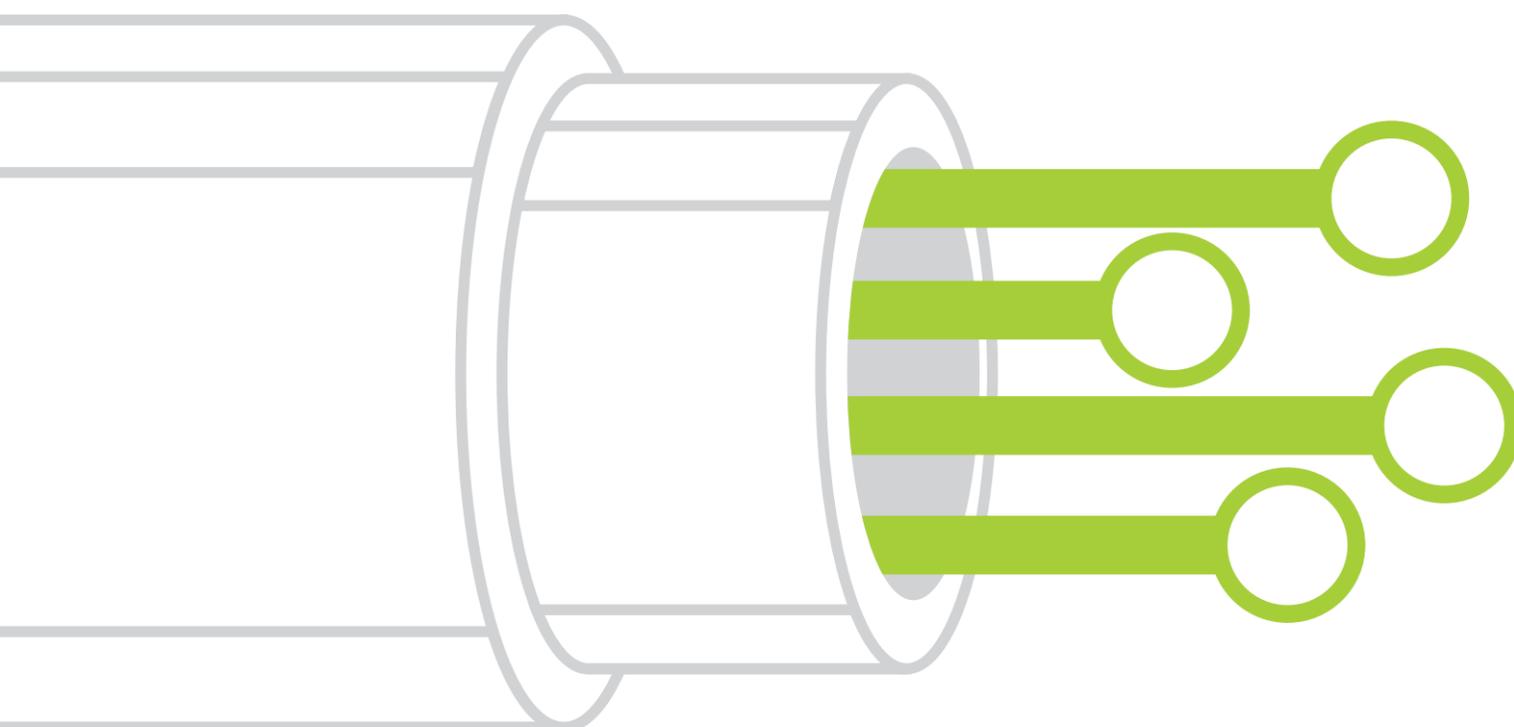
FOR THE UK TO BE GENUINELY COMPETITIVE KEY OBSTACLES NEED TO BE OVERCOME:

A. POOR NETWORK CAPABILITY

Fast broadband should be a given but this is not the case, with approximately 8% of homes unable to achieve speeds higher than 10 Mbps. The Government has said that it wants ultrafast broadband of 100 Mbps delivered to nearly all UK premises by the end of 2017 and there is an ongoing investment of £1.7bn for the national broadband scheme (BDUK).⁽⁵⁾

Mobile infrastructure needs a fast overhaul with an improvement in 4G coverage and preparatory work for 5G. In December 2014 the Government guaranteed mobile operators a £5 billion investment to help improve mobile infrastructure by 2017. Considering 4,500 miles of British roads have no mobile coverage, the size of this task is still considerable (source RAC Foundation).

However, research into other connected protocols may solve the broadband problem. Visible light is a much more efficient mode of transmission than radio waves with potentially a much bigger capacity. Tests of Li-Fi (Light-Fidelity) in Tallinn have achieved speeds of 1 GB per second, 100 times the speed of traditional Wi-Fi.⁽⁶⁾





B. INTEROPERABILITY

Delays in developing interoperability between systems will hinder business growth and the creation of valuable partnerships. Without 'open source' systems, automated devices will not be able to communicate with each other and share data. Analysts will not be able to extract workable insights to power innovation as they will be working with large data gaps.

Three of the big companies behind artificial intelligence software (IBM, Facebook and Google-parent Alphabet) all made available proprietary machine learning technology under open-source licences in 2015, so there is an acceptance of the requirement for integrated systems, although Apple is less receptive to sharing its technology.



C. DATA SECURITY

Data security on an individual and national level will be a priority. Consumers are becoming more aware of the value of their own data and also of the risks they run entrusting it to businesses. If the value exchange can be made clear, whether it be the chance of cheaper car or medical insurance based on personalised data or reduced energy costs, then there will be more chance of consumer buy-in.

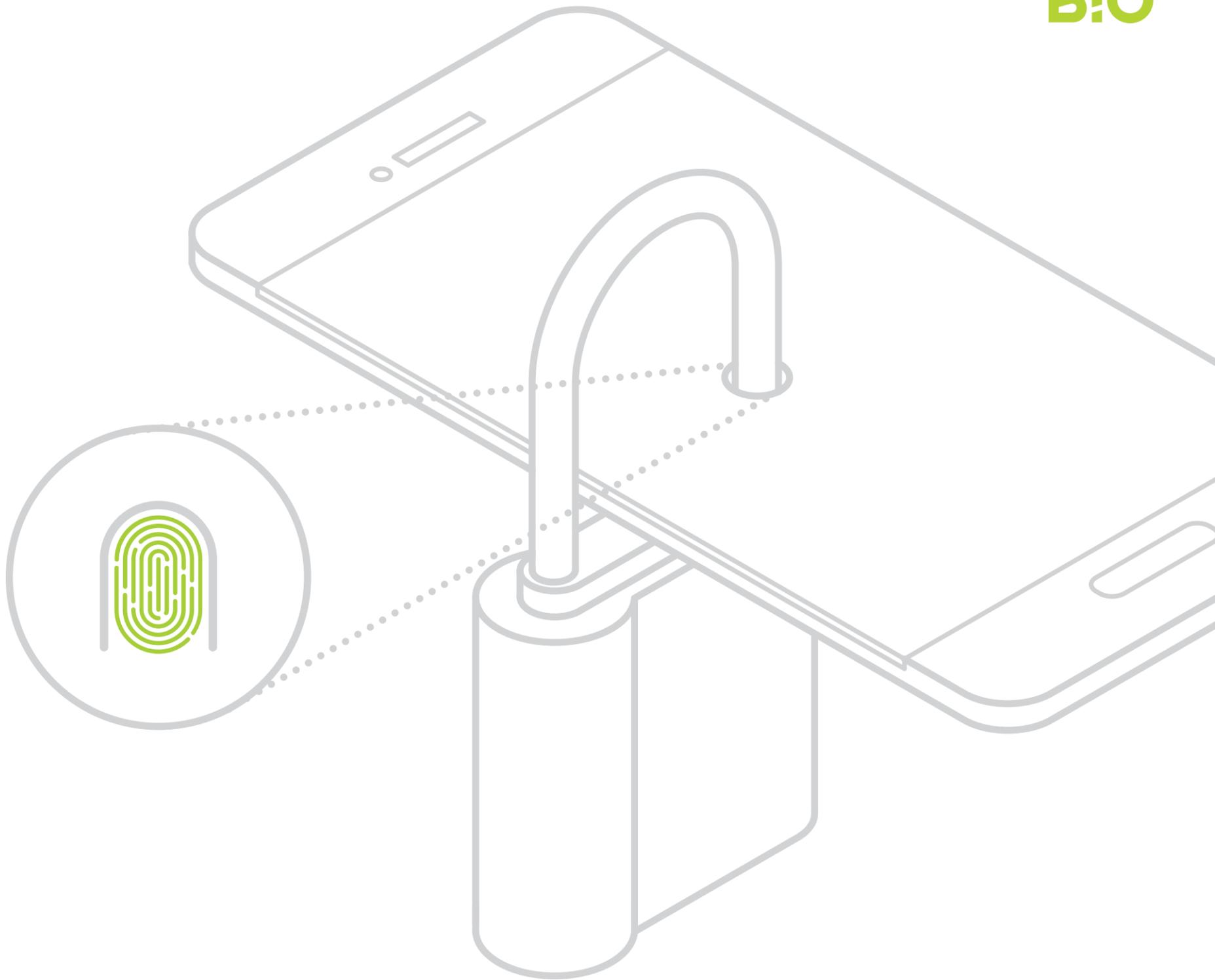
On the industrial level, sharing data between companies creates problems over who has access and 'leakage', while in terms of security, a smart city could be incredibly vulnerable to hacks of essential support systems.

“In terms of research and vision and intellectual property I would put the UK in the top quartile but in terms of roll out and expectations of infrastructure I think the government has set unchallenging and disappointing goals.”

Paul Copping, Smart Cities Adviser – Digital Greenwich

The big existential question regarding smart cities, even if they are achievable, is will people want to live in such sanitised, automated and monitored environments or will they prefer a place where some degree of chaos and creativity can thrive? Psychologists and anthropologists are already studying the impact of living in a smart city on how people behave and these learnings will need to be fed back into future projects.⁽⁷⁾

Hugh Knowles, founder and Director of the IoT Academy and Head of Innovation at the NGO Forum For The Future says: “Smart cities are not a goal – liveable cities are a goal. The goal is to have a great place to live where you can easily have access to the things you need as a functioning human being.”



“In Greenwich, we want to create a working environment where all the functions of a council can integrate and we can understand all the different functions. For example, a council truck is going to do its functional job but is also a safety threat and is also emitting polluting gases. We want to take every individual molecule of a city and build around it. The lorry, for instance, will feature on a number of different dashboards in different departments and the data can be difficult to join up. There are also lots of offset issues that cut across different areas of staffing and road capacity. We can begin to draw these things together for a better overview of resources and decision-making.”

Paul Copping, Smart Cities Adviser – Digital Greenwich

— SECTION 02

THE SMART WORLD:

AN EVOLVING REVOLUTION

- SECTION 02.1.1

SMART HOME:**INTRODUCTION**

Homes with hologram walls, robotic kitchens and interior micro-climate controls have long been a staple of science fiction and the first mention of a 'smart house' was made by The American Association of House Builders in 1984. However, with the arrival of smart devices and connectivity some of these concepts are within reach.

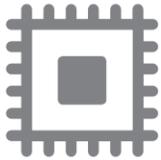
A smart home may have a heating system that analyses data on temperature and then uses the information to inform decisions on whether to vent windows or switch off heating valves. Equally, it might have simple water sensors placed on structures which wake up and fire a message to a monitoring system when wet to help guard against flooding.

The strategy for future housing stock will need to take into account high density living, environmental efficiency and lifestyle trends for more single occupancy dwellings.

SECTION 02.1.2

SMART HOME: HIGHLIGHTS AND HEROES

There is a new wave of micro-chipped gadgetry displayed at trade shows each year. Some of these are mere gimmicks but other devices may bring genuine benefits.



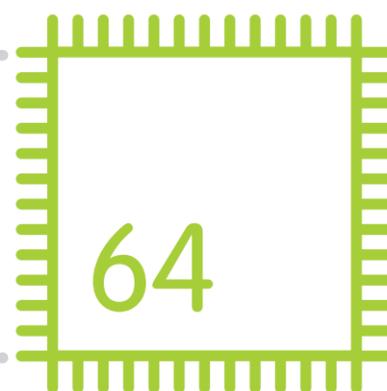
Pantelligent, the intelligent frying pan that connects to a smartphone app to let people know its temperature as they cook,^[8] is not likely to be an essential device. On the other hand, experts say heating control management systems like Hive from British Gas will drive mass acceptance of connected systems.

Companies will develop new iterations of their products that stretch into other functions, for instance the latest version of Hive now includes smart plugs so users can switch off lamps or music systems remotely and sensors that detect if windows or doors have been left open.

O2 UK is planning to launch a smart home platform to its 25m customers in summer 2016 that uses an AT&T software platform to bring together heating, power and home security management on a single system.^[9]

The home owner will be able to control a number of devices, from intruder alarms to smoke sensors, via the central hub and a smartphone app.

Time-saving devices that are able to sense when products are about to run out and can re-order automatically are also now on the market. Amazon Dash Replenishment Service is the next step from the current Dash Button and in beta. Businesses currently trialling the technology include Brita, with a water filter sensor that measures usage and will order a replacement filter at the right time.



^[8] <https://www.kickstarter.com/projects/hevans/pantelligent-intelligent-pan-cook-everything-perfe>
^[9] <http://www.ft.com/cms/s/0/bc2bd864-a972-11e5-955c-1e1d6de94879.html#axzz3wMzVezPQ>

SECTION 02.1.3

SMART HOME:

THE FUTURE
CONSUMER EXPERIENCE

As devices develop learning capabilities, the domestic landscape will transform. Management systems for heating, lighting, security and waste will develop personalised schedules for occupants that anticipate needs.



These separate sub-systems will integrate under a central domestic hub for optimum efficiency. Auto-repair should become the norm – upgrades will be downloaded automatically for security systems, while self-monitoring sensors will send alerts to repair centres if there are any physical problems, like a malfunctioning radiator. The call out team will know the exact right part to bring, saving time and ensuring their shifts are more productive.

However, experts do not expect a roll-out of standardised smart homes at an even pace across the globe, as individual countries will have different priorities. Some will want technology that focuses on helping elderly people live semi-independently, due to their ageing population demographic, while others may face a challenge regarding water resources so will focus on the technology that will better help manage water use in the home.



▪ SECTION 02.1.4

SMART HOME:

CHALLENGES & OPPORTUNITIES

The data generated by a connected home can help owners, local authorities and social housing landlords **cut costs and better manage capital investment**. For instance, social housing landlords generally put kitchens on a 20-25-year capital upgrade cycle. But if individual oven or refrigerator usage can be monitored and homes with lower rates identified, different refurbishment cycles could be deployed, **saving millions of pounds**.



Matt Leach, chief executive of housing solutions agency HACT and a co-founder of the Connected Home Consortium (CHC) says: “Landlords have to investigate how to move away from a model of reactive repairs, which have to be managed in terms of cost and are skewed to weekends, to predictive repair systems which are much smarter in the way they maximise efficiency of tools and people.”

The challenges to the development of the smart home include adoption rate of the technology, interoperability and consumer attitudes to releasing personal data.

The UK is only adding new housing stock at the approximate rate of 1% of total stock each year, so it will be the ‘retro-fitting’ of homes that will introduce technology. Leach says that landlords and consumers still need to be convinced of the benefits and that installation of a system “that manages a significant part of someone’s life, like a smart heating system, will have to be completely robust and glitch-free. This will hold people back for a little while.”

The number of rival systems on the market for home heating management illustrates the problems of interoperability. Alongside Hive, players include Google’s Nest, Tado and Honeywell. This problem can only be solved by manufacturers agreeing to link up systems via Application Programming Interfaces (APIs) or ‘middleware’ that can integrate ‘families’ of connected devices, or by one company coming to dominate the market.

However, Leach believes that consumers will eventually opt for trusted brands with scale and interoperability will be market-driven.

Not everyone will want their consumption patterns and movement around the home monitored. If the benefits in the form of cheaper bills and insurance can be effectively marketed then consumer buy-in for data-sharing is more likely. Leach suggests that tenancy agreements in the future could resemble the terms & conditions around data usage offered when people visit websites or sign up for social media.

“Go down the current ‘smart home’ shelving in any consumer electronic store or look on the websites and every single advertisement and picture is the same. There is a box on the wall and a hand holding a phone with an app. The extent to which the box will just be completely commoditised should not be underestimated – it is the sensors in the box and the value that can be driven by the innovation powered by the data that is important. The boxes are gateways into the home and businesses will succeed or fail on the basis of the services they can provide from the data.

The big jump will come when a property company is willing to bet on a roll-out of kit at scale. Then we can start innovating with data streams. It is not a straightforward decision to roll out 10,000 smart home management systems across housing stock but we might see steps made in 2017 and 2018. The problem is that we have not yet built a great business case – it will be a leap of faith for investors.”

Matt Leach, CEO of HACT and co-founder of the Connected Home Consortium

▪ SECTION 02.2.1

SMART TRANSPORTATION: INTRODUCTION

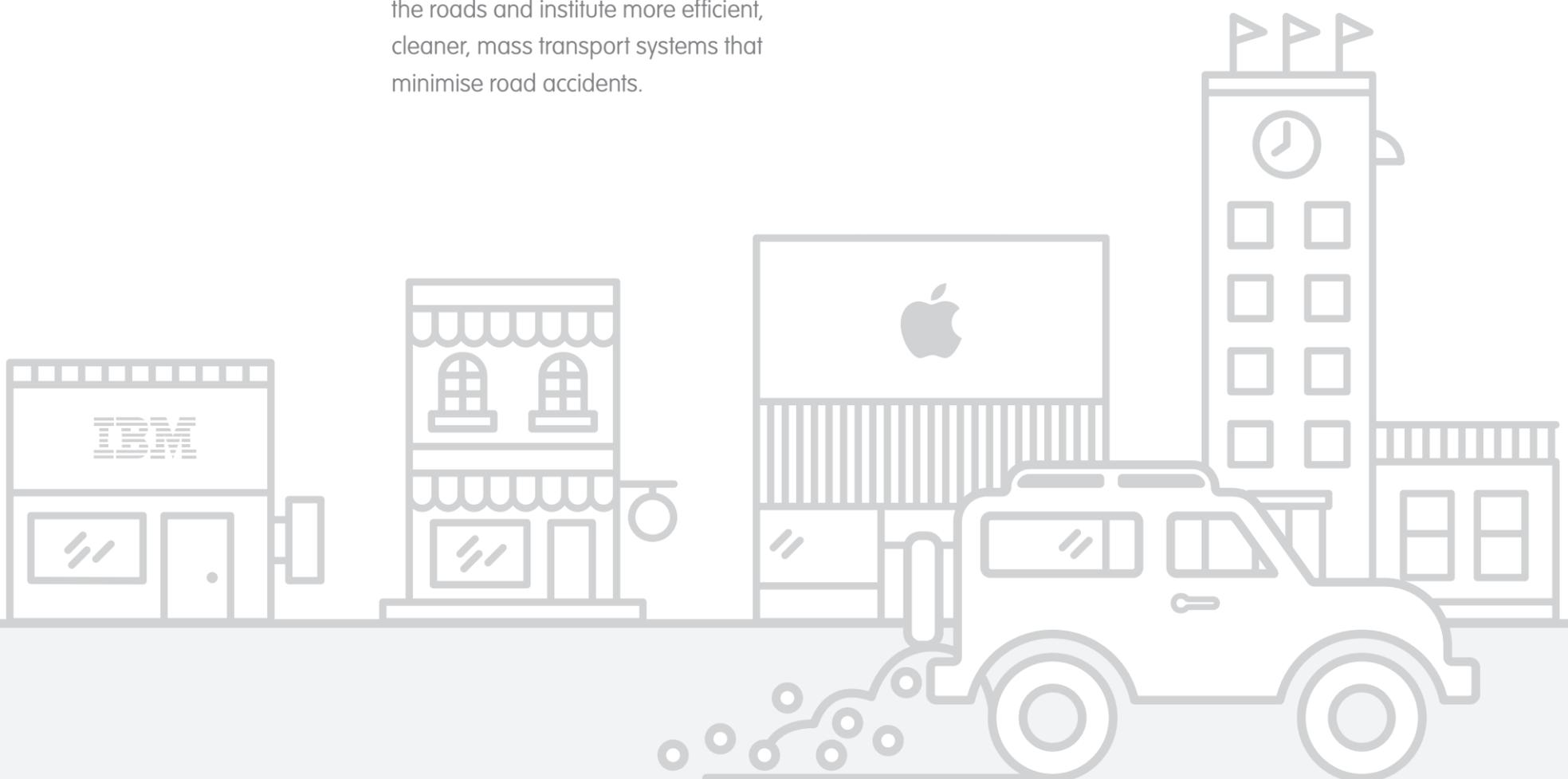
Congestion, gridlock and pollution are **growing challenges** for city authorities.



The top 10 most polluted cities in the world, as measured in particulate matter of micro-size,^[10] are all growing urban centres in India, Pakistan and Iran. In such environments there is a huge risk to public health, which in turn has an economic cost for health services and businesses.

The ultimate aim of any transport authority would be to remove cars from the roads and institute more efficient, cleaner, mass transport systems that minimise road accidents.

However, while car ownership remains a cultural norm, smart technology can vastly improve the driving experience and help associated businesses from replacement parts to insurance.



SECTION 02.2.2

SMART TRANSPORTATION: HIGHLIGHTS AND HEROES

The battlelines have been drawn between the car manufacturers and technology giants over **who will win out on the roads of the future** and connected technology is incrementally improving performance and self-driving capabilities.



Tesla is a pioneer of electric cars and self-driving vehicles. The company introduced a “fully integrated autopilot” system in 2015 that meets the definition of smart technology, as it offers real-time data feedback from the Tesla fleet, so that the system is “continually learning and improving upon itself”.

Tesla’s Model S functionality includes steering within a lane, changing lanes if an indicator is tapped and active, traffic-aware cruise control. There is digital control of motors, brakes, and steering to help avoid collisions and the car can scan for a parking space and alert the driver when one is available. It can also parallel park on command.

However, Tesla acknowledges this is not a true self-driving car system, rather it resembles the systems used by airplane pilots when conditions are clear. The driver is ultimately in control of the car.

Looking at public transport, data systems are already in place to regulate time periods between vehicles on, for instance, Bus Rapid Transit networks. For maximum efficiency and safety, such systems need to be able to communicate with each other – the bus, rail or tram networks need to be able to share data on traffic density, disruption to networks and energy requirements.

“Business will use technology to solve issues they are facing, but can also be extended to benefit consumer use. The use of tracking devices in buses is one of the early examples of this, enabling bus companies to track the movement of their vehicles which also provides timetable information at bus stops. A solution that has since been extended into mobile phone apps that customers can use to plan their journeys end to end in real time taking account of traffic conditions and integrated into wider travel alerts.”

Mark McCluskey, Head of Marketing – SmartTech, O2

SECTION 02.2.3

SMART TRANSPORTATION:

THE FUTURE CONSUMER EXPERIENCE

The self-driving car heads the project list and prototypes are being tested in real-world conditions. **Google dominates headlines** but other technology companies are also looking to develop such vehicles.

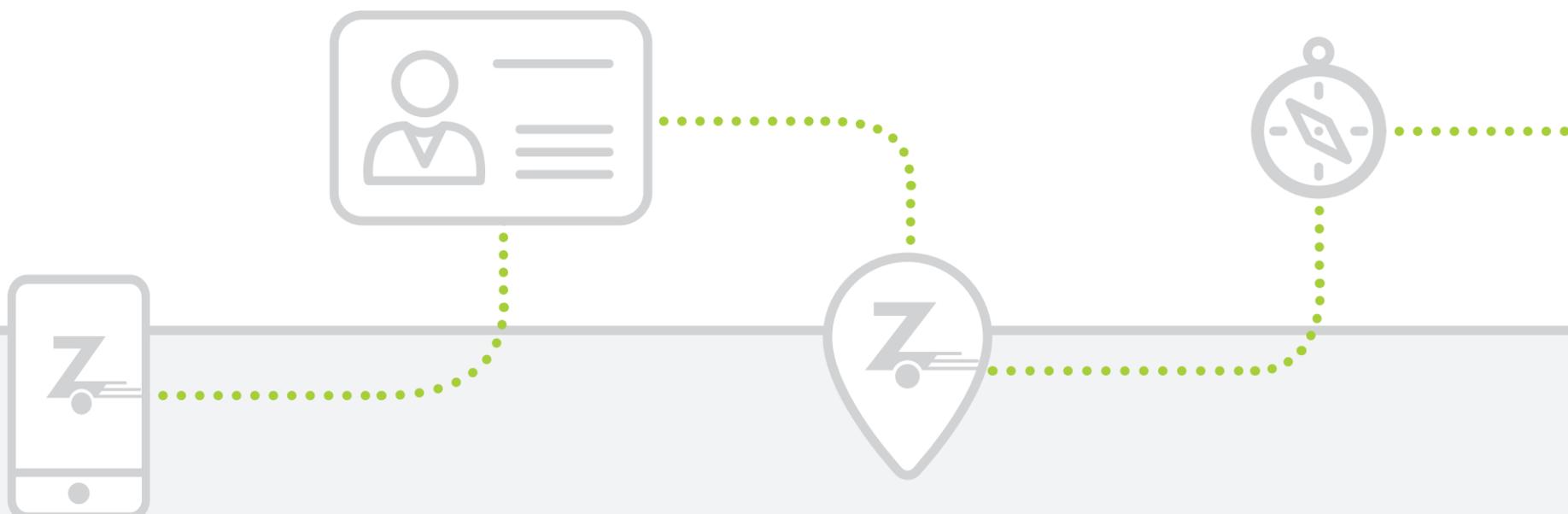


Google claims that its prototypes have sensors designed “to detect objects as far as two football fields away in all directions”, including pedestrians, cyclists and other vehicles, and that software programs process the data to make real time navigation decisions.

To add real value to the passenger self-driving cars will need to communicate with centralised transport management systems to share data on traffic density, road disruption and energy requirements.

The International Association of Public Transport (UITP) is leading an “Information Technology X Public Transport” initiative encouraging transport stakeholders to adopt working standards for a common IT architecture. The recently unveiled Alstom Attractis Tram system contains IT architecture with these open source standards so it can integrate with other transport networks. ⁽¹⁾

Interoperability across transport systems will also help with consumer adoption of new digital tools, such as Near Field Communications payment systems. Commercial partnership possibilities will also open up and operators can tap new revenue streams, such as advertising and sponsorship.



⁽¹⁾ <http://www.alstom.com/press-centre/2015/6/uitp-2015-alstom-launches-attractis-and-srs-two-major-innovative-urban-solutions/>

SECTION 02.2.4

SMART TRANSPORTATION:
CHALLENGES AND OPPORTUNITIES

Take-up of self-driving vehicles will be driven by trust in the on-board and networked systems. **Safety will be the number one priority** and the ability to take manual control of a vehicle in micro-seconds is likely be a deal-breaker for many.



There will be regulatory and compliance issues to tackle. Insurance claims will still remain for collisions but who will claims be lodged against? The car-maker? The systems operator? The passenger? All these issues need to be untangled.

Connected technology will make car-sharing and car-pooling schemes such as Zipcar and UberPool easier to use – passengers will be able to find vehicles when they want them and have instant data on the condition of the car, such as when it was last checked and its systems upgraded.

A smart city that can connect its various transport systems will be able to co-ordinate traffic flow management, divert or halt vehicles instantly due to unforeseen incidents and anticipate where maintenance works will be needed long before infrastructure deteriorates.



SECTION 02.3.1

MANUFACTURING AND HEAVY INDUSTRY: INTRODUCTION

The first real impact of 'intelligent' machines is being witnessed in manufacturing and heavy industry where **data is being gathered on efficiency, performance and quality of output**. This data can be interrogated to find ways of improving performance and to identify new opportunities.



Within industrial plants, sensors can be used to gather data on a company's own manufacturing machinery. Consistent monitoring will help identify when parts start to wear and need replacing before they completely deteriorate and cause expensive shut down.

On a broader level, forward-thinking manufacturing companies can commercially exploit data gathered in research & development or product testing by selling it on to interested parties or to develop projects in partnership with businesses from other sectors. Data can help a company to expand and diversify into other areas and ultimately position themselves as a service provider as much as a physical manufacturer.



SECTION 02.3.2

MANUFACTURING AND HEAVY INDUSTRY:

HIGHLIGHTS AND HEROES

Airplane engine manufacturers are pioneering the transition from their core businesses. Rolls Royce has a heritage in airplane engine manufacturing but has introduced a service brand called TotalCare. It does not sell physical parts but an overall management and maintenance package with costs based on a dollars-per-engine-flying-hours model.



GE Aviation is another company that has used data to optimise the performance of its products. Analysis of the information fed from sensors mounted on its engines has led to improved performance with the optimisation of factors such as fuel use.

These improvements deliver a benefit to its direct customer base of airframe manufacturers, who can in turn recommend strategies for maximising fuel use to their airline customers.

Mining is another heavy industry being transformed by smart devices. Rio Tinto launched its 'Mine Of The Future' project^[12] in 2011 that envisioned a future of autonomous trucks and drilling devices controlled by operators thousands of kilometres away and high performance computer systems that optimised the process of mineral recovery.

The company has been testing and introducing elements of this blueprint and reports that "the autonomous [truck] fleet outperforms the manned fleet by an average of 12%, primarily by eliminating required breaks, absenteeism and shift changes."

Farming is also combining heavy machinery and automation in 'agritech'. Sensors are deployed across a variety of tools to determine, for instance, soil suitability or weather conditions and depending on the information, mechanised tillers and seeders take relevant actions. Automated farming mobilised on a mass scale can optimise crop yields and minimise wasted effort and misallocation of resource, such as expensive fertilisers.

^[12] http://www.riotinto.com/documents/Mine_of_The_Future_Brochure.pdf

SECTION 02.3.3

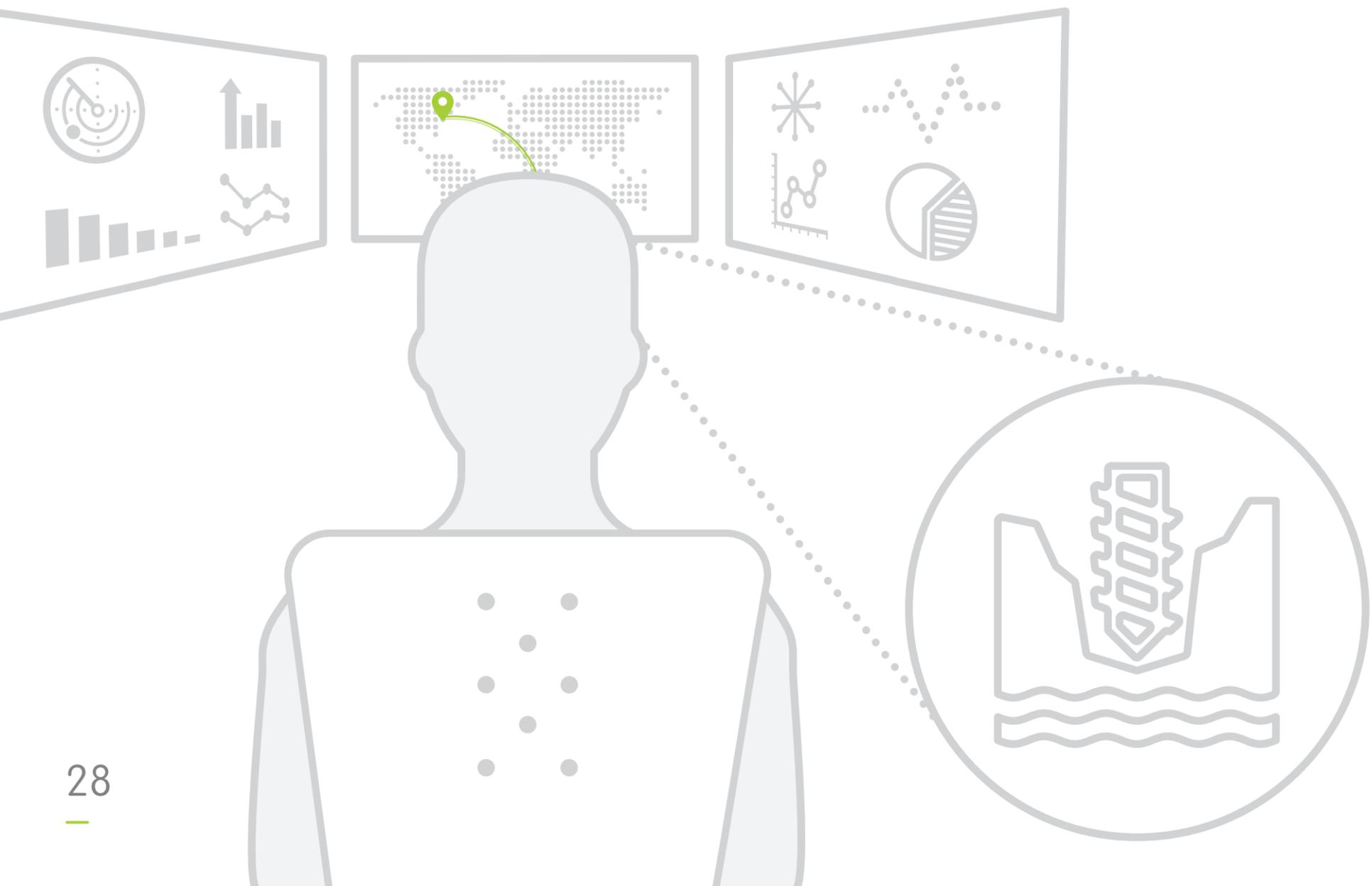
MANUFACTURING AND HEAVY INDUSTRY: THE FUTURE OF MANUFACTURING

Smart systems will eventually optimise all parts of the manufacturing process. Potential 'downtime' will be anticipated before it happens by workflow monitoring.



Rigorous application of efficiencies to the supply chain will ensure there is no shortage of basic materials and spare capacity will be quickly identified and outsourced to elsewhere in the company or other parties.

Auto-repair will become the norm. Machines will be able to self-diagnose problems, send alerts to the central repair hub and teams (robotic or otherwise) will be despatched with the correct part so no time is wasted in replacing and fitting.



SECTION 02.3.4

MANUFACTURING AND HEAVY INDUSTRY: CHALLENGES AND OPPORTUNITIES

The real business opportunities become apparent when companies **start identifying the value in their data** and how insights can help expand into previously unexplored services and products or be useful to other businesses and sectors.



Agricultural businesses will have valuable information on fertiliser effectiveness to feed back to chemical manufacturers or a construction industry will have information on the deterioration cycle of various building materials of use to housing developers.

This will present a new level of complexity in data and partner management and manufacturers will need to invest in the personnel and technology needed to pursue a 'manufacturing as a service' goal.

Interdependency will help establish international standards for technology and this in turn will mean innovations are more likely to be adopted. Ultimately there will be benefits for both small and large companies in shared research and data trading will become a large part of a company's revenue stream.

"I see the move from manufacturers into services companies as more of an opportunity than a challenge; the biggest constraints are developing the necessary business models. We're already helping many organisations transform their business models by the use of IoT solutions. For example one aircraft lifejacket manufacturer we work with has developed a service based business model enabled by smart asset tracking that gives them a predictable income stream and reduces the supply chain and spares holding costs of their airline customers."

Dr Alex Bazin, Vice President and Head of Internet of Things – Fujitsu

▪ SECTION 02.4.1

SMART HEALTH: INTRODUCTION

Average life expectancy is rising in most regions across the world, presenting new challenges in the monitoring and care of an ageing population and adding huge burdens to the cost of healthcare services. In the UK, the average life expectancy for women is projected to reach 100 by 2057 (Office of National Statistics). At the same time, there are increases in specific life-threatening conditions in some countries, many arising from obesity.

Connected devices that empower people to self-monitor and to avoid behaviour that could lead to illness will save money that can be reinvested in research and new treatments.

“We need horizontal and vertically integrated systems. Then we can see where people are and what is going on. Information needs to be shared. We are looking at how we can empower patients and enable them to take control of their care. That is the game changer.”

Shahid Ali, Professor of Digital Health – The University of Salford

SECTION 02.4.2

**SMART HEALTH:
HIGHLIGHTS**

To relieve the burden on healthcare services it makes sense to encourage people to change unhealthy lifestyles.



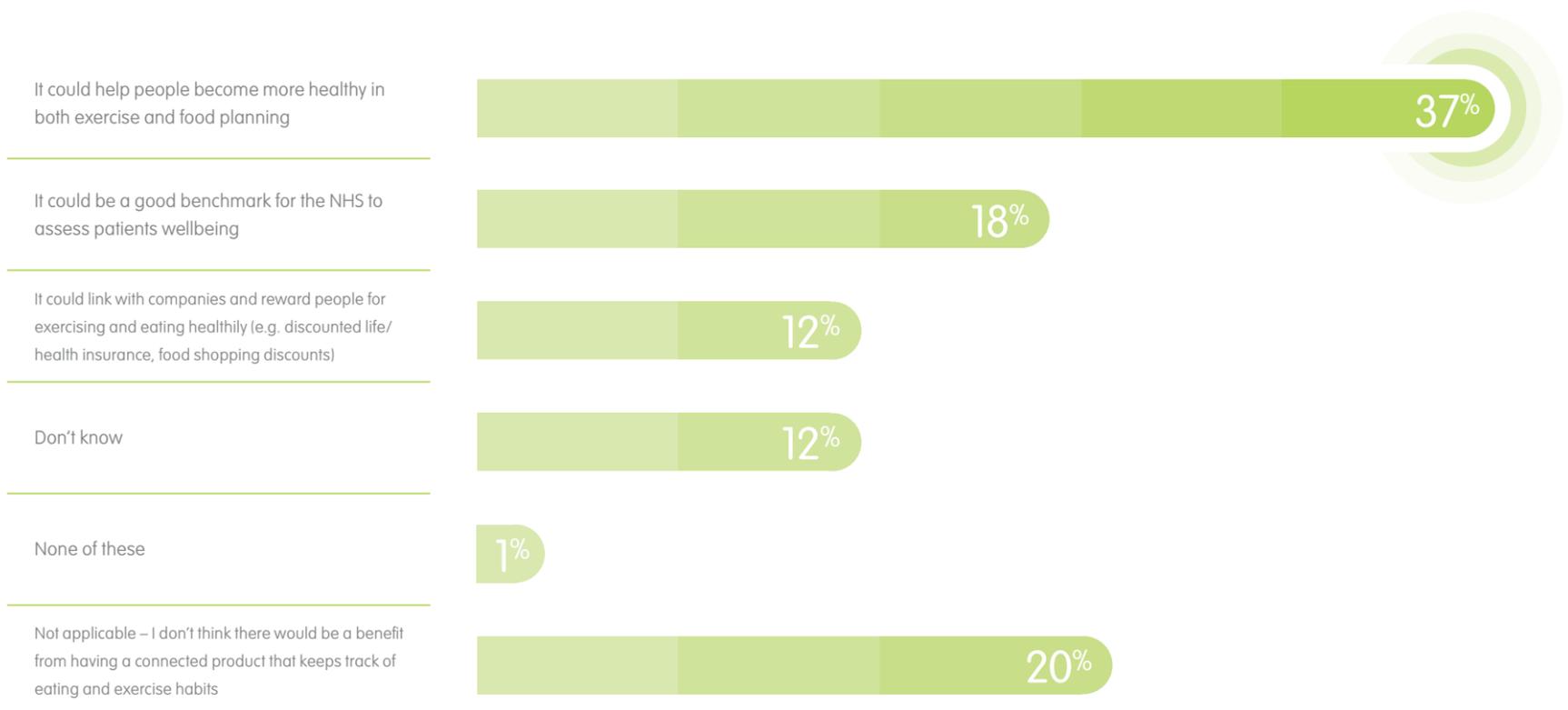
Rising sales of fitness-tracker wearables, like FitBit and Jawbone, to monitor factors such as heart rate and sleep quality could be helpful in this respect. Unit sales of health and fitness trackers in Western Europe were expected to reach 7.1 m in 2015 (source Statista).

NHS England has a library of health apps that it endorses and encourages patients and clinicians to use.⁽¹³⁾ However, there is debate among the medical community surrounding self-monitoring apps and fitness wearables, with worries about their reliability and user over-diagnosis and over-treatment.

Devices need to be of clinical standard and also affordable to the segments of society that would benefit most from their use if they are to make a genuine contribution to combatting illness.

When presented with a list of benefits that an eating and exercise monitor might provide 37% of the YouGov study opted for 'A device could help people become more healthy in both exercise and food planning' ahead of helping with NHS assessment of patients or sharing data with other companies for financial benefits.

Q: Thinking specifically about health and diet...Which ONE, if any, of the following do you think would be the biggest benefit of a connected product that kept track of eating and exercise habits?



⁽¹³⁾ <https://www.england.nhs.uk/2013/03/12/nhs-apps/>

▪ SECTION 02.4.3

SMART HEALTH: THE FUTURE CONSUMER EXPERIENCE

Monitoring systems that offer prompts to patients and check physiology and metabolism will **save professionals time and increase their productivity**. The first step is the development of useful apps that can help people with on-the-spot advice.



DietSensor ('The first nutrition coach with a sensor') is an app designed to work with the SCIO spectrometer sensor.⁽¹⁴⁾ The sensor can scan food molecules and deliver a chemical analysis. The app can deliver a breakdown of the amount of carbs, fat and calories because it accesses a database of previously-scanned foodstuffs for a match. It will also deliver health tips and advice on diet to the user. The database is currently being assembled and should be "consumer grade" by May 2016.

Diabetics are one group that can use the app to improve their lives. They need to monitor their carb intake to know how much insulin to inject into the bloodstream and errors can have serious, potentially fatal, outcomes. With accurate nutritional data they can make decisions on varying their diet to avoid illness. The DietSensor will send advice in real time to help and guide their choices.

DietSensor CEO and co-founder Remy Bonnasse says: "The point of the app is to give more feedback with less effort. Lots of apps do not give enough feedback or actionable advice. The user has all this data but does not know what to do with it. People who are not sick do not want to change anything. We aim to give advice based on evidence-based medicine but in simple language at the right time in the right situation."

In the future, Bonnasse sees bio-sensors being injected into the bloodstream and communicating with internal or external monitors. This could enable a truer blood-sugar reading for a diabetic than a finger prick where skin can block accurate results. Combined with, for instance, an internal artificial pancreas that secretes insulin, this could reduce the time lag between recognising blood sugar levels are dropping and the reaction of an insulin pump to near zero and prove a life-saver.

SECTION 02.4.4

SMART HEALTH:

CHALLENGES AND OPPORTUNITIES

The bigger picture for connected systems will be to help monitor the ill, old and infirm so they can live independently. Sensors will check movement in the home and send alerts if they detect inactivity or a fall. Vital life signs will be under automated scrutiny and alerts triggered if necessary.



The overall aim would be to move from 'one size fits all' patient monitoring to a more personal and productive service. GPs would identify patients who just need reassurance, those who need lengthier consultations and those who need to be admitted to hospital. Less serious patients living at home could receive scheduled, automated, messages of encouragement, while nurses could interact with those that need slightly more advice and specialists could intervene in more serious matters.

Experts identify two main challenges in overhauling healthcare services. One is encouraging commissioners overseeing budgets to invest in trials and the second is the requirement for a total cultural change within the NHS regarding attitudes to care.

Health data is also extremely sensitive and can have a direct impact on a person's work and financial prospects. Experts hope that the offer of improved treatment and the opportunity to contribute to a better healthcare system for all will be a powerful motivator to share data.

"In 10 or 15 years we will be in a completely different environment. It will not be the NHS as we know it. There will be a totally integrated system and there will not be segmentation of primary care, secondary care and community care – there will simply be care for the specific individual and the individual will be in control of what their requirements are. They will be served by the actual system and connected in such a way that efficiencies and productivity come at every single point. This will be all automatic and just be happening – it will not be something that 'needs to be done'."

Shahid Ali, Professor of Digital Health – The University of Salford

— SECTION 03

BRINGING THE SMART WORLD TO LIFE: JOHN THE CONNECTED

SECTION 03

INTRODUCTION

What will this future world look like? Let's try to imagine a typical day in the life of 'John, The Connected Citizen'.

In our and our children's future, what will this connected smart world change in our daily lives?

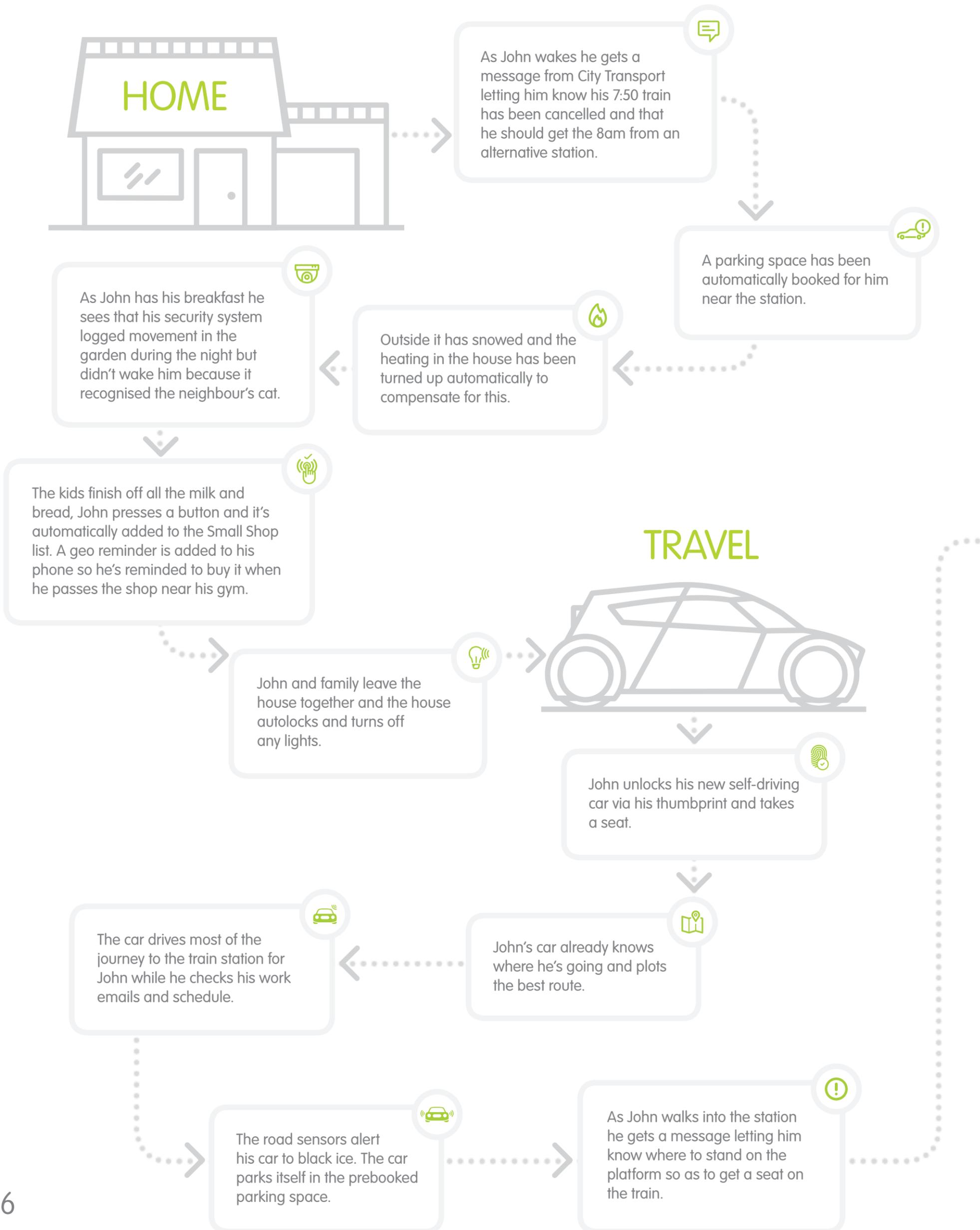
Will our commute to work be easier? Will the stresses and strains of urban life be smoothed away by our new intelligent data-led devices?

In the next pages John, our connected citizen of the future, takes us a on tour of a typical day in his smart life.

"A revolution is evolving. A smart connected world is emerging that will enable us to live better lives, to use our limited time more efficiently, to make more informed decisions and help us focus on the vital elements of our lives. Products will live longer and be more valuable to us, reducing wastage and environment damage. Services will be more personalised and personal through up-to-the-minute monitoring, delivering what we need, when and where we need it. The manufacturing and delivery processes of these products and services will optimised beyond recognition. This new world is real and coming soon, and will create massive challenges and opportunities for us as consumers, citizens, workers and humans. From connected products to smart lives, the creation of a connected smart world will be good for everyone."

Justin Small, Chief Strategy Officer – The BIO Agency

JOHN: THE CONNECTED CITIZEN



WORK

Once at work John needs to complete site visits across the main factories in his area. So he logs into the robots at each factory and conducts his site visit and checks, taking the time to interact with the employees as he does.



John also reviews the machine data delivered to him, seeing that new parts have been automatically ordered for the printing machines and engineers have been prebooked to install them by the system, reducing the chance of any down time.



His lunch has been auto-ordered for him by his health app which is planning his food intake helping him manage his diabetes.



A drone drops off the food and John scans it first with his smart phone before tucking in. The data is automatically sent to his personal trainer app.



John checks on the cameras at his dad's house but sees that he is fine, just doing his daily exercises.



During his lunch break he watches his son's sports day live on his smart phone. Afterwards John gets a message from his father's house alerting him to a possible fall.



After work John goes to the gym.



HEALTH

John does his session whilst his smart watch monitors his heart rate and blood pressure and sends the data to his doctor ready for his Skype monthly check up.



Before he starts his session he analyses his blood with his smart phone and gets his daily gym plan which is especially adapted to John's particular needs and food intake.



After the gym John walks to the station.



As he walks past a supermarket he gets a reminder to buy milk and bread.



On the train home John logs in to the home cameras and helps his kids with their homework.



He gets home, spends some time with the kids and then relaxes watching a new film suggested to him by his personal entertainment system.



— SECTION 04

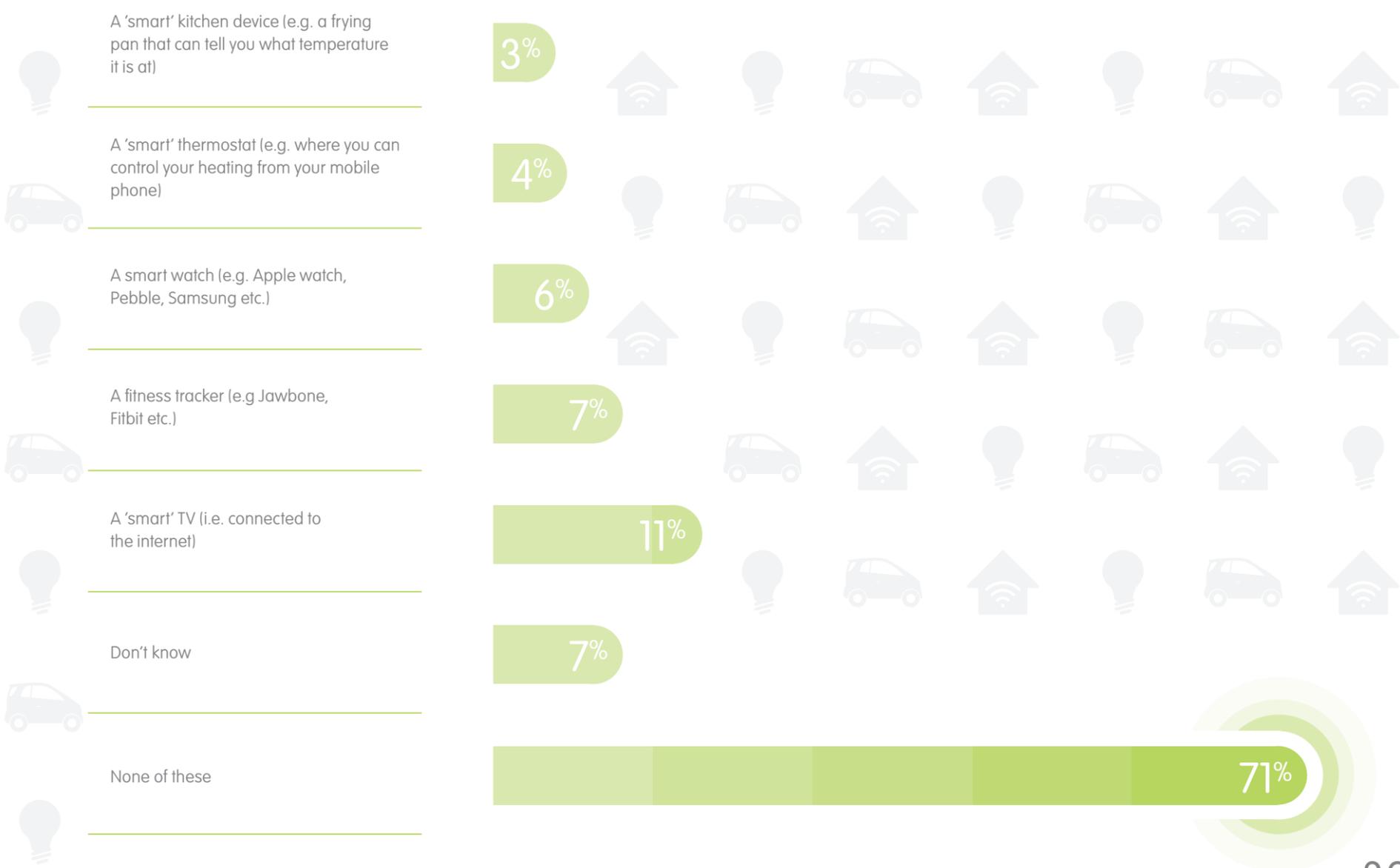
THE CONNECTED CHALLENGE & SMART OPPORTUNITIES



Technology companies may be enthusiastic about a connected future but senior managers and consumers may be less excited. A reality check is necessary; for example, a KPMG study of global automotive executives shows only 3% see self-driving cars as an “extremely important” market and two thirds do not see a significant breakthrough for 21 years.⁽¹⁵⁾

From the consumer perspective, take up of smart devices is slow despite media hype. YouGov research shows that when presented with a list of possible smart device and asked which they intended to purchase 71% said ‘None of These’. However, 7% intend to buy a fitness tracker.

Q: Which, if any, of the following products do you intend to buy in the next 12 months (i.e. between now and December 2016)? (Please select all that apply)



⁽¹⁵⁾ <https://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/global-automotive-executive-survey/Documents/2015-report-v2.pdf>

As Hugh Knowles, founder and Director of the IoT Academy and Head of Innovation at the NGO Forum For The Future, explains, the need to identify clear problems and devise genuine solutions should drive decisions and investment.

He says:

“The approach of the tech industry seems to be to make it ‘smart’ and it will work.

This will lead to a lot of disillusionment – we had smart fridges for 20 years. They were a bad idea then and are now – they are an idea in search of a need; no-one needs the level of functionality a smart fridge can offer.

Too many people are trying to solve incredibly niche first world problems that do not really need to be solved. All too often people are trying to make something fundamentally flawed that little bit smarter in the hope that someone will buy it. But there is an enormous amount of potential to do incredible things with the Internet of Things.”

Experts do not see smart cities springing up overnight but municipal authorities and private enterprise gradually adopting systems with aspects of **intelligent functionality**. This means there may be expensive mistakes but also that consumers gradually acclimatise to mechanisation and there is no ‘future shock’.

Data lies at the heart of the predicted transformational change and data ownership rights will have to be clarified. Companies will have to figure out their parameters for a fair value exchange with consumers.

Businesses need to **develop a vision for how they fit into the new world.**

Four questions businesses should ask themselves:

1

Do you want to transform into a platform that services the goods and products you sell or 'stick to your knitting'?

2

How will you build the data management systems and tech stacks necessary to collate and process data?

3

What smart functionality do you want to invest in, given a limited budget, to give you a distinctive strategic positioning?

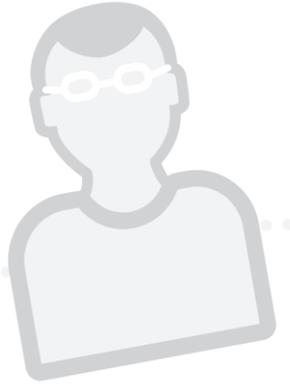
4

What kind of talent do you need to start recruiting now to help build your business vision?

Businesses that make the right choices will be winners.

Marketers will also see multiple benefits as the data derived from smart devices will give them **genuine insights** into how their services and products are used in the real world.

Companies will then be able to produce products and services that offer greater value to a customer over their whole lifetime. Segmentation and strong customer relationships will be enhanced.

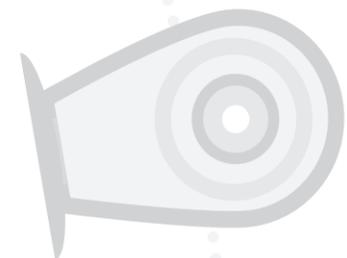


“The ‘Internet Of Things’ has already had a big impact on the suppliers of technology and the telco industry, however these industries will in many ways be the enablers of change. The change will come in stages as one industry has a knock on impact on the next, industries that move things whether that be products, people or cargo will begin to benefit from some form of tagging/monitoring.



As prices fall and this approach becomes more commercially viable this will expand rapidly. Stemming from this, industries that either supply or are fueled by information will begin to see the impact. The more devices and/or people that are connected, the more they will be able to make meaningful analysis and suggestions for businesses and users. During this phase the wider technology industry is likely to hit a second wave of transformation as more devices that supply and use data flood onto the market.”

Mark McCluskey, Head of Marketing – SmartTech, O2



“To achieve the potential of a connected smart world, governments, policy-makers, regulatory bodies and businesses need to coordinate plans and consider collaboration at unprecedented levels. Companies will have to make choices about the core nature of their business, what partnerships to pursue and the skills their workforce will require. They will need to understand that the most valuable thing they will produce is data, and that this data will enable them to become service providers if they so choose.”

Peter Veash, Chief Executive – The BIO Agency

— SECTION 05

CONCLUSION

Smart devices integrated into networked systems will become increasingly ubiquitous and permeate all areas of the personal, societal and business landscape.



- Consumers will be **empowered** and enjoy greater control over their own daily lives. They will be able to self-monitor elements ranging from energy consumption to health – and companies will have the opportunity to provide real time feedback and advice and embed themselves as genuine lifestyle partners.
- Citizens will see **improvements to services** and their environment as city infrastructure becomes technology-enhanced and public-private partnerships develop solutions for challenges including congestion and power supply management.
- Businesses will be able to use the data harvested from connected devices to **become more competitive** by streamlining processes, introducing efficiencies and identifying genuine points of difference. Real-time information on how consumers use products will help in improvements and new product development.
- Data and the accompanying extracted insights will have commercial value in their own right. Businesses will be able to **sell information** or work with partners on new projects. Ultimately, many companies will have to shift their business models as they move into new markets or become more focused on service provision.
- The obstacles that need to be overcome to unlock the potential of a smart, connected world include **better device and system interoperability**, growing consumer awareness of the value of personal data and rising fears over data security.
- Companies need to **reassure consumers** and potential partners by investing much more in updating security across all their systems instead of constantly repairing antiquated IT infrastructure. Positive sentiment towards data-sharing will be encouraged by the repeated demonstration of the genuine extra value that can be provided.
- The smart city will not materialise overnight but rather be built in **incremental steps** and doubtless a number of blind alleys and false trails will be constructed along the way. However, businesses need to start thinking now about their role and relevancy in a networked world.



ABOUT THE BIO AGENCY

BIO is an award-winning digital agency consulting and delivering on customer experience-led innovation and transformation. We are one of the only agencies in the UK that can provide an in-house, end-to-end service, spanning everything from business vision and strategy to service design, creative innovation and technical development and build. Defining ourselves as **Digital Change Agents**[®] we create experiences that are simple, seamless and intuitive, changing the way customers engage and buy from today's organisations. We work to redefine sectors, helping clients move ahead of their competitors and creating companies fit for the future.

Peter Veash – Chief Executive

Peter started out in direct and integrated marketing, but felt most comfortable when putting an idea through digital. He founded The BIO Agency, a pure-play digital agency, in 2006. Now a hundred strong it has grown to become one of the UKs most successful digital agencies. Peter champions omni-channel solutions and creates digital change in companies.

His key strength lies in understanding the required consumer experience with the ability to execute innovation. As a result BIO has been featured in the Sunday Times Tech Track Top 100, ranked 1st for creativity and innovation by RAR, 3rd for creativity by Econsultancy and 2nd for performance by The Drum.

Find out more

At BIO we work with clients to put them at the forefront of the digital revolution and believe that connected products can not only revolutionise the customer experience but will change our world for the better.

We'd love to share some of our insights and help you on your journey.

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