OLIVER WYMAN

THE INTERNET OF THINGS

DISRUPTING TRADITIONAL BUSINESS MODELS

EXECUTIVE SUMMARY

With the Internet of Things, or IoT, we're at the dawn of a new revolution, which could be compared with the digital wave that disrupted most industries not so long ago. For although digitalisation clearly created immense value for consumers, it was also very tough on companies unable to adapt quickly enough. So, how can we generate value in this new game?

The Internet of Things is everywhere. Wearables, or portable technologies, and other health-related accessories are among the first to come to the fore, such as bracelets, watches, bathroom scales, and others, with Fitbit, Jawbone, Withings, and iWatch. Objects like cars, tractors, suitcases, fridges, garbage cans – even the human body – are getting connected.

Yet machine-to-machine (M2M) interfaces are nothing new: they've been around for over two decades. So, what has changed? Significantly lower sensor costs, an explosive rise of connectivity, increased computing processor power, and miniaturisation of these components are all factors that augment innovation opportunities and hence the range of connected objects.

The figures speak for themselves: in 2008, there were as many connected objects as there were humans on Earth, about seven billion. The number of connected objects is expected to rise to between 50 and 100 BN by 2020, or annual growth of over 30%. The current value added by IoT is estimated to represent €400 BN, and should reach €1.8 to €2.2 TN by 2020, or five times what it is today.

But beyond the figures, the burning issue is how this value will be distributed. Who will benefit? One thing is certain: there will be winners and losers. How can companies avoid being disintermediated or attacked in their market by newcomers or incumbent players who manage to capitalise on the potential of IoT before everyone else? How can they avoid the establishment of de facto platforms able to capture data from several different spheres and thus the corresponding value?

The possibility of generating data, collecting it, and then using this information to create new services is opening up new potential not just for existing players but also for newcomers reinventing traditional business models. Who will be the Uber or BlaBlaCar of IoT?
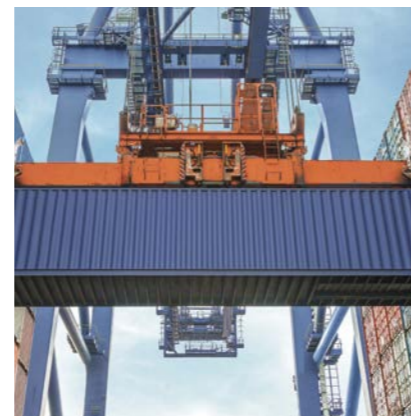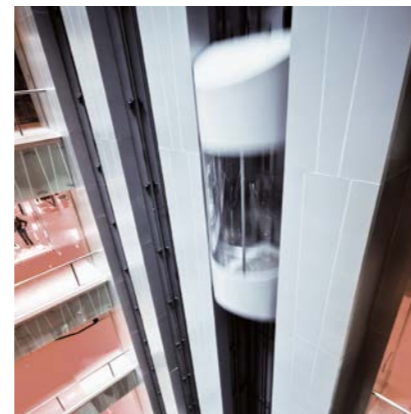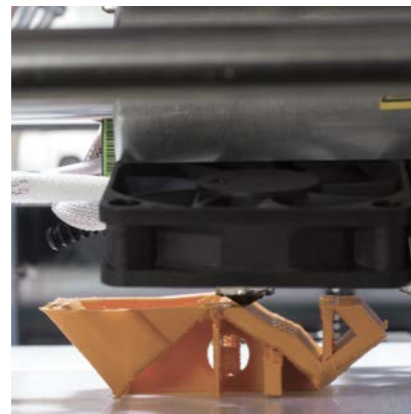
Is it so fantastic to imagine that Google could revolutionise the world of insurance? Could it aggregate key behavioural and lifestyle data collected through a powerful ecosystem of wearable objects and connected objects in the home and car, combined with data from the web, and relegate insurers to the lower value-added role of risk bearer?

Imagine a world where we no longer have to go to the supermarket or make grocery lists online, because groceries are delivered directly to us – according to our needs, which are identified from the data collected in the home by a connected refrigerator. Does this sound like science fiction? Think again.

The development of a data-based society will challenge traditional business models in a big way. In our view, four types of impact should be expected:

- **Impact 1.** The dividing line between business sectors and industries will shift and become blurred.
- **Impact 2.** New cross-industry ecosystems combining data from different sources will be established. Will this move us toward a monopoly situation or coexisting ecosystems?
- **Impact 3.** The Internet of Things will accelerate the establishment of services.
- **Impact 4.** Customer relationships are becoming hybrid and business-to-business-to-consumer (B2B2C) is growing fast.

Anticipating the disruptions, being an active player in these changes, and understanding new business models and corresponding ecosystems are the keys to getting the most out of the Internet of Things revolution.

DISRUPTING TRADITIONAL BUSINESS MODELS

IOT SCENARIOS IN NINE INDUSTRIES

DISRUPTING TRADITIONAL BUSINESS MODELS

EMMANUEL AMIOT

The Internet of Things, or IoT, is everywhere and the phenomenon is accelerating. Many industries will see profound effects on their historical positioning and business models. The landscape will be remodelled as new ecosystems emerge. Some players have already assumed their new position. Value will be created, but there will be winners and losers. So, to stay in the race, you urgently need to define your IoT strategy and anticipate future developments. In this first chapter, we describe the main impacts of IoT in terms of business models, data ecosystems, the migration of value toward services, and customer relationships. We then recommend an approach to define your IoT strategy based on a central principle: start with the end-to-end customer experience, and how they are using products, to redefine your new value proposition and corresponding portfolio of services before thinking about data and connected objects.

TECHNOLOGY IS AT A TURNING POINT

The Internet of Things (IoT) – Internet of Everything or Internet of Objects – is generating a buzz and making the front page. Wearables, or portable technologies, and other health-related accessories are among the first to come to the fore: bracelets, watches, scales, and other activity trackers (such as Withings, Fitbit, and Jawbone) are blockbusters. In the mass market, countless objects – cars, pressure-cookers, washing machines, refrigerators, light bulbs, utility meters, thermostats, suitcases, dustbins, drugs, and even the human body – are getting connected. The same applies to machine tools, vehicle fleets, planes, buildings, and many other areas of business and daily life (see Exhibit 1).

More than just trendy gadgets, IoT is triggering a real business model revolution, based on data and service. This shift will be faster than expected. However, we're not talking about just machine-to-machine (M2M) but rather multiple connections across machines, people, and processes. And we're no longer talking only about connections to smartphones or internet boxes but also about objects that can interact with each other and generate huge volumes of invaluable data, radically transforming services and relationships with users.

Exhibit 1: IoT revolution in different industries and spheres of life
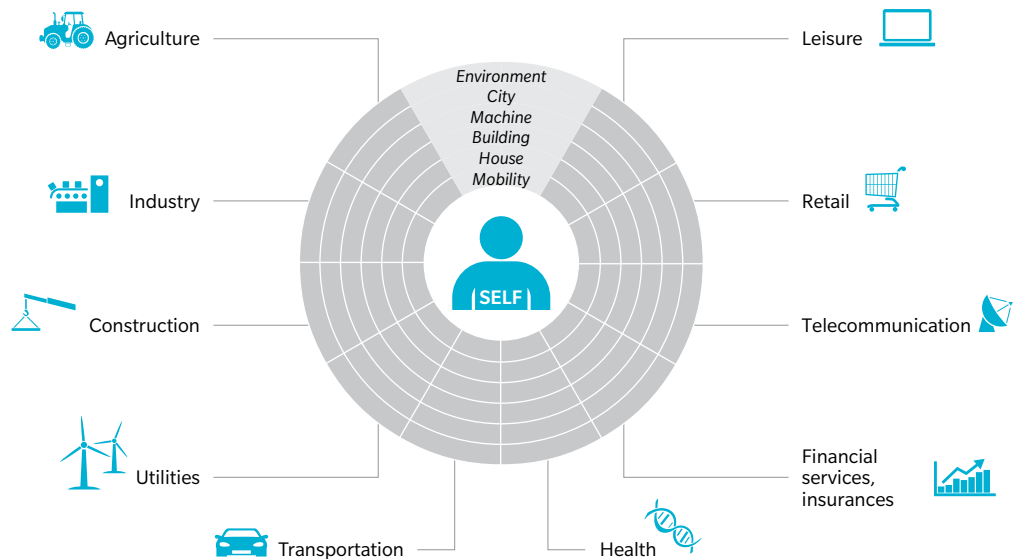
Source: Oliver Wyman

This is about new features that will change our daily lives at a dizzying pace as four essential ingredients come together:

- An object
- A smart component – with sensor, microprocessor, storage, software, operating system, and so on
- Connectivity
- Huge volumes of data

TECHNOLOGY CAN NOW BE ACCESSED AND INTEGRATED EVERYWHERE

Five trends are changing the game today (see Exhibit 2) and will accelerate the development of IoT and a more automated society, based on the generation and intelligent use of data in real time.

Significantly lower sensor costs. The average cost of a sensor is now €0.5, just half what it was a decade ago. This cost is expected to drop below €0.3 by 2020, even though sensors will still have all the

standard connectivity features, a wi-fi connection, an accelerometer, and so on.

Explosive rise of connectivity. There are currently about 1.8 BN 3G connections and 500 MM 4G. By 2020, 3G will have doubled and 4G increased fivefold as these figures rise to 3.6 and 2.3 MM respectively. Other forms of connectivity will also grow, including wi-fi, Bluetooth, ZigBee, LoRa (low-speed and low frequency connections, consuming very little power), as well as more proprietary protocols such as SIGFOX and li-fi (light-powered connection). Objects will communicate directly with each other, without necessarily passing through hubs. Between 2014 and 2018, the speed of connection will be multiplied by four. Starting in 2019-2020, 5G should be an important accelerator of IoT by enabling the optimisation of multi-network data traffic.

Increase in processor power. The computing power of processors will continue to double every 18 months. Moore's Law (predicting a doubling of processing power every two years) will remain valid but the appearance of quantum processors could accelerate this pace.

Miniaturisation of all of these components. Processors the size of a grain of sand (1x1x1 mm) – including a solar cell, wafer-thin battery, memory, pressure sensor, wireless radiowave component, and antenna – now animate objects. Cameras the size of a grain of salt, with a resolution of 250x250 pixels, are already available. Sensors the size of a grain of dust collect and transmit information on temperature, pressure, and movement.

Development of the "cloud". Cloud computing is giving access to almost infinite storage capacities, facilitating data integration and combining this data in megabases, thus enabling the distribution of virtual applications.

Exhibit 2: IoT technology trends 2014-2020

		IN 2020 (VS. TODAY)
Sensor cost		€ 0.3/captor
Wireless connectivity		Penetration rate of 4G multiplied by five
Processor power		x6
Miniaturisation		"Computers" the size of a grain of sand
Cloud, storage, data		x16 data volumes

Source Intel, GSA, GSMA, law Moore, IDC, ExtremeTech

MORE THAN JUST TRENDY GADGETS, NEW IOT APPLICATIONS ARE REVOLUTIONARY

The first IoT applications are already astonishing, whether for the retail or business market. The following are just a few examples.

Vehicle fleets are being optimised. Maximise vehicle fleet usage, increase the productivity of human intervention, reduce fuel consumption by at least 10%, redefine itineraries in real time depending on traffic and weather conditions: Orange Applications for Business and Océan (the geolocation specialist it recently acquired) are already offering these applications to construction sites, public works, retailers, utilities, and others.

Supply chains are being revolutionised. Instantaneous information as well as the combination of data from various sources (like temperature, humidity, verification when a package is opened, truck capacity utilisation, vehicle arrival time, and driver fatigue) make revolutionary applications possible. Caterpillar already does this, for example, by tracking driver eye movements and fatigue. Throughout the supply chain, players have started integrating IoT into activities such as planning, management of the last mile, and storage. Bobcat, for instance, increased the productivity of its connected forklifts by 20%, with a return on investment in just 18 months, while Amazon's Kiva robots are reducing the cost of preparing orders by 30%.

Smart cities are emerging. Optimised parking space management with real-time identification of free spaces has become a

reality, and smart lighting varies according to daylight intensity and movement. Traffic management can now be facilitated by a precise view of traffic flows in real time. Every big city is moving in this direction, from Barcelona (recognised as the best smart city in the world by Juniper Networks in 2015) to Nice, Amsterdam, and New York.

Smart buildings are producing tangible results. Selex ES solutions for connected buildings send out recommendations for real-time adjustments, identify inefficiencies, allow preventative maintenance, and reduce average energy consumption by 7%. Philips' LED lighting fixtures are connected directly to the Ethernet network and all have an IP address. So any user with a smartphone and IP address triangulation can be geolocated by the lighting fixtures and thus control their immediate environment (lighting, temperature, and so on). Facility managers receive real-time information on building occupation, and cleaning staff know which offices have been used since their last visit.

The connected factory is becoming a reality. We are witnessing the emergence of a new generation of production lines and smart robots able to react to information received in real time. Details such as order status, characteristics of materials entering the production line, and status of other machines enable production systems to adapt their parameters in terms of pace, quality, descriptive labelling, packaging, and signage. SAP and Festo AG are already developing production lines that can produce either remote-control units or cellphone cases on demand, using the same plastic cases. The improved synchronisation of production lines and the resulting reduction in downtime is reflected in 10% lower energy consumption and 40% lower customised production costs.

IOT STATISTICS ARE ALREADY IMPRESSIVE

In five years, there could be five times more connected objects generating 50% more value.

In 2008, the number of connected objects equalled the number of humans on Earth, that is to say about seven billion, each object being equipped with multiple sensors.

Up from 15 BN in 2014, it is estimated that the number of connected objects will rise to between 50 and 100 BN by 2020, or annual growth of over 30%.

Every second, 80 new objects connect to the internet for the first time.

The value added by IoT is estimated to represent €400 BN. This figure is expected to rise fivefold by 2020 to reach between €1.8 and €2.2 TN.

Data volumes will explode. In 2008, IDC estimated that the internet contained 800 BN gigabytes of data. This is barely the amount that 20 homes will generate in 2020. The brain of the mouse was modelled in 2014, and forecasters estimate that even the human brain will be modelled by 2030. The pace at which data is generated is phenomenal. It should also be noted that 75% of data will not be structured, and that 40% will come from sensors.

The share of IoT in global gross domestic product (GDP) should rise from 1.5% in 2014 to 2.1% in 2020.

Planes are getting connected and are optimising their routes and fuel consumption. Flight Efficiency Services is the operational predictive maintenance and optimisation system established by GE. A multitude of sensors compile and analyse engine performance data to optimise flight and maintenance processes. Alitalia, for instance, reports fuel economies of 1.5% for its connected planes.

Shampoos are closely tracked. Manufacturers of consumer products, such as L'Oréal, are integrating more and more radio-frequency identification (RFID) chips into their products. Inventory management is improving in productivity and responsiveness. Manufacturers are starting to understand their product flow better than retailers do.

Retail is getting connected to help shoppers. In Lille, Philips LED lighting fixtures guide shoppers through supermarket aisles based on their shopping list. Carrefour's C-Où ("Where is it?") application helps customers build their shopping itinerary based on the products they want to buy.

Preventative healthcare is becoming a reality. The Withings bracelet is a gadget opening the door to personal health. Employee health and well-being services are developing at record speed.

Industries like agriculture are, contrary to popular belief, at the leading edge of digital technology. Sowing is optimised and crops are treated based on weather forecasts, fields needing fertiliser are identified by infra-red systems, and weeding and harvests are mechanically assisted.

Exhibit 3: IoT trends

NUMBER OF CONNECTED OBJECTS
IN BN (2012-2020)
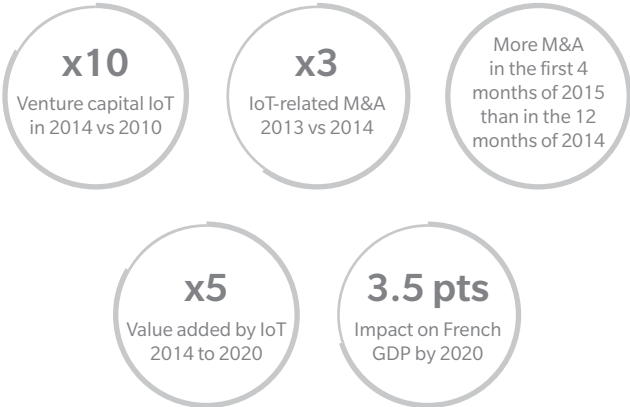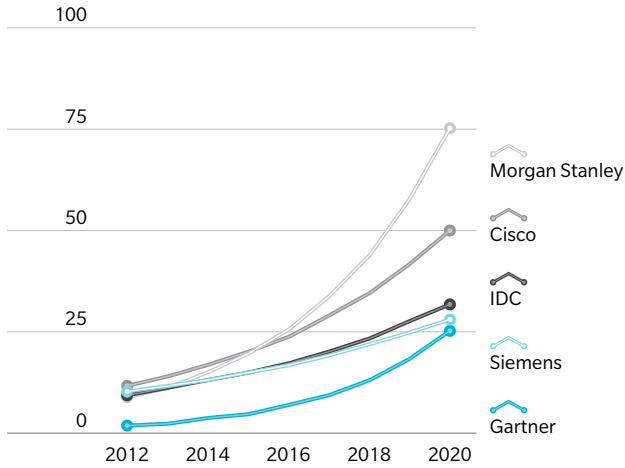
Source Gartner, Cisco, Morgan Stanley, IDC, Siemens, CrunchBase, TechCrunch, 451 Research, Montaigne Institute

After 2020, these figures are expected to grow exponentially. On several occasions in the past, the penetration of innovations has been largely underestimated. Didn't Thomas Watson, CEO of IBM, think in 1943 that there would be a worldwide market for about five computers? More recently, in 1999, peak penetration of mobile phones in France for example was estimated at 90%; today the rate is 120%. Cisco, in turn, predicts 10,000 BN objects will be connected in 2030. What appears certain is that it is impossible to make such long-range predictions.

The level of investment in connected objects is probably the most reliable indicator (see Exhibit 3). It shows that we are now at a critical turning point. One of the surest signs that an industry is about to be structurally transformed is the sudden surge of "tech" entrepreneurs investing in it, supported by private equity firms.

Ten times more venture capital was invested in IoT in 2014 than in 2010 (€341 MM vs. €34 MM). Major technological players have also accelerated their investments. IBM announced in March 2015 that it would invest €3 BN in IoT between 2015 and 2017, while Cisco is investing $1 BN in creating a platform for IoT known as Intercloud. In 2014, Google acquired Nest, the global connected thermostat leader, for $3 BN. The same year, Facebook bought the Oculus virtual reality company for $2 BN. In China, Alibaba launched an IoT Smart Living strategy in April 2015 and Baidu announced that it could put the first autonomous car on the market as early as 2015.

The pace of acquisitions is accelerating. Companies have spent more on mergers and acquisitions in the first four months of 2015 than during all of 2014, or $14.8 BN in 2015 versus $14.3 BN in 2014.

The real question is about the allocation of the value generated by IoT. One should naturally expect winners and losers, and the disruption of existing business models.

We have experienced this with digital transformation, which created immense value for consumers and players who were able to adapt quickly enough, but was also rough on everyone else. The term "uberisation" is now being bandied around; IoT may become equally significant.

THE BOUNDARIES BETWEEN INDUSTRIES ARE BEING CHALLENGED, PROMPTING A REVOLUTION IN BUSINESS MODELS

The development of a data-based society will challenge traditional business models in a big way, and we can identify four likely impacts.

IMPACT 1

The dividing line between business sectors and industries will shift and become blurred. The possibility of collecting and using new data will enable players to expand outside their traditional positioning. For instance, automakers will be able to expand into insurance by collecting, aggregating, and analysing driving data. Insurers, on the other hand, will be able to manage customer pools actively.

IMPACT 2

New cross-industry ecosystems combining data from different sources will be established. Are we moving toward a monopoly situation or coexisting ecosystems? Quality data won't be free of charge. Imagine the power of ecosystems able to combine data as different as the weather, personal health information, and behavioural indicators with aggregate data on health for each population segment.

IMPACT 3

IoT will accelerate the establishment of services. The migration to services (touched upon in our report *Digital Revolution: New Customer Experiences, New Business Models, New Transformations*) is not a new phenomenon but will be multiplied tenfold by IoT, enabling the development of new services. With IoT, the service dimension characteristically precedes the object, so that the Internet of Services must be conceived before the Internet of Objects. The Withings strategy is a perfect illustration.

IMPACT 4

Customer relationships are becoming hybrid and "business-to-business-to-consumer" (B2B2C) is growing fast. Alongside players who will be in a position to reinforce their customer relationships with intelligent data collection strategies, others will be disintermediated. Some businesses will move from business-to-consumer (B2C) to business-to-business (B2B), and vice-versa, while B2B2C relationships will facilitate more direct access to the end user.

IMPACT 1

AS DIVIDING LINES BETWEEN INDUSTRIES BECOME BLURRED

IOT IS RESHAPING BUSINESS MODELS
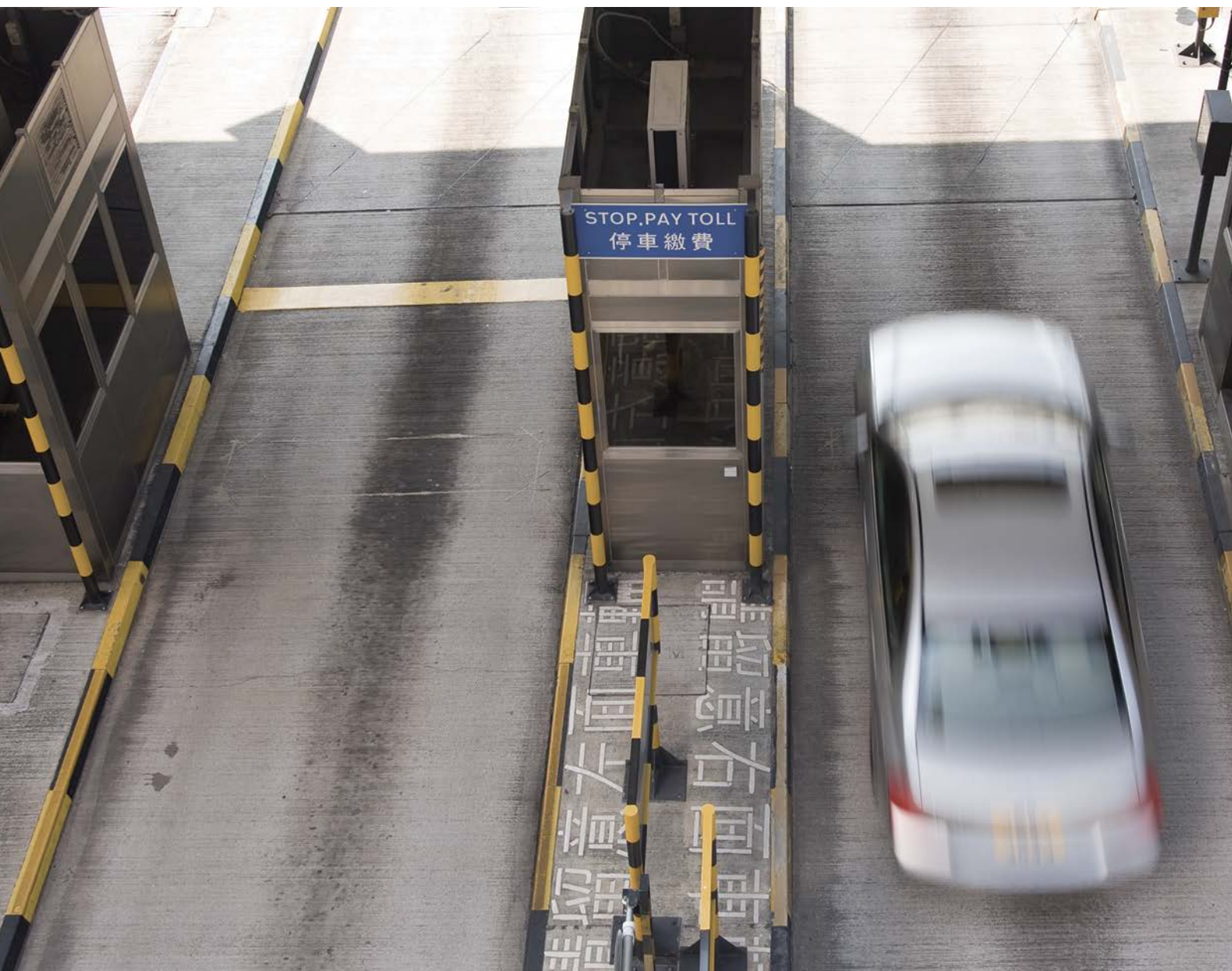
The possibility of generating, collecting, and using data to create new services is opening up new potential, not just for existing players but also for newcomers reinventing traditional business models.

There's no need to panic but the risks mustn't be underestimated either. We don't believe in a monolithic scenario where Google dominates every industry and has a finger in every profession. What is more plausible is the emergence of new players, now still at the incubation stage. The following examples illustrate potential disruptions of the value chain in different industries: insurance, retail, health, and energy.

INSURANCE

AUTOMAKERS ARE TAKING ON CAR INSURANCE, GOOGLE IS ENTERING THE HOME SERVICES MARKET, WITHINGS IS GOING INTO HEALTH, TRIMBLE INTO BUSINESS

The aggregation of essential data is critical to the insurance business model. The collection and use of great volumes of data have long been the main barriers preventing newcomers from entering the market until now. The possibility of new entrants aggregating key data to select risks more efficiently or personalise prices based on the assets insured, and especially the characteristics of insurance subscribers (lifestyle, behaviour, age, and so on), effectively reshuffles the deck.

Premiums based on driving style (pay-how-you-drive) and lifestyle (pay-how-you-live) already exist. Insurers like John Hancock have turned pay-as-you-live into a core value proposition: the healthier your lifestyle, the cheaper your insurance. (See Exhibit 4.)

Although these offerings are still fairly consistent with existing models, they could radically change the landscape tomorrow. Just imagine:

Peugeot as car insurer. Insurers could lose their grip on the car insurance customer relationship if policies are integrated directly into the vehicle purchase contract. Automakers would then be the first to collect data essential to pricing, and insurers would become mere subcontractors.

Google as home insurer. By aggregating key personal data (for example, on behaviour and lifestyle) collected through a powerful ecosystem of connected objects (in the home, car, carried, or worn) and data from the Web, Google could become a formidable agent for risk selection and appraisal. Google could then reverse auction batches of risks to insure, relegating insurers to the role of low-value-added risk holder.

Withings as health insurer. By analysing the behaviour, lifestyle, and health habits of its customers, Withings could directly offer home, health, and personal accident insurance.

Trimble as vineyard insurer. Agricultural specialisation puts this tech and IoT player a step ahead of the game. As a result, Trimble is becoming an expert in agricultural claims patterns.

Some of these examples smack of science fiction but IoT represents a real risk for insurers as they could lose a significant share of their revenues. On the one hand, pinpointing risk and enabling better prevention will reduce the cost of risk and the corresponding premiums. On the other hand, the value captured by other players with smart data could confine insurers increasingly to the B2B side of the equation, focused on risk management.

Exhibit 4: Peugeot would become your car insurer, Google your home insurer

Manufacturers include car insurance in a bouquet of "on demand" mobility services

Pay How You Drive

Allianz

AXA

Aviva

Generali

Customers pay according to their "actual risk"

Google manages all home services (insurance contracts, support/assistance services)

"Reverse auctions" (for insurers)

Risk

Insurers would become mere "risk bearers/ solvency checkers"

Risk
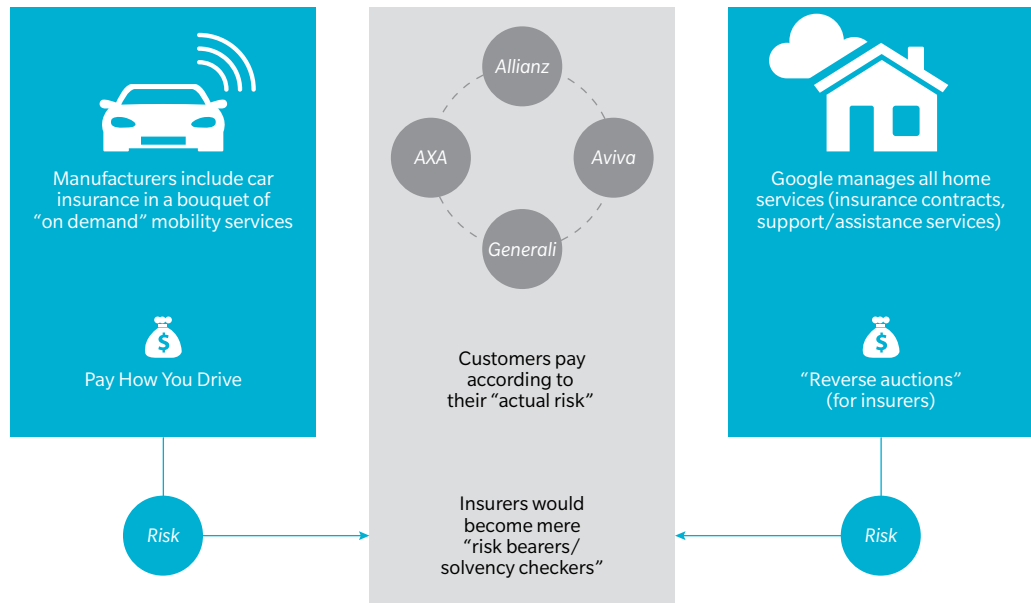
Source Oliver Wyman

RETAIL

THE SUPERMARKET IS BECOMING SECONDARY – UBER DELIVERS GROCERIES BASED ON YOUR CONSUMPTION AND HABITS

The online supermarket is nothing new. This isn't what we mean. We're talking about a logistics provider who revolutionises shipping to become your main retailer. In neighbourhoods and whole cities, an ecosystem is being created, which is capable of capturing restocking requirements and optimising distribution. Connected objects are being used to collect data, aggregate this data across different spheres, and provide connected shipping.

It will no longer be necessary to go to the supermarket or make a grocery list on Ooshop. Uber delivers to consumers according to their needs, identified directly in the home with an entire ecosystem of data collection partners. These partners include ChillHub, whose connected fridge is now equipped with sensors and tomorrow will have cameras on GE's IoT appliance platform. With Amazon's Echo or Dash, consumers can dictate or scan their grocery list, and washing machines can order laundry detergent automatically before it runs out. (See Exhibit 5.) New delivery providers like Onfleet already combine orders from different sites and optimise delivery rounds, proposing a profitable on-top model.

Uber collaborates with Amazon Fresh. Amazon's objective is to attract customers willing to pay a little more for the convenience of a fresh produce delivery service. Extending Amazon Fresh also enables the online brand to acquire and retain customers in other spheres – making profitability on fresh produce almost a moot point. The impact is enormous, and the figures speak for themselves: with 2% earnings before interest and taxes (EBIT) and 20% volume-based variable costs, and 10% of volume transferred from the offline to the online sphere, traditional retailer margins will vanish.

AMAZON

Dash
Replenishment
Service

Amazon
Dash Button

Amazon
Dash wand

Amazon
Echo

order

AMAZON (OR WALMART?) COULD ACQUIRE OR DEVELOP AN UBER-TYPE SERVICE AND REPLACE YOUR SUPERMARKET

Smart homes equipped with devices allowing Amazon to detect what's missing. Orders are placed automatically and delivered by Amazon Services, using an "Uber-like" delivery model.

UBER

HEALTH

IBM AND WELLTOK ARE BECOMING YOUR PERSONAL HEALTHCARE ASSISTANTS

Could a B2B player like IBM, very advanced not only in the cloud and data analysis but also in healthcare and the weather, become a retail market player in the healthcare industry?

IBM recently announced a $1 BN investment in the Watson Group, including $100 MM intended for start-ups developing applications on the Watson Developer Cloud. Just imagine the impact when billions of personal data records are connected to an analytical platform like Watson, identifying the right patterns and generating personalised recommendations to improve well-being and health. (See Exhibit 6.) In keeping with this dynamic, IBM signed an agreement with

Apple on health and recruited numerous professionals from B2C companies. What if tomorrow IBM became a major B2C player with an instrumental role in converging these two spheres?

If IBM or Apple manages to convince patients to open their medical file and share their data, will these players be positioned to capture the lion's share of the value created in the health sector?

Other players are emerging on the health market. The American start-up Welltok, for example, which raised $59 MM in 2014 then $37 MM in 2015, provides customers with fitness itineraries and healthcare treatments from its CaféWell platform in partnership with IBM. The symptoms detected by the Simband bracelet from Samsung or a Vital Connect biometric patch are combined with personal behavioural data collected by Apple Watch or using external factors provided by

Exhibit 6: IBM could conduct patient check-ups

SYMPTOMS
FEVER, HYPERTENSION, OXYGEN
Philips, Medtronic, Vital Connect, cue

PERSONAL DATA
CARDIAC ACTIVITY, SPORT, NUTRITION
Apple Watch, Fitbit, Withings

EXTERNAL FACTORS
TIME, HUMIDITY, POLLUTION
Nest, Weather Channel, Honeywell

IBM
WATSON HEALTH CLOUD

DISEASE DATABASE
Health insurance, WebMD, NHS

DIAGNOSIS

CONSULTATION WITH A DOCTOR
RESEARCH AND REMOTE HEALTHCARE, DOCTOR'S APPOINTMENT
ZocDoc

Source Oliver Wyman

The Weather Company (IBM Cloud). This convergence of individual and collective data represents a real revolution. Indeed, most health improvement initiatives do not require a doctor's intervention.

ENERGY

NEST-GOOGLE IS REDUCING YOUR ENERGY BILL

The utility industry is among those most affected by IoT, for example in the residential market. New solutions are coming from all sources: public service and telecommunications (telecom) operators, utility players, and new technological players. Orange Homelive and AT&T Digital Life are already offering energy optimisation solutions, compatible with any supplier or partner, like Hive with British Gas. All of these offerings require specific action by the customer.

Others, like Google or Actility in France, could go much further. In the USA, Google has a licence to purchase and distribute power. Happy Hereford, the wind farm of its subsidiary Google Energy, is the second largest in this domain. Its new-generation batteries are today providing power storage solutions for the car, and tomorrow will do so for the home. Its family of thermostats – connected to household equipment (such as washing machines, so they start at the right time), smart meters, and car battery recharging terminals – is growing continually and enabling the immediate and flexible integration of network production capacity.

By becoming a power distributor that can optimise the balance between demand and production in real time, Google is in a position to cause major disruption to the business model (see Exhibit 7).

Exhibit 7: Could Google – or Orange – become your power service provider?

Renewable energy sources
2014-15

Nest
2014

25°

Google batteries

Energy licence
2013-14

Rush-hour Rewards

Long-lasting electrical autonomy with Google batteries

Communicating with Whirlpool household appliances is now possible

A single hub to control electronic devices
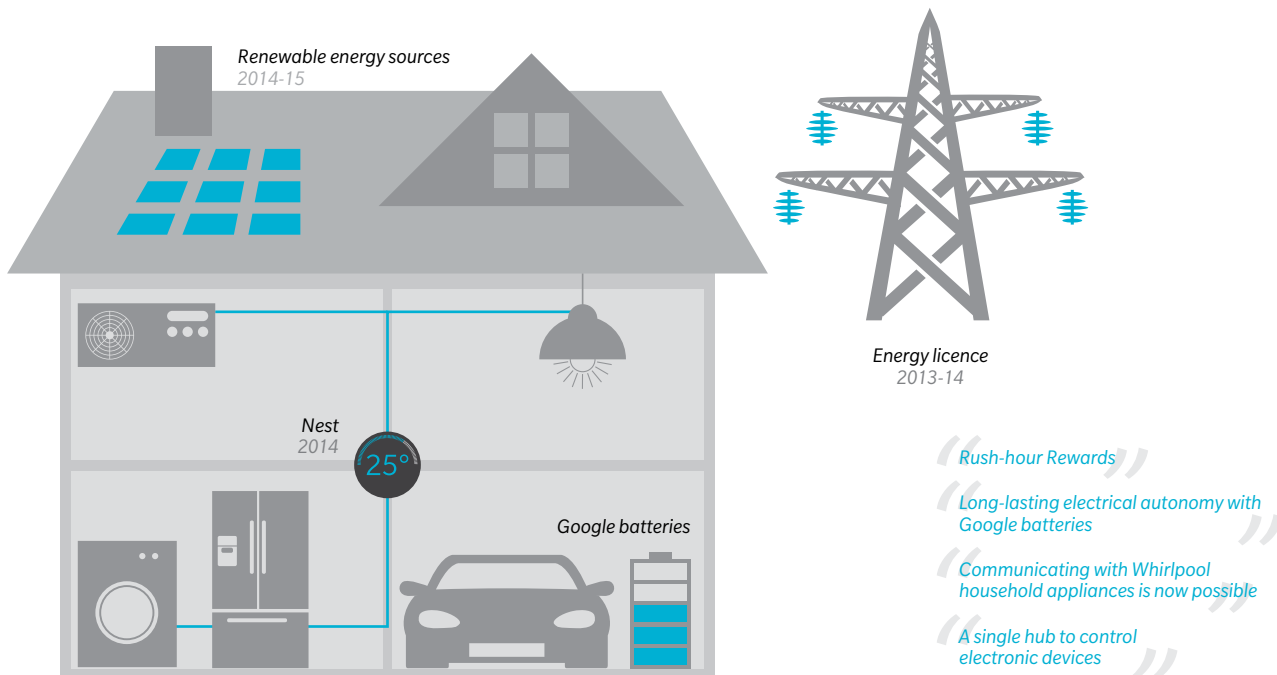
Source Oliver Wyman

ECOSYSTEM INTEGRATORS WILL CAPTURE VALUE

All players are conscious that the capture and use of data, and the identification of attractive patterns, will create value.

That said, will this data be free of charge, sold, or easy to collect? According to Gartner, more than 30% of the data used by companies in 2017 will come from specialised service providers, which naturally want to monetise this asset. How do we collect this data? What strategy can we implement while retaining the trust of customers and protecting their private information? Could de facto standards be imposed, reinforcing the asymmetry of access to information from which the digital economy already suffers? We can improve our understanding by distinguishing three steps in the management of data:

1. Collection
2. Coordination
3. Analysis

Exhibit 8: Percentage of applications requesting data access, 2014

PERCENTAGE OF APPLICATIONS
REQUESTING DATA ACCESS
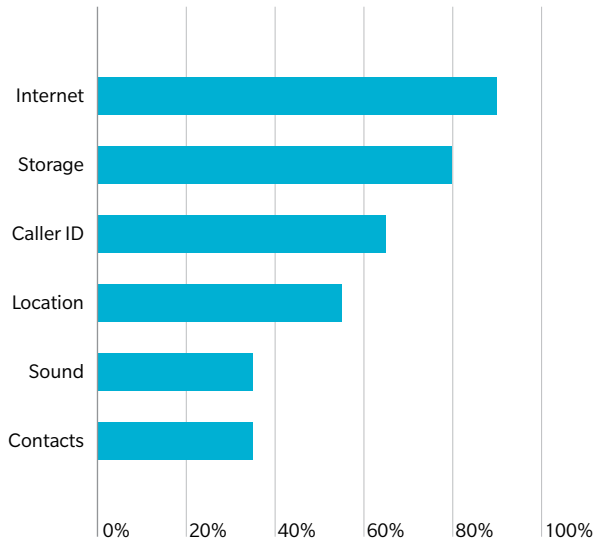
UBER APPLICATION COLLECTS DATA
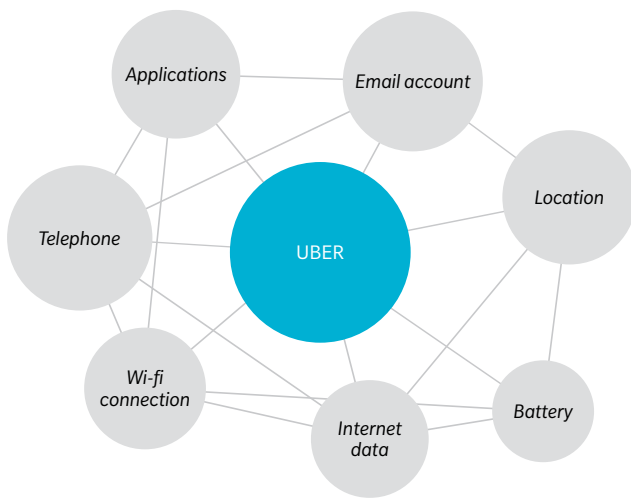
Source: Uber, Oliver Wyman analysis

COLLECTION

DATA WON'T ALWAYS BE FREE

In B2C, mobile phones will remain a data collection hub. The most widespread method to collect personal data is through applications on mobile terminals, which are already stuffed with sensors (gyroscope, accelerometer, GPS, digital fingerprints, and so on). For example, the new Samsung Galaxy S6 contains more than a dozen types of sensors.

The mobile phone sensor market is expected to grow annually by 19% on average from now to 2018, rising $2.3 to $6.5 BN from 2012 to 2018. New sensors are constantly being integrated into smartphones: barometers, magnetometers, pedometers, detectors of light, proximity, heart rate, radiation, and humidity, for example. The applications then capture all the data that the smartphone has collected.

You probably can't imagine the amount of personal data you already provide without knowing it. According to Accenture, 79% of companies directly collect personal data from their customers, for instance, through online accounts. When you use an application, it collects your internet access data 90% of the time, your phone number 65% of the time, and your contact list 35% of the time (see Exhibit 8). Many Android applications don't even ask for your explicit permission.

To use Facebook Messenger, for example, you must provide a large amount of personal data and give the application direct control of your mobile phone.

Most consumers are willing to share their data, since they derive a tangible benefit from it. This is not expected to stop but will be done more transparently with opt-in

authorisations by type of data, granted by users with greater awareness. According to a Morgan Stanley study, 81% of users would be willing to share their personal data if they received an advantage in return, such as a lower insurance premium. Data monetisation will increasingly make consumers more aware of the value of their data and thus more likely to attempt to monetise it, for example, through personal data intermediaries.

Some rare data should continue to be free, but merely collecting information has little value if there is no aggregation ecosystem to utilise it properly.

AGGREGATION

MONOPOLIES, DE FACTO STANDARDS, OR COEXISTING ECOSYSTEMS?

The first digital revolution created an asymmetry of information between new players, like Google or Bookings, and traditional players at the expense of the latter. Will such an imbalance recur with connected objects?

The subject is not technological, as there is little doubt that open standards will gradually become the norm. Under the aegis of the World Wide Web Consortium (W3C), protocols will interact extensively across equipment, within networks, and in the cloud.

The Thread Alliance, led by Google, integrates the application layer (or cluster library) of ZigBee with Nest. Since 2014, it has supported an open IoT vision, in which objects don't need applications to interconnect and transmit data. This alliance creates more bridges with other standards, such as the Open Interconnect Consortium of Intel and the AllSeen Alliance. The latter promotes AllJoyn, an open source, open standard platform conducted by the Linux and Qualcomm foundation. Its objective is to ensure the interoperability of equipment, regardless of brand, network, OS, and so on. Apple's decision to open its ecosystem and use Thread/ZigBee to support its home automation solution, HomeKit, with the iPhone as a control hub is a move in this direction.

But beware, because these declared intentions of opening up technology must not hide the fact that technological convergence by no means prevents the rise of de facto standards. Specific platforms may also become dominant because of their aggregation capacity and the simplicity of the

Exhibit 9: A strategic control point, ecosystem aggregation of data starts with data organisation

COLLECT   AGGREGATE   ANALYSE   ORCHESTRATE SERVICE
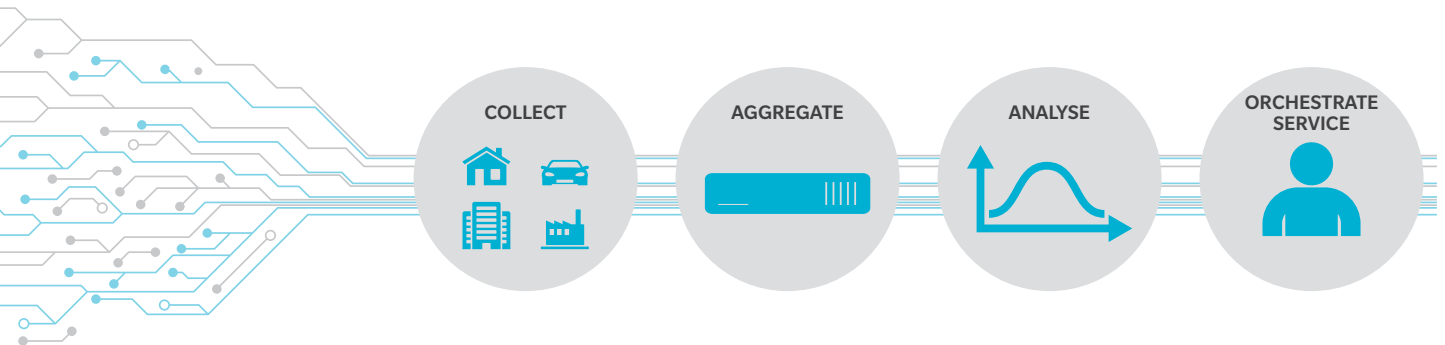
Source Oliver Wyman

De facto standards have become widespread, and the same thing could happen in IoT

getting established (think of Google, Apple, and Samsung), so latecomers will have a lot of trouble modelling a system favourable to their interests.

Big names joined the Nest/Dropcam ecosystem during the Las Vegas CES in January 2015, including Samsung, Somfy, ARM, Pebble, Jawbone, Philips, and LG. In April 2015, Apple launched HealthKit, its health application, and Apple Watch. Now being pilot tested, its connected home management application, HomeKit, has heavyweight support from Philips, Honeywell, Haier, Netatmo, Withings, and others. CarPlay, an on-board version of iOS for vehicles, has been launched with Volkswagen, Toyota, Renault, Peugeot, and Ford.

customer experience, akin to what happened with Apple and Android. By nature, these platforms will be able to incorporate data from multiple sources, while the suppliers of objects and IoT services will have access only to their own data and possibly a negligible share of information from other objects. These platforms will thus acquire supremacy on data, which will put them in a near-monopoly position. They will then be free to sell this data to third parties, utilise it and monetise it themselves, and therefore deprive the companies participating in their ecosystem of a considerable opportunity to create value.

Although Android is currently an open standard, middleware and application layers (Google applications, for example) use proprietary specifications. The Android operating system (OS) installed on 80% of mobiles worldwide is not the Android it was at the beginning. De facto standards have become widespread and the same thing could happen in IoT.

Aggregating or combining relevant data within the same sphere will become critical (see Exhibit 9). Ecosystems are quickly

A sign that IBM is entering the retail market is the partnership signed with Apple to penetrate the corporate market with Apple objects fed with IBM intelligence. Samsung is lagging behind. Based on its own operating system, Smart Home (announced in January 2014) integrates Smart TV, household appliances, and smartphones. The mobile terminal is becoming the residential hub used to control everything, from the front door and the elevator to home appliances.

These aggregations by sphere depend on open and horizontal technical platforms that enable the various verticals to design professional applications (see Exhibit 10). Horizontal IoT platforms like ThingWorx, acquired by PTC in 2014, are growing non-stop. They make it possible to accelerate development and maintain IoT applications by providing infrastructures in software-as-a-service (SaaS) mode or facilities where developers can come to develop their applications. Between 2013 and 2014, ThingWorx revenues rose by approximately 60%.

Exhibit 10: A monopolistic backbone or coexistence of integrator ecosystems cutting across different industries?
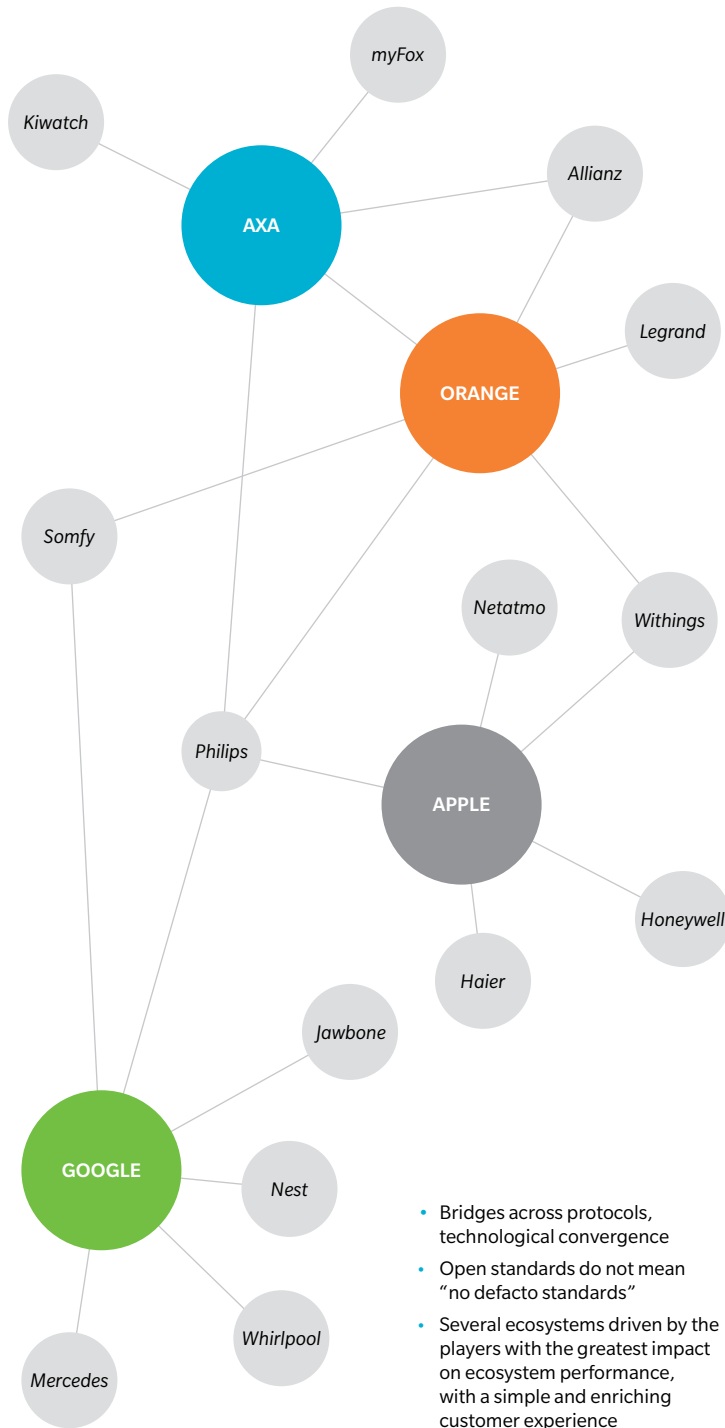
- Bridges across protocols, technological convergence
- Open standards do not mean "no defacto standards"
- Several ecosystems driven by the players with the greatest impact on ecosystem performance, with a simple and enriching customer experience

Source Oliver Wyman

Similarly, in March 2015, Microsoft presented a project to personalise its Azure cloud platform for IoT in three dimensions: credit management, remote surveillance, and preventative maintenance. This platform will include services such as Azure Stream Analytics, which identifies patterns by analysing data flows, or Azure Intelligent Systems service platform, designed to interconnect electronic sensors and other devices.

Within the residential and mobility sphere, the question is about how to gain a foothold in data access for the future and prevent a small group of players from capturing the lion's share of the value. We feel that the key is to build strong and attractive ecosystems that offer enriching applications and a simple customer experience. Users won't want to juggle ten different ecosystems, but two or three at most. In the retail market, this requires the creation of trustworthy ecosystems aggregating the services of different players. This can be done by local players who already possess valuable "trust capital", such as a telecom operator integrating automation and security into the home.

Telecom operators have a special position in the home. Recognised for their reliability and security, they enjoy the trust of consumers, so they will be able to market connected residential home automation, security, and energy solutions. Playing an aggregator role, they will open up an extensive market to the manufacturers of connected objects, bringing them credibility and enabling them to develop their services. However, Apple with HomeKit and Google with its new operating system for the home have similar intentions.

In business and smart buildings, the same ecosystem rationale should prevail. This rationale requires designing vast libraries of professional applications as well as detailed knowledge of each profession. Some companies, like Schneider Electric, have started integrating all the verticals of construction. This rationale is also applied by Orange Business Services. Precise knowledge of customer professions is therefore essential to design business applications for fleets of vehicles and construction sites, combat theft on construction sites, or optimise maintenance in services.

In the midst of such expansion, it is not easy to secure a position in the market. Despite the difficulty, a wait-and-see attitude would be very risky. Every company must soon clarify its strategy and the role it wants to play. Builder of a multisector ecosystem? Leader of a vertical ecosystem integrating competitors? Or central player in a powerful ecosystem?

ANALYSIS

VALUE IS SHIFTING TOWARD PLAYERS WHO MAKE THE BEST USE OF DATA

According to IDC, only 1% of data is currently utilised. Although this rate appears probable on average, there are, however, significant differences between players. Retailers don't use much information about sales slip, but Amazon exploits all your data. Banks don't utilise the information they have on you, whereas the new financial technology players, or FinTechs, do so intensively.

Integrating and utilising data and developing IoT applications require very specific expertise. Numerous platforms, some global, are being launched or growing fast. Datavenue, Orange's IoT platform, was created with corporate partners, including Schneider Electric, Malakoff Médéric, SEB, and TF1. This platform offers secure data hosting to its customers, opens its application program interfaces (APIs), and provides toolboxes (for data flow management, data anonymisation and utilisation, invoicing, and so on) to developers, thus becoming a service engine. Datavenue is also being increasingly integrated into corporate processes and information systems.

In the same manner, a significant number of start-ups (like Always Prepped) as well as incumbent firms (such as Equifax, Acxiom, and Experian) are developing their data collection and aggregation activities, combining the sale of data and software. Still others are positioning themselves on "analysis as a service". This is true for Granify, Mineful, and Retention Science.

Today, companies cannot get around the need to collect and utilise data and develop applications. Is this part of their core business? Do these skills need to be developed in-house or can they be outsourced? Our vision is that data analysis creates more value when it remains very close to the core business. Value will migrate toward companies that are able to develop powerful analysis tools by industry, or even for specific niches. However, this transfer poses an acute skill challenge. By 2020, the USA will be short of about 1.3 MM experts known as data scientists.

IMPACT 3

IOT IS ACCELERATING THE DEVELOPMENT OF SERVICES

Data per se is of little value but can be used in many ways to:

- Improve performance and reduce costs
- Raise service levels or develop new services
- Reinforce customer relationships.

Industry has already started to move toward services, and IoT is accelerating this phenomenon dramatically.

IOT IMPROVES OPERATIONAL EFFICIENCY, WHICH HELPS COMPANIES DIFFERENTIATE

IoT is a source of productivity gains and operational performance for companies.

In the industrial sphere, IoT enables the emergence of Industry 4.0. These cyber-physical systems connect objects and allow them to interact without human intervention. They may be designed, for example, to optimise utilities or allow autonomous movement. With the help of a new generation of software and robots, such as the Kiva Systems robotic assistants, vehicle production lines can be optimised, reducing the time required to produce a personalised car by 40% and energy consumption by 10%.

For retail, IoT is a great tool to optimise storage and shipping. Amazon, whose business depends on a powerful and reliable supply chain, uses more than 15,000 smart Kiva Systems robots to make the picking process faster and more efficient. These robots, connected to the central ordering system and able to navigate through the warehouse with RFID codes, reduce picking costs by 20% to 40%. Amazon is thus estimated to save $500 to $900 MM annually.

In logistics, IoT creates new fleet management solutions. Masternaut services, for example, give customers real-time visibility on their fleet (position, productivity, vehicle usage, or geolocation) and goods shipped (compartment temperature). These solutions help Masternaut customers optimise their costs and cut their fuel bill by 25%.

In water and electricity, IoT solutions to track and manage infrastructures remotely help suppliers such as Veolia and Thames Water save millions and more effectively ensure the quality of the resources they manage. For example, the start-up Redbird uses drones to assess the state of infrastructures in real time and identify anomalies that could cause future incidents. Redbird's customers, such as GDF Suez, can use these services to arrange preventative maintenance and reduce the cost of technical interventions.

Concentrating exclusively on performance gains and cost cutting is nevertheless too simplistic; IoT is above all a source of innovation, a new way of thinking about a business, an opportunity to be different and get a jump on the competition. IoT is also the only option that can eliminate the risk of disintermediation.

IOT SUPPORTS SIX SERVICE PATTERNS

These six patterns, described below, force existing players to migrate from their initial positions (see Exhibit 11).

REINFORCE THE VALUE OF EXISTING PRODUCTS

Offering customers a better experience than competitors do is the objective of companies like Bouygues, SEB, Babolat, and Terraillon. These firms are already integrating IoT technologies into their products. For instance, in addition to providing tennis rackets to Rafael Nadal and the best tennis players in the world, Babolat equips its rackets with sensors that allow players to analyse their game and improve their technique. Terraillon uses its connected scales as a platform to offer online fitness coaching services and support customers in their efforts to lead more active lives. Although still quite new, this type of product value reinforcement stands a good chance of quickly becoming the norm.

Exhibit 11: Six service patterns accelerated by IoT and data

REINFORCED PRODUCT VALUE		PRODUCT TO SERVICE		NEW SERVICES	
Terraillon	SEB	Schneider	Biotronik	ThyssenKrupp	Orange
Bouygues	Babolat	GE	Philips	John Hancock	Allianz

SERVICE WITH NO OBJECT		PRODUCT AND SERVICE AS A SERVICE (USAGE, MULTIOBJECT)		INFINITELY PERSONALISABLE SERVICE	
AutoGrid	OPower	DriveNow	Smoove		
OnFarm	Wink	Whirlpool	Keolis	IFTTT	

- Drives players to move from their initial positions
- Performance becomes dependent on system players
- Reinforced service "motorisation", B2B

Source Oliver Wyman

OFFER CUSTOMERS INNOVATIVE SERVICES

Whether it is a matter of going further and improving existing services or proposing new services, IoT expands the portfolio that equipment insurers, retailers, and manufacturers offer to their customers. In construction insurance, putting sensors into concrete has driven the development of novel solutions. Issues related to the malfunctioning of connected objects, and, in particular, civil liability, offer considerable potential for new services. IoT will thus enable the development of new support services by insurers or telecom operators.

The increased need for cyber-security will generate the development of adapted services. Due to their control of connected home hubs, telecom operators will be in a good position to expand their services beyond connectivity. Orange's Homelive and Canadian Rogers' Smart Home Monitoring are integrated security, comfort, and home automation solutions that allow people to control their alarms, doors, and lights remotely. Such services will form an integral part of the connected home offering of tomorrow's operators, which will manage the customer experience inside the home and develop more engaging relationships with customers, creating many additional service opportunities.

MOVE FROM A PRODUCT-CENTRIC OFFERING TO SERVICES AND SOLUTIONS

In industry, for example, equipment manufacturers, such as ThyssenKrupp, propose predictive maintenance services to their customers by collecting and analysing data. These services – which complement the traditional "physical" product (elevators in this case) – make it possible to reduce operational risks (with up to 70% fewer technical incidents) and introduce more predictability into operational planning.

EXPAND THE "PRODUCT-AS-A-SERVICE" (PAAS) CONCEPT

The ability to collect product usage data makes it possible to let customers pay for products according to usage, rather than purchasing them outright.

We are at the dawn of a zero marginal cost economy where only the use of the product is relevant, rather than acquisition and ownership. Equipment manufacturers, in particular those making household appliances, are already thinking about introducing usage-based pricing. IoT is accelerating the move toward a world where private individuals pay for their washing machine by the load, and airline companies pay for their engines according to the number of flights or miles travelled. And usage is becoming increasingly hybrid. For example, it is no longer the car that is insured but the use of a means of transportation.

INTRODUCE GENERIC SERVICES

The proliferation of IoT communication standards creates interoperability issues. For example, movement detectors of one brand may not be able to communicate with the alarms of another. As a result, new generic – or objectless – services are emerging, including platforms such as Wink, which helps customers make their homes fully connected and interactive.

OFFER INFINITELY PERSONALISABLE SERVICES

The IFTTT (If This Then That) service goes even further by enabling the creation of action and reaction pairs, opening the door to hundreds of applications. For instance, as soon as your Nest Protect detector signals a high carbon monoxide level, an Android warning is sent to you and your neighbours are notified by SMS.

In sum, IoT primarily paves the way to accelerate the transition from product to service, and it creates new opportunities for global companies such as GE, Schneider Electric, and Philips.

IOT STIMULATES THE TRANSITION FROM PRODUCT TO SERVICE

In industry, some companies are transforming their initial business model. GE, for example, is expanding its service model well beyond the manufacture and repair of aircraft engines. It collects and utilises data concerning the operation of its engines to establish increasingly powerful predictive maintenance plans. GE is also developing fleet management and operational tracking services for Airbus and airlines themselves. Specifically, with each flight, 100 sensors per engine generate 500 gigabytes of data to analyse. As a result, Alitalia reduced its fuel consumption by 1.5% while AirAsia, by augmenting its fleet usage, generated annual savings of more than $10 MM.

The same applies to the energy sector. Schneider Electric has become a supplier of building objects but is also increasingly a maintenance and facility management player. Data gathered from these objects and fed back to an IoT platform will enable the significant development of services. The Schneider Electric Andover Continuum solution helps to reduce average building energy costs by 30% using the smart EcoStruxure system, which controls heating, ventilation, air-conditioning, lighting, IT services, and security (access, cameras, and alarms). In this way, Schneider Electric is employing new IoT technologies to expand its portfolio of services and capture value from facility management companies.

Although IoT represents a real threat for insurers, it also creates formidable opportunities for those that manage to rethink their value proposition completely. IoT makes it easier not only to segment risk in detail and identify fraud but also to reinvent the service model. Examples are rife, ranging from the development of prevention systems to automatically triggered emergency and assistance services, not to mention the installation and monitoring of supervision cockpits.

In the construction industry, IoT allows equipment manufacturers to become service providers. For example, the elevator manufacturer ThyssenKrupp Elevators (TKE) is installing hundreds of sensors in its products to track indicators such as engine temperature, speed, friction, and braking. Using the collected data, TKE can predict incidents before they happen, plan

maintenance to reduce downtime, make repairs faster (the technicians are equipped with analysis systems to quickly identify the cause of incidents), and optimise the operation of its elevators. In short, data makes it possible to integrate services into facility management.

The same is true for utilities. Industrial gas, for example, could move from selling products to providing services with IoT. One global industrial firm is offering a medical gas distribution solution supported by sensors and a remote IoT SIGFOX communication system. This solution involves providing not just the product (industrial gas in this case) but also quality control, remote monitoring, and support on critical situations such as alarms, emergencies, and fluid supply failures.

In the household appliance sector, SEB is developing connected products that perfectly embody industry's migration to services. For example, its smart multi-cooker Cookeo Connect can be controlled by Bluetooth from the customer's tablet or smartphone. The Cookeo app can automatically add the ingredients for a selected recipe to the user's electronic grocery list and offer advice on how to prepare the dish. Rather than being a mere cooking utensil, the multi-cooker has become a residential cooking services platform.

From aeronautical products to gas turbines, IoT is transforming the spare parts business in the industrial equipment sector. Siemens is becoming a technological partner rather than a supplier, a service provider rather than a simple product manufacturer.

With the continuous drop in 3D printing costs and real-time data feedback from connected objects, spare parts no longer have to be produced in a central hub and then delivered to the customer; they can now be printed on demand, where they are needed. A manufacturer such as Siemens is now able to deliver spare parts to its customers ten times faster than before.

Media excitement around IoT emphasises objects particularly for retail consumers. However, by 2020, IoT equipment for industries, companies, and buildings will grow more quickly than for the mass market. Professional IoT is expected to represent at least 40% of connected objects.

In terms of value, industry will also represent an essential share. From operational optimisation that cuts costs and improves responsiveness to innovative service offerings that differentiate a business, IoT represents a very attractive opportunity. According to Cisco, 36% of the total value added by IoT in 2020 will come from purely B2B applications through better asset management and usage, and optimised supply chain and logistics operations.

The imminent service revolution will be enabled by the collection and aggregation of data, so missing this first step will make the transition to services much more difficult.

IMPACT 4

NEW BALANCE IN CUSTOMER RELATIONSHIPS

IoT is revolutionary in another domain – the customer relationship. The connection of objects can allow players, upstream in the value chain or from other sectors, to capture this relationship. It can also help historical players to reinforce the quality of their customer service. Indeed, IoT will permit a substantial increase in the frequency, intensity, and particularly the relevance of interactions with customers and consumers. We have identified six disruptive trends, described below, concerning these relationships (see Exhibit 12).

Exhibit 12: Six disruptions that change the relationship and deepen knowledge of the customer

REINFORCED CUSTOMER RELATIONSHIP	PARTIAL REINTERMEDIATION	TRANSACTIONAL TO INTERPERSONAL
Mahana Adidas Tesco *Carrefour Virgin Atlantic*	*L'Oreal Danone Evian* *Procter & Gamble*	*Philips GE Jaguar* *Michelin Allianz*
PARTIAL DISINTERMEDIATION	**INTERMEDIATION**	**B2B TO B2C**
Home equipment gaining ground versus distributors	*Insurance sold by manufacturers*	*Industrial gas to home healthcare*

Source Oliver Wyman

IOT REINFORCES THE CUSTOMER RELATIONSHIP

IoT makes it possible to create new contact points and opportunities to interact with customers, and in turn reinforces the relationship with them.

Take, for example, beacons: their large-scale deployment in sales outlets and throughout cities is set to be an incredible vector of transformation for retail. Already installed at Carrefour, Macy's, Mahana, Tesco, and Virgin Atlantic, the Apple iBeacon is an indoor geolocation system using Bluetooth Low Energy (BLE) technology that can detect receptive terminals and send signals to them. This new category of transmitters revolutionises in-store experience while making a whole range of new services available to customers with compatible applications. From geolocation in stores to payment at the cash register, including available product promotions, the iBeacon offers a more fluid and intuitive experience.

For retailers, these beacons add value to the point of sale by making it interactive. Passers-by are notified of available discounts to attract their attention. If shoppers agree to be geolocalised in the store, their itinerary can be analysed in detail in order to model customer types according to profile. Distribution thus reinforces the relationship with consumers in several ways.

IOT REINFORCES KNOWLEDGE OF THE CUSTOMER

Manufacturers of consumer products have long been frustrated by their lack of direct knowledge of end customers. Retailers alone had a direct relationship with consumers at the time of purchase, relegating the manufacturer to a back-office role. Consumer service initiatives, surveys, and other clubs were simply palliatives.

We are at the dawn of a partial reintermediation, as integrated RFID tags, or the connection of products, makes it possible for manufacturers to collect hitherto inaccessible information. Information on store-by-store sales flows and inventory levels is now available. Manufacturers can therefore adapt their logistics, promotions, and advertising by location and in real time, depending on sales and inventory levels.

We can also imagine future connections between products and customers, enabling the establishment of detailed links between specific customers and usages or buying behaviours. Whereas retailers currently use very little sales slip information, manufacturers are building a knowledge base to develop a better understanding of consumers, or even establish a direct relationship with them.

Companies like Danone, Evian, L'Oréal, and P&G have started to take this decisive approach which, over time, should change the balance of power between manufacturers and retailers.

FROM TRANSACTION-BASED TO RELATIONSHIP-BASED

The frequency of contact with customers will increase. Jaguar Land Rover, for example, is trying to do this by becoming a partner to customers throughout the life cycle of the car, in order to monetise the relationship after the initial transaction (see Exhibit 13).

The connected car enables Jaguar to establish a direct relationship with customers. The automaker provides them with essential data in real time and creates opportunities to contact them. For example, with remote verification of the state of the

tyres and battery, Jaguar can anticipate technical incidents and notify customers before a problem occurs. A significant amount of data can also be collected to understand precisely how customers use their cars. Using this data, Jaguar can suggest the models that are most suited to individual customers for their next purchase.

B2B TO B2B2C AND PARTIAL REINTERMEDIATION

E-commerce has long fostered the reinforcement of direct customer relationships by upstream value chain players, and IoT will drive these opportunities even further. Without becoming fully B2C, a certain number of business models will continue to operate as B2B2C but the balance of power will shift among value chain players.

Take a household appliance manufacturer, for example. Its connected washing machines or refrigerators gather data that enables it to perform remote maintenance and update product performance for a given usage.

The potential to migrate further toward B2C and services is obvious. It isn't essential to go through a pure B2C phase because the manufacturer doesn't have to take charge of sales and distribution. On the other hand, it can

Exhibit 13: Jaguar as customer partner throughout the life of the car

1 ESTABLISH A DIRECT RELATIONSHIP WITH THE CUSTOMER

2 PROVIDE KEY DATA IN REAL TIME

3 CREATE NEW CUSTOMER CONTACT OPPORTUNITIES

17° FUEL RANGE 279 km
Last park location of vehicle

17° FUEL RANGE 279 km
Direction to your vehicle

Warning!
The battery is low. Please start the engine or contact your dealer for more information

Slide to unlock
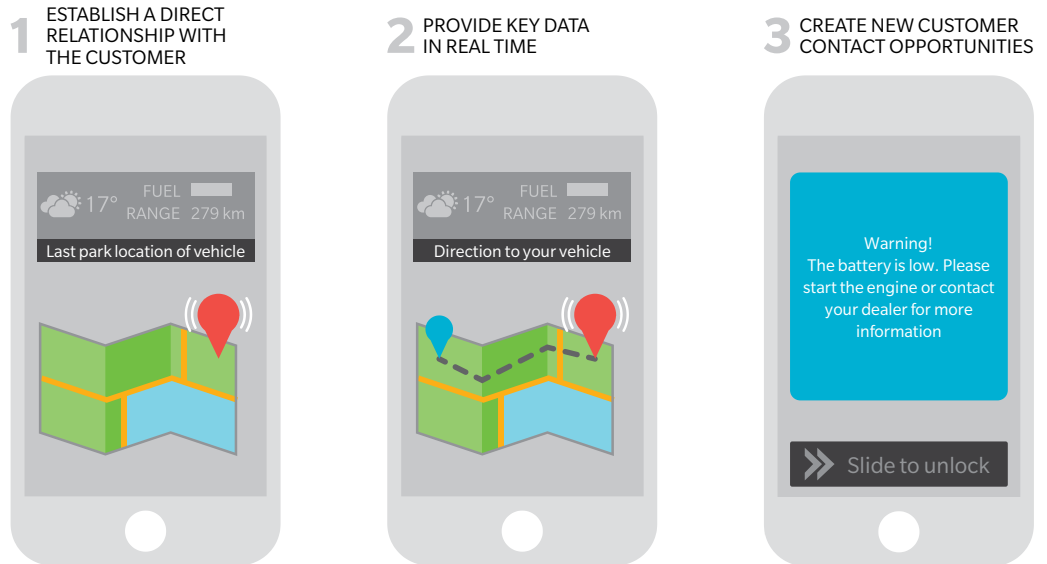
JLR's customer relationship management philosophy

Track the customer throughout the vehicle life cycle to monetise the relationship after the initial transaction

Source JLR

capture value in terms of customer satisfaction and loyalty, and will also be in a position to challenge retailers on aftersales service.

B2B TO B2C

Other players could modify their model while moving more radically toward B2C. We have already cited the case of IBM, whose power to analyse combined data opens up opportunities to enter the consumer market. Other industries could make the same sort of move. Air Liquide Healthcare is already moving into home health support. All forms of home assistance and care, supported by IoT, could attract companies from the industrial sector to service activities for the end customer.

Likewise, public works and construction players could transform their business models. Could a company like Colas, which integrates sensors into roads and sidewalks, develop other B2B or B2C businesses using the data collected? Will the latter make it possible to supplement data collected by JCDecaux, for example, through its urban display panels?

B2C TO B2B

The reintermediation of some players is driving the disintermediation of others, but one is not necessarily better than the other.

For example, an insurer losing the sale of a policy to an end customer and becoming the supplier to a car manufacturer is not necessarily losing out if its volumes are large and the market is consolidated around two or three insurers.

A company that collects data to develop ad hoc services is well on its way to reinforcing its customer relationships. A player who misses out on these changes, on the other hand, is likely to be disintermediated. But is this a real problem? According to our research, models will be increasingly hybrid. Companies will be in direct contact with some customers while also being on the sidelines with others. This will require additional agility compared to current models. (See Exhibit 14.)

Exhibit 14: Potential IoT value and risk by vertical

	INDUSTRIAL INTERNET	SUPPLY CHAIN	INSURANCE	CONNECTED BUILDING	TELECOM AND TECHNOLOGY	RETAIL	AIR TRANSPORT	SMART UTILITIES	HEALTH
Productivity and costs	High	High	Limited	High	Limited	Average	High	Average	High
Differentiated customer service	Average	Average	High	Limited	Average	High	Average	Average	High
Innovative services	Average	Average	High	High	High	High	Average	Average	High
Revenues	Average	Average	Average	Average	High	Limited	Limited	Limited	Limited
Risk of disruption	Average	Average	High	Average	Average	High	Limited	High	Average

Potential value
- High
- Average
- Limited

Risk of disruption/risks
- High
- Average
- Limited

Source Oliver Wyman

HOW CAN YOU MAKE INROADS INTO SUCH A VAST SUBJECT?

APPROACH IOT AS A BLANK SLATE, STARTING WITH SERVICE

It is highly tempting to start with available data to derive an IoT strategy. We believe, however, that by starting with their existing assets, companies may miss out on the most innovative business models.

The scope of exploitable data will become infinite. It will be easy to get lost while trying to determine what can be exploited. Starting again with a blank slate and customer needs, thinking about usage ever more deeply, in terms of service: this is the approach most suited to designing innovative models. Withings initially built its offering by thinking as much about personal health and well-being as about data and collection tools. Such approaches, which derive their power from a detailed understanding of what users value, mean plunging into different verticals or spheres. They also increasingly require the ability to navigate laterally across verticals.

DERIVE A DATA AGGREGATION STRATEGY FROM THIS ANALYSIS

Data will not always be free, and powerful ecosystems capable of capturing them will come to the fore. It is thus important to establish strategies to collect solid data in a manner that respects customers. Depending on its specific position in a domestic market or its size on a global level, each player must decide if it wants to be an integrator of different systems or a mere participant in an ecosystem.

Philips, for example, has adopted a position of compatibility with major ecosystems. The company works in partnership with major players that complement its lighting offer, such as ABB.

Any data strategy must be based on trust and security. In a connected economy, the pact of trust between the company and its customers will be key. Establishing transparent opt-in agreements is essential, just like IoT end-to-end security to avoid the remote hacking of connected objects (for example, at home or in the car) and the plundering of data.

DIFFERENTIATE YOURSELF BY TRANSFORMING YOUR OPERATIONAL MODEL

To succeed, it is essential to adapt your operational model and differentiate yourself, which involves large-scale transformation of practices and the value proposition. A number of disruption points are emerging. We believe that only open-system models will be successful. Designing products with non-proprietary protocols is imperative.

Virtualisation and increasing disconnection of the physical product (or hardware) and software must be integrated far upstream. Products will have longer life cycles than software. Products will therefore have to be more evolutionary and reparable through online updates, meaning that cars or electricity meters must integrate this factor right from the design stage.

Service must be thought out before the product and must cover multiple products and models. The infinite potential of concepts such as IFTTT must be integrated into design as much as possible.

Some of the examples presented at the beginning of this article may still seem remote, but concrete, short-term initiatives can already generate significant value.

We have observed many usages with attractive return on investment (ROI). By equipping its refrigerated grocery aisles with sensors that respond immediately to potential breakdowns (to avoid the loss of food products), one supermarket chain amortised its IoT investment in a matter of months.

Pilot testing of "first viable products" is essential with IoT. This makes it possible to discover potential usages and gradually establish corresponding business models within ecosystems.

BUILD AN OPEN ECOSYSTEM (MARKETPLACES, ALLIANCES, START-UPS)

Succeeding in IoT will require establishing cross-vertical collaboration in different spheres. No company, no matter how large, can invest alone in tomorrow's applications.

The first impact will be the development of marketplaces where various players contribute to building the right solution. Telecom operators in particular are in a good position because they can be the architects of ecosystems, combining verticals and the technological building blocks that they provide and integrate.

Some players think they can develop an IoT strategy while remaining closed. They believe that they will be able to protect their business of installing automated home appliances by creating a closed ecosystem in the home. We think that these attempts are highly likely to fail. On the other hand, open strategies are likely to succeed if they offer exemplary customer experience and service as well as consistency.

Major European corporations do not appear to be very advanced in IoT. Nonetheless, there is a great proliferation of ideas and start-ups that need funding, especially for the second or third round of financing. To us, it seems difficult today to differentiate through IoT without an established and ambitious investment strategy or partnerships with start-ups.

Only open-system models will be successful

ADOPT A EUROPEAN APPROACH BASED ON COMMON STANDARDS

When a manufacturer develops a solution for the United States or China, an immense market immediately opens up. This is less true for Europe. The rationalisation of European industrial plans, reduced from 34 to 10, including one focused on connected objects, is a very good sign.

However, this is not enough. Aligning standards between different countries in Europe would be a decisive driver to accelerate the emergence of European IoT leaders. Such alignment is also critical to maintain innovation in Europe, as well as to ensure European data security, independence, and control.

In particular, a European response would support the emergence of ecosystems driven by large industry or service players, and would counterbalance the establishment of dominant de facto platforms.

Building European cloud and IoT data platforms as credible alternatives to global platforms therefore seems desirable in more ways than one.

IOT SCENARIOS IN NINE INDUSTRIES

The Internet of Things affects all industries, but their maturity level in this transformation depends on their particular characteristics. This is why we chose to carry out a more in-depth study of nine industries that appear most affected by this phenomenon: insurance, health, air travel, retail, industry, smart buildings, infrastructure and smart grids, telecommunications, and the supply chain. For each industry studied, we analyse the impacts of IoT and the opportunities and threats for incumbent players, and we end by anticipating strategic scenarios and new IoT business models.
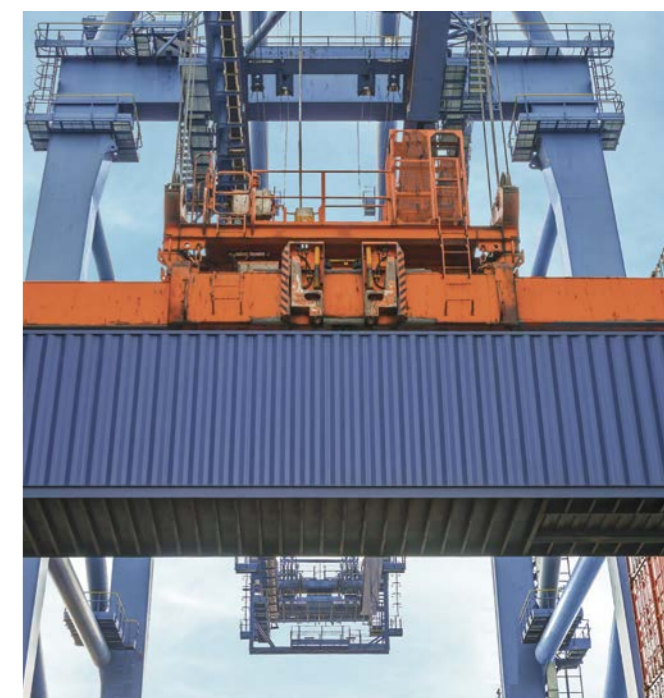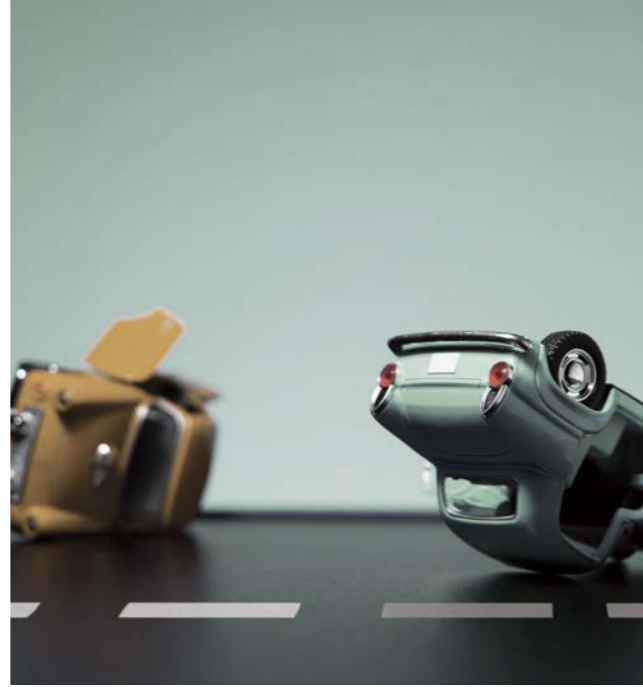
INSURANCE

A NEW DIRECTION
FOR INSURANCE

DAVID GIBLAS
THIERRY MENNESSON
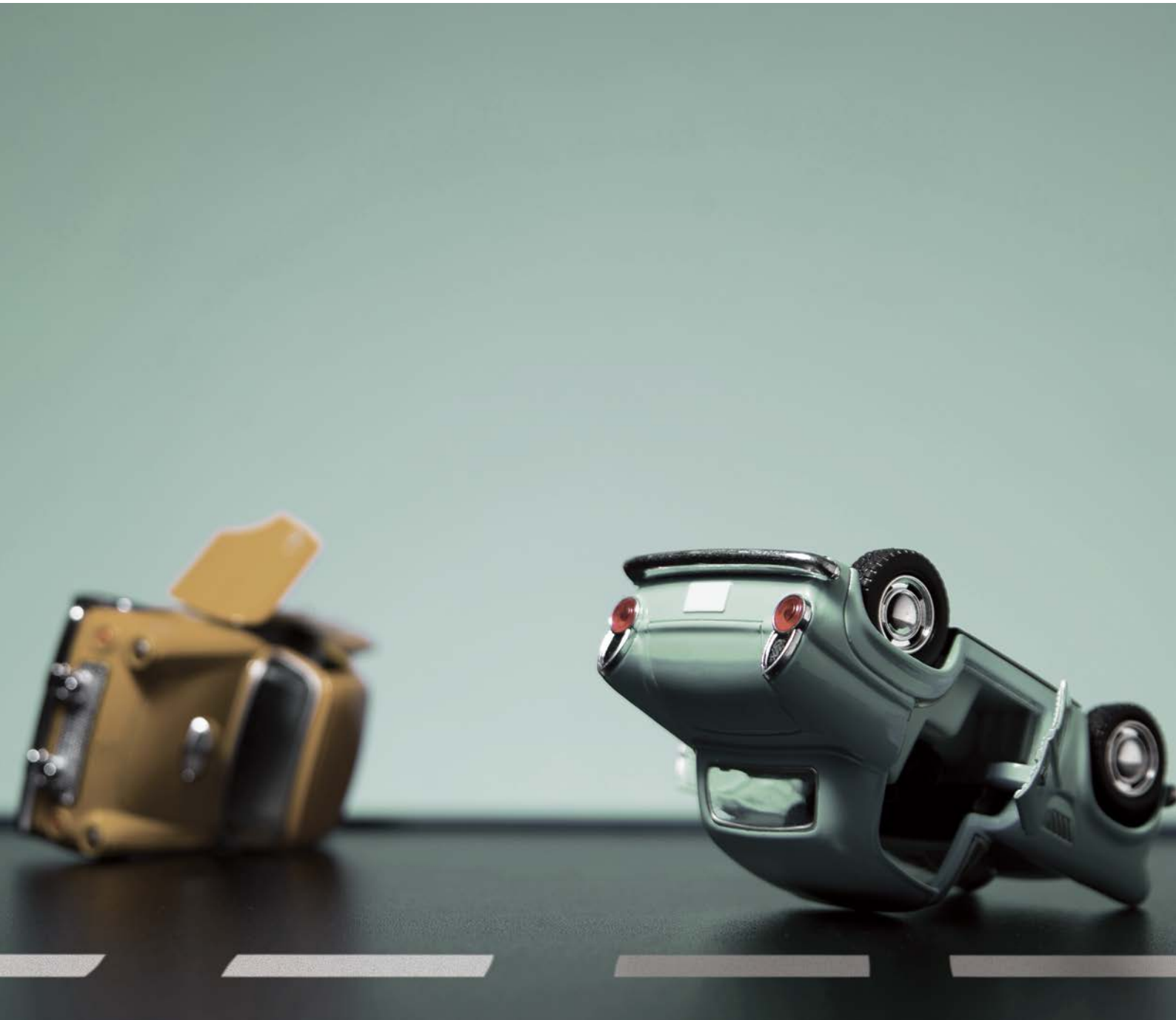
THE IMPACT OF IOT ON INSURERS

Insurance is an industry heavily dependent upon understanding and analysing risk, through gathering and observing data over time. Until now, this involved finding correlations between the frequency and severity of insurance claims on the one hand and data describing insurable assets on the other. These analyses were then used to develop models to select and price risks and manage risk portfolios. This information, known as cold data, primarily entailed a static description of the object of insurable risk (such as a car) and the environment likely to influence that risk (including driver profile and car usage type).

IoT deeply affects the insurance business by providing access to new types of dynamic information, known as hot data. This data relates to the object of risk, its usage level, and user behaviour. For many branches of insurance where risk is directly correlated to the exposure and behaviour of policy-holders, this hot data will deeply transform risk selection, pricing, and monitoring models.

Personal lines insurance (automotive, home, and health) is directly concerned by this correlation, with motor insurance being the most advanced in applying IoT-based models (see Exhibit 1). Indeed, telematics initiatives were carried out for this purpose as early as the 2000s.

Insurers have now made great advances in pay-how-you-drive offerings based on dongles plugged into the dashboard, smartphones, telematics devices ('black boxes'), or a combination of these technologies. Some have already launched an equivalent health offering, such as John Hancock's pay-how-you-behave policy (Manulife). Others are thinking about an application for home insurance, namely pay-how-you-live.

We believe that commercial insurance will also be greatly impacted by the emergence of IoT, even if the implications are greater for risk prevention and selection than for pricing models. Some industries are natural candidates for rapid transformation, such as agricultural insurance, building insurance, and small and medium-sized businesses in some market segments.

In addition to data, IoT is also revolutionising the customer experience. Interactions were until now few and far between (claims being made every four to five years on average in some lines of business) and often with negative perceptions because they were connected to claims management. IoT makes it possible for insurers to move from a low-frequency transaction-based model to a much more interactive model built on new ways to provide prevention, advice, coaching services and, of course, rapid assistance and support. The transition from "insurer as payer" to "insurer as protector" is therefore a fundamental change in positioning, allowing insurers to play their role fully in protecting customers and, in the process, to generate new potential sources of revenue, reduce claims, reinforce customer relationships, and improve their image.

Key takeaways. IoT is creating two major shifts that will have an impact on the economic models of insurers. It is now possible to exploit new information – known as hot data – relating to policy-holder usage and behaviour; Insurance will move toward more prevention and monitoring in real time, for the well-being and protection of customers from day to day.

Exhibit 1: The impact of IOT on personal lines insurance

More accurate underwriting, risk mitigation, risk management, and claims services

New pricing models: pico-segmentation, usage-based insurance (UBI) pricing models

New insurance/non insurance services: prevention, coaching, monitoring, etc.

New customer experience, better customer engagement, and improved client satisfaction

Development of smart end-to-end protection

SMART CAR INSURANCE SERVICES

AXA   Progressive   Aviva

Coverbox   Allianz   Generali

SMART HOME INSURANCE SERVICES

BNP Paribas   StateFarm

American Family Insurance   Allianz

SMART HEALTH INSURANCE SERVICES

Manulife   Oscar

Cigna   BP   AIA

Source ABI Research, Oliver Wyman analysis

IoT could revolutionise how property and casualty (P&C) insurance is priced, distributed, and serviced; it could shift the business model toward service-driven ecosystems

THREATS TO INSURERS

IoT offers real opportunities to insurers but also presents major new threats, which must be anticipated and managed.

Upstream of the insurance value chain, the need to possess huge volumes of data was the principal entry barrier until now. Today, this barrier is fast disintegrating under pressure from new players like GAFA (Google, Apple, Facebook, Amazon). These players are able on the one hand to collect increasingly

refined data and on the other to generate new relevant data and ultimately extract the intelligence required to feed their business models in real time. An additional threat to insurers is posed by the emergence of a new category of players, the aggregators, which consolidate data from multiple ecosystems to propose new services.

Further down the value chain, in the domain of distribution as well as the customer relationship, there is a battle to gain access to the customer. A wide variety of threats are coming from pure players (for example, GAFA and Instech), data concentrators, new big data players (such as Big Telematics, Cobra, and SAS), telecommunications operators (like Orange), "big tech" (IBM for instance), service operators and manufacturers (including car manufacturers and energy providers), IoT equipment manufacturers, and so on.

The danger of disintermediation is very real for insurers. IoT incontestably flattens the value chain, as evoked in Thomas

L. Friedman's best seller, The world is flat. Hyper-connectivity and the flow of data enable players from different industries to expand into the insurance market. Different players may have different strategies but they share the ability to generate, collect, or consolidate data and, based on the extracted intelligence, to develop customised, on-demand service propositions. They are positioning themselves as unavoidable access points to customers. Some players appear more likely than others to win this battle. The legitimacy and ability to cope with these changes is becoming a burning issue for insurers in each market segment.

We are also seeing a demoduralisation phenomenon led by specialised players who hack the customer relationship on a very specific activity through a low-price approach combined with IoT. Automotive assistance in the US is a good illustration of this phenomenon. Newcomers like Urgent.ly (partners of Mapquest and AT&T) are using service provider network management capacity combined with technology firmly woven into the customer relationship to position themselves in the automotive assistance market and extract it from the traditional insurance value chain. The mandatory installation of eCall into all cars starting in 2018 will very probably amplify this phenomenon in Europe.

The home assistance market is also attractive, with many start-ups positioning themselves as service aggregators (HomeAdvisor.com, Buildzoom.com, and Pro.com for example) or Amazon and Google deploying new home services offerings. The "uberisation" of assistance, which we translate as the emergence of sophisticated relational marketplaces, will spread gradually to all domains; we wouldn't be surprised if Uber itself decided to extend its know-how into the assistance sector.

But the new rules of the game are even more threatening to traditional insurers. Indeed, some players might even be tempted to extend their incursion into the insurance value chain as soon as they have perfect control of data and the customer relationship (see Exhibit 2). Players like Google will very soon be able to calculate the cost of risk precisely, and so could set up a reverse auction system based on the estimated price for a given pool of risk. In this scenario, insurers would lose control of pricing and be relegated to the low-value- added role of risk holder.

The question remains open on whether these players – whose ability is now proven – actually want to become fully fledged insurers for certain types of risk. The decision to continue along this path depends essentially on their interest in positioning themselves in a highly regulated business made less attractive by the rising cost of capital.

The accepted objective of using data to acquire new knowledge is to make our lives easier, safer, and less exposed to risk. According to our estimates, we can expect a big reduction in losses and consequently a shrinking of premiums by more than 20% for specific business lines. This will drive insurers to find new ways to generate revenues to compensate for the lost turnover. We see three main revenue-generation opportunities: the rising need to insure cyber-risk and new IoT intelligence; diversification of insurance to provide customers with prevention and coaching services; and first-mover advantage, in which a new IoT-based selection and pricing model is used to attract the most profitable risks in the market and leave the rest to the competition.

In the latter cases, the adverse-selection phenomenon could be fully tapped by adopting an IoT business model. There will be big winners but also some big losers.

Exhibit 2: Threats are coming from all sides

IN THE NEW IOT AND DIGITAL WORLD, MANY ACTORS ARE WELL PLACED
TO CAPTURE THE CLIENT RELATIONSHIP
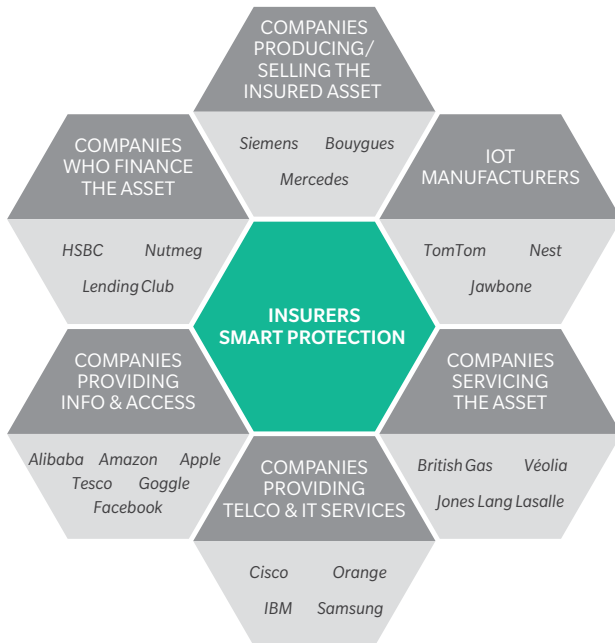
- How can client access and relationships be maintained in this new ecosystem?
- Which actors are the best placed and have the credibility to capture the insurance relationship?
- Can we keep/do we have to keep the customer relationship?
- What are the best distribution channels to sell smart protection offerings?
- Which actors would be the best possible distribution partners for insurers?

Source Oliver Wyman

Customer hyper-segmentation and risk pooling challenges are now burning topics of discussion, particularly concerning the impact of pay-how-you-drive offers. IoT will make it possible to refine knowledge of usage- and behaviour-related risks, and sanction of higher-risk profiles. We believe that pricing will be increasingly segmented, probably starting with the populations that are least well segmented today due to the lack of basic behavioural information (on young drivers for instance). Segmentation will then be refined in other areas as the correlation between behavioural, usage, and claims data is better understood.

Some insurers are already applying micro-segmentation of risk to particular types of insurance, and IoT is opening the way with nano- or even pico-segmentation. We are also convinced that pricing models will fit in nicely with highly sophisticated risk selection and portfolio management models. The trend is thus toward the de-averaging of pricing, without knowing at this stage whether this will ultimately lead to purely individualised pricing or even if the public authorities will allow it.

The new offerings will encourage customers to reduce their exposure to risk by adopting safer and more responsible behaviours. Ultimately, this would be in the best interest of customers and insurers alike.

However, this principle cannot be applied uniformly in every domain. In healthcare, for example, this system would strongly penalise people who suffer from unfavourable genetic predispositions and who cannot reduce their exposure to risk by simply changing their behaviour. We consequently recommend extreme caution and discernment in applying such models to ensure that populations

known or considered to be particularly at risk can continue to find insurance at an affordable cost. The public authorities will have a major role to play in managing the application of these new models.

Key takeaways. Insurers face many threats to the value chain both upstream (including data collection and usage) and downstream (such as distribution and customer relationships).

We are already witnessing the emergence of players in many industries attempting to adapt or divert the customer experience in their favour: the latter are sometimes termed customer experience (CEX) specialists or growth hackers. Some of these players may even be tempted to become fully fledged insurers.

Insurers must imagine new sources of revenue to compensate for the reduction in insurable assets. The adverse selection phenomenon will considerably boost the premium to the first movers who manage to industrialise an IoT business model suited to insurance. The public authorities will have a major role to play in regulating the application of these new models and ensuring that some population segments do not become uninsurable.

NEW IOT BUSINESS MODELS AND STRATEGIC SCENARIOS

Insurers must thoroughly rethink their value proposition to take account of the unprecedented disruption of the industry that IoT will cause. The value proposition, which covers not only products and services but also the customer experience, must be fundamentally changed to migrate to more

personalised, on-demand service while improving the core business of the insurer.

In our view, the IoT value proposition for insurers will have seven dimensions (see Exhibit 3):

1. Sophisticated risk segmentation, selection, and management
2. Improved fraud identification and claims management
3. Establishment of automatic assistance and emergency services, automated claims notification, and automated claims management
4. Development of new pricing models based on usage and behaviour
5. Introduction of new risk prevention, protection, and management services
6. Real-time risk tracking and management
7. Redefinition of the customer experience

We believe that implementing these new proposals must be both segmented vertically (retail, car, home, health insurance, and so on) and progressive. This will make it possible to manage the greater complexity of multiple factors, such as the need to process new data not immediately exploitable for the purpose of understanding claims, acquire new skills, transform the value chain, create new partnerships, and stabilise applicable technologies.

These new IoT-based propositions will force insurers to address the key issues of their data access strategy and their distribution and customer relationship strategy

DATA ACCESS STRATEGY

Many initiatives launched today by insurers depend largely on a collaborative partnership with IoT suppliers: telematics for the car, thermostats and other sensors for the home, fitness bracelets for health, to name only a few.

Our perception is that these initiatives are principally designed as vehicles for communication or "buzz", or to test new customer services and learn to use new data, rather than as a real medium-term strategy.

Many questions remain concerning the target of the IoT data collection and usage environment, and there are a number of potential operating models. These include a single open platform by ecosystem, several proprietary platforms by ecosystem, a platform covering multiple ecosystems, open data platforms, and hybrid models.

We are convinced that insurers cannot win the data battle alone, due to the unbalanced distribution of power. They will thus have to cooperate with other players across, within, or by combining vertical ecosystems (car, home, health, and so on) and cannot afford to ignore the need to monitor ongoing data initiatives and conduct multiple pilot tests to pre-empt the best possible partnerships depending on the estimated value of the data.

Exhibit 3: New IoT value proposition for insurers

New customer experience: hassle-free, differentiation through selected delights, signature moments, experience innovation

Prevention and risk advisory services, feedback and ability to change/command customer behaviours

Rapid emergency in case of claims, fast FNOL (First Notice Of Loss) and claims processing, anticipation of indemnification

Better risk assessment, more accurate pricing and risk monitoring

Risk monitoring in real time: auto diagnostic, (predictive) maintenance, self monitoring, tele coaching services, ...

New pricing models: usage/behaviour-based pricing

Better fraud identification, better assessment of the cost of loss

DEPLOY NEW NON-INSURANCE SERVICES

OFFER IMPROVED INSURANCE SERVICES

IMPROVE RISK CARRIER CORE BUSINESS

	INSURE THE RISK	CONTROL THE RISK	PREVENT THE RISK
5. Insurance only vs. diversification	Insurance and assistance	+ tracking, emergency, some location-based services	+ prevention, monitoring, coaching, multiple adjacent services
4. Static vs. dynamic value chain	Static	Fast reactive	Dynamic: dynamic pricing, product configuration, instant marketing, events-triggered services
3. Past-based vs. predictive model	Static models based on past claims patterns	+ usage based data	+ behaviour data and predictive patterns
2. "Cold" vs. "hot" data	"Cold" data	+ rapid adjustment	+ "hot" data on-the-fly
1. Few data vs. variety of data	Internal data used (customer, risk, history, claims record, ...)	+ external static data	+ multiple IoT data sources

Source Oliver Wyman

DISTRIBUTION AND CUSTOMER RELATIONSHIP STRATEGY

Many players, such as GAFA, are betting on using data to capture the customer relationship. Their objective is not to sell raw data or even the corresponding patterns but to position themselves as unavoidable players in the customer relationship by incorporating multiple services using the intelligence extracted from this data. Faced with this new type of competition, insurers must define their positioning precisely.

We expect the polarisation of distribution and customer access models (see Exhibit 4), with the emergence of two major archetypes:

Archetype 1. An "insurance inside" model distributed by other upstream or downstream players in the insurable matter value chain. This insurance could be subscribed to when purchasing an item requiring insurance (for example, car manufacturers could sell a package of services including IoT-based auto insurance) or paid over time according to the usage of the insured good or service (energy providers and telecoms providers are well placed to distribute IoT-based home insurance). This archetype may go as far as transferring (some) retail insurance to cover the civil liability of the manufacturers of goods and providers of services. This is true, for example, in the automotive industry, where the spread of autonomous vehicles will cause a large share of premiums to migrate from coverage of drivers to liability coverage of manufacturers.

Archetype 2. A "smart protection services" model in which the insurer preserves the customer relationship by providing a package of services, insurance, and more.

This package would cover a whole range of needs, from prevention to assistance, not to mention coaching and monitoring. This model could be established either through partnerships (service orchestration) or extending the value chain (service integration).

Disintermediation incontestably puts great pressure on producer margins, and this will be the main problem with archetype 1. Nevertheless, we feel that this positioning can generate great value if insurers can fully exploit the potential of their data and establish wide-reaching partnerships with distributors. These extended relationships must be based on providing high-value-added services around the intelligence extracted from customer, product, and service innovation data. They should also be backed up by sophisticated selection and pricing models, adapted marketing and sales materials, effective distributor and customer tools, and a portfolio of assistance services.

The ability of insurers to operate internationally will also be critical in implementing this archetype. Indeed, it is highly likely that the shift from business-to- customer (B2C) to business-to-business (B2B) coverage will require insurers to propose offerings covering all of the countries where manufacturers or service providers do business (for example, automotive). This could therefore lead to consolidation of non-life insurance players.

The main problems with archetype 2 lie in the feasibility of execution and the legitimacy of insurers in playing a service hub role. Indeed, distribution and customer experience have not been the historical strength of insurers. In addition, digitalisation of the insurance sector remains immature in comparison with other industries, even if some insurers have greatly accelerated their digital transition.

Exhibit 4: Polarisation of archetypes in insurance

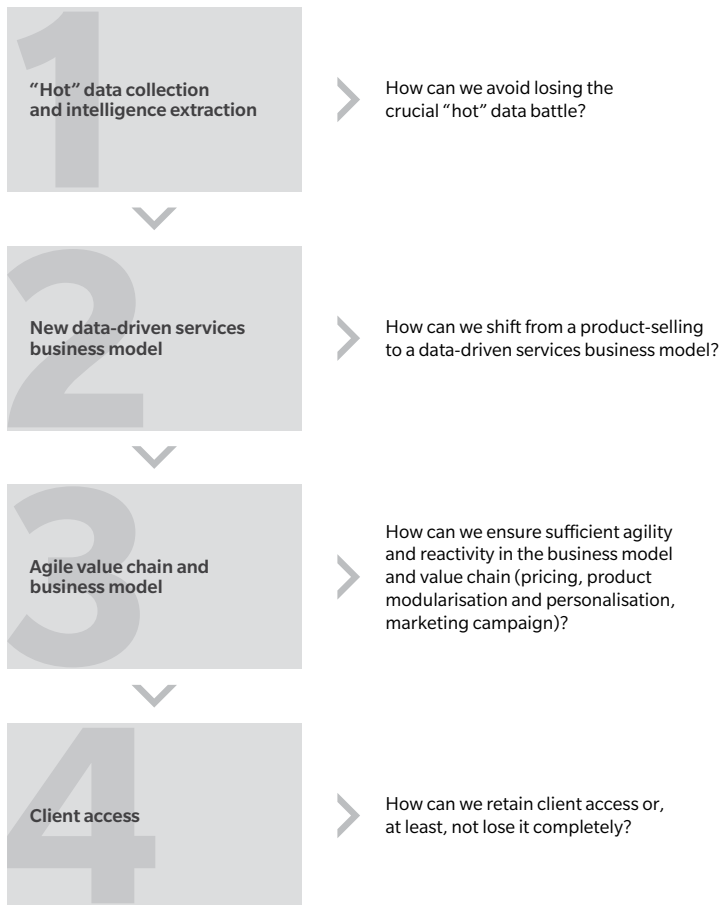|	NEW MODELS RISK CARRIER	TRADITIONAL MODELS		NEW MODELS CLIENT ACCESS
	ARCHETYPE #1 THE PURE RISK HOLDER	THE LOW COST	THE MULTI LINER	**ARCHETYPE #2** SMART PROTECTION SERVICES
Model key characteristics	• Insurer is competing on its core "risk carrier" business • New players have secured client access and expanded into insurance services distribution	• Insurer is competing on price and provides only basic products and services • Insurer only targets selected consumer profiles	• Insurer provides a wide range of tailored insurance products and services • Distribution model is a combination of proprietary and non-proprietary channels	• Insurer has become an end-to-end risk manager • Insurer plays the role of a hub aggregating insurance and non-insurance digital services for its customers (white-labelling)
Margin potential				
Difficulty	Low	Medium	Medium	High
Value creation model				

Source Oliver Wyman

This archetype will thus require huge efforts from insurers to establish a customer-oriented culture, create a seamless and user-friendly customer experience, adopt new fast execution practices, develop tangible innovations, accelerate digitalisation, reinforce the agility of the value chain, recruit and retain new talent, and build extended ecosystems. To accomplish this, insurers are advised to take inspiration from best practice, including by pure internet players, and pay particular attention to the aforementioned CEX specialists and growth hackers.

We believe that insurers who have an existing assistance subsidiary are better equipped to build archetype 2 because these structures can help create and manage service provider networks and provide a strong(er) customer culture. Moreover, several large insurance companies already use their assistance subsidiary as a secret weapon for diversification and pilot testing. The most pressing questions would then involve insurer governance and the ability to deliver rapidly. As one famous insurance industry CEO told us: "Assistance used to be sold with the insurance; but in the future, we might see insurance being sold with the assistance."

It is crucial for insurers to apprehend the forces at play and the changes to come in each of their verticals. By analysing their positioning, strengths and weaknesses, investment capacity, and legitimacy, they will be able to identify the most relevant business models. The definition of these target business models will have to start with a detailed understanding of the end-to-end customer experience (for example,

Exhibit 5: Main challenges for insurers in the IoT race

1 "Hot" data collection and intelligence extraction › How can we avoid losing the crucial "hot" data battle?

2 New data-driven services business model › How can we shift from a product-selling to a data-driven services business model?

3 Agile value chain and business model › How can we ensure sufficient agility and reactivity in the business model and value chain (pricing, product modularisation and personalisation, marketing campaign)?

4 Client access › How can we retain client access or, at least, not lose it completely?

Source Oliver Wyman

Addressing these challenges will require insurers to shift to different marketing strategies and rethink the end-to-end customer experience

from car insurance to integrating the need for mobility of all kinds) and, at each step, rethink the corresponding value proposition, capitalise on the intelligence of current and future data, as well as develop the best sourcing strategy for data, services, and technology (see Exhibit 5).

In the automotive industry, for example, insurers may well be obliged to come up with an "insurance inside" archetype, given the power of auto makers. The latter have already made great efforts to reinforce control of their ecosystem and erect new entry barriers (for instance, with connected cars and autonomous cars). Other serious players are also in the race, such as Google and Apple. It is probable that the "insurance inside" model, as we have already mentioned, is just an intermediate stage for auto makers before moving to B2B insurance. Conversely, in home, health, and corporate insurance, the game isn't over yet. Although the battle is raging in all of these sectors, insurers can still hope to position themselves in the customer relationship with a smart protection services archetype, using their assistance subsidiary as a spearhead.

Key takeaways. IoT will drive insurers to redefine their value proposition, in terms of offering but also customer experience, and migrate toward more prevention-oriented assistance services. Data access and distribution strategies will be decisive in executing these new IoT business models. Two distribution archetypes will come to the fore in the long term: insurance inside and smart protection services. These new business models must be defined, starting with the end-to-end customer experience, by rethinking the corresponding value proposition at each stage. The ability of insurers to form partnerships and join the right ecosystems with a vertically segmented approach, and capitalise on their assistance services or offers, will be decisive.

HEALTHCARE IS POISED FOR TECHNOLOGY-LED TRANSFORMATION

ANDREW CHADWICK-JONES

These days, the surest sign that an industry is about to undergo wrenching change is a sudden influx of tech entrepreneurs backed by venture capital investment. Travel, retail, journalism, and media have all been the target of their own tech attacks in recent years. The process has created immense value for consumers but has been brutally hard on the companies that traditionally dominated those sectors – at least those that failed to respond quickly and well.

For decades, healthcare has largely been exempt, despite serious attempts by market leaders in financial services, consumer technology, software, and beyond. But it now seems this vital industry's turn has come at last. Over the past five years, tech start-ups and venture capitalists (VCs) have been targeting health and healthcare at a rapidly accelerating pace, urged on by regulatory reform, a crisis in costs, and value-starved consumers. While perhaps not highly visible (yet), the tech sector has been quietly working on the next generation of our healthcare market: Health Market 2.0.

Most commentators would agree that healthcare systems are inefficient and the product of policy decisions taken more than a generation ago.

For example, the UK NHS' structure is little different from the time of its inception in 1948. And in a time of rising consumer expectations, the user experience of healthcare is falling behind, particularly when compared to Uber for personal transport, Amazon for shopping, or Open Table for picking a restaurant and making a reservation. In healthcare, nearly everything is inconvenient, slow, confusing, and opaque. It is hard to determine which doctor to see and even harder to know if they are following evidence-based guidelines, taking a holistic approach to medicine, or are priced in line with the market.

And so the tech entrepreneurs are doing what they do best: redefining the rules and tipping value their way, creating magnetic new products and services that eliminate hassles and delight consumers.

Some provide general health information (such as Greatist or WebMD), help consumers prepare healthy meals (Zipongo), or even provide live, video-based personal training sessions (Wello). Others drive personalised engagement by aligning consumer actions and behaviours with incentives and rewards (Welltok), offer primary care based on a whole new model (Iora Health), or enable consumers to find doctors, make appointments, and identify low-cost opportunities (Castlight and ZocDoc). And of course there are the apps for smartphones and tablets, tens of thousands of them, to count your steps, track your blood sugar, connect you to a community of patients with similar concerns, provide health information, or let you compete with your friends on who burns the most calories.

Exhibit 1: Healthcare software and apps companies early stage funding

NUMBER OF ROUNDS OVER $2 MM
2009-2013
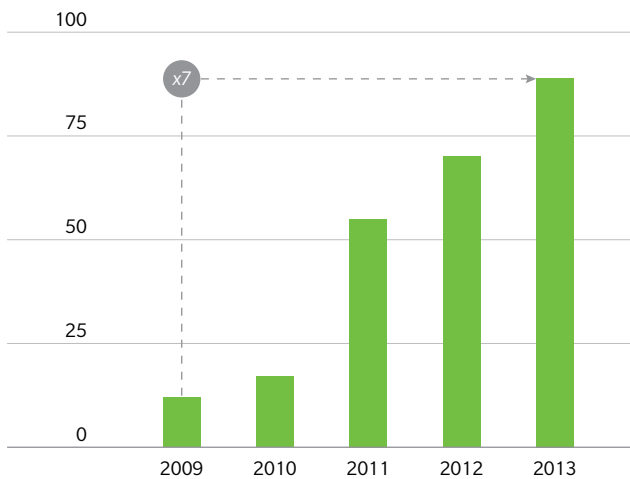
There are between 50,000 and 100,000 health and fitness applications

Consumers have responded. WebMD attracts 180 MM unique visitors each month to its network of websites. Jawbone's Up band, one of the leaders in fitness tracking, recently registered its trillionth step. There are between 50,000 and 100,000 health and fitness apps, mostly monitoring exercise and eating, some tied to wearable sensors or biometric devices.

According to the research firm Research2Guidance, the top ten health and fitness apps generate up to four million free and 300,000 paid downloads each day. The top-ranked, MyFitnessPal, says it has more than 40 MM registered users. And where there is accelerating consumer demand, there is investment. In 2010, only 17 healthcare-focused software companies attracted seed investments of $2 MM or more. In 2013, the number was 89 (see Exhibit 1).

Just as important as venture capital are the investments that the incumbent technology firms are plowing into health-related projects. Google, in addition to developing a "smart" contact lens that measures blood glucose levels, has invested in a dozen health start-ups through Google Ventures. IBM recently announced it would invest $1 BN into the new Watson Group, including $100 MM toward venture investments to support start-ups who are building cognitive apps through the Watson Developer Cloud. In early 2014, Intel bought Basis, a health-related smartwatch company, for somewhere between $100 MM and $150 MM. WebMD launched a new programme in its iOS app Health Target that integrates not just activity from a Fitbit or Jawbone UP band but also data from health devices essential to those with chronic diseases (such as glucometers and wireless scales). Apple made a series of announcements in September 2014 positioning the company to broadly expand their consumer relationships into health.

All in all, the past two or three years have seen an outpouring of innovation and investment in health and healthcare that is simply remarkable, and all the more so for its pace – easily ten times faster than anything healthcare has seen before.

THE FUTURE HEALTH SYSTEM AND THE RISE OF THE QUANTIFIED SELF

Consumers have long tracked activities relevant to their health, keeping diaries and logs of exercise, calories, and the like. But over the past few years, the "quantified self" movement has taken the practice to a new level, using electronic sensors to track a variety of metrics that can then be digitally processed, interpreted, and shared in databases with other people's information (see Exhibit 2).

The popular devices created by Fitbit and Jawbone let us track steps, activity, and sleep. Soon though, we will also be able to track metrics on calories consumed and burned, blood pressure, glucose, oxygen levels, heart rate, and cholesterol. Consumers at last will have access to a set of relevant numbers regarding their health, just as they have had numbers to track their finances.

Already 95 MM Americans are using mobile phones for health information, according to Manhattan Research. Most are tracking a single health indicator, such as weight, diet, exercise routine, or symptoms. Consumer tools such as Greatist (general health information), Zipongo (nutrition), and Wello (fitness) allow consumers different entry points to improve their "health IQ" – and resources to help change long-term behaviour.

Consumers have never had access to this kind of data before. Neither, for that matter, have their doctors (except in the emergency department or intensive care unit). Physicians tend to look at electronic health records (EHRs) only when patients are symptomatic – a few times a year (or decade) – and the records are mostly limited to clinical information. But we're approaching a time when the EHR will incorporate real-time data on multiple metrics, and the conversation between doctor and patient will have greater intensity and depth, supported by real-time data.

It makes eminent sense that a population's health managers would support and pay for predictive, preventative, personalised, real-time engagement that could help consumers live without many acute health events. Already, companies from BP to San Francisco start-ups are giving their employees Fitbits to track exercise and sleep, thinking that knowledge is power and can help to reduce healthcare spend while increasing productivity.

The quantified self movement will set the stage for long-term behaviour change by engaging consumers and activating social networks. By encouraging the silicon players, retailers, and consumer-health companies to enter the market, the movement will catalyse the rise of a consumer health market, counter-balancing the current health producer-centric world. And once consumers have experienced health and wellness in a connected, social or mobile, 24/7 retail setting, they will inevitably come away with higher expectations for service, access, personalisation, and speed from their care teams.

Exhibit 2

HEALTHY LIVING VALUE
- Steps or activity
- Sleep
- Nutrition
- Stress
- Weight

CLINICAL AND HEALTH CONDITION VALUE
- Blood sugar
- Weight changes
- Blood pressure
- Heart function
- Blood oxygen

EXPENSES AND BUDGET VALUES
- Affordability
- Deductible status
- Exposure
- Pharmacy costs
- Reward opportunities

SUMMARY
HEART RATE 110 BPM
BLOOD PRESSURE 120 / 80
GOOD GOOD GOOD

QUANTIFIED SELF, THE BRIDGE TO A PERSONALISED HEALTH AND WELLNESS MARKETPLACE

Real-time personalised preventive health

Increased relevance and engagement through social communities

Smart personalised shopping

SOCIAL AND EXPERT COMMUNITIES

EXCHANGES AND SHOPPING MARKET

HEALTHY LIVING REWARD EXCHANGE

Source Oliver Wyman

Finally, imagine the impact when trillions of personal data points are connected to a big-data analytical engine that can perceive patterns and dispense advice. Consumers will soon have access to IBM's Watson computing system for personalised advice on health and wellness. Welltok's integrated CaféWell platform connects health plan members to a wide range of health improvement programmes, devices, health and lifestyle information, and applications in a single consumer interface. With its Watson partnership, it is creating CaféWell Concierge, delivering a uniquely personalised experience and advice based on the information gathered by Welltok and processed by Watson's big-data computing capability.

This convergence of big data and consumer social data – or whole population data and individual data – suggests how the supply side and smart care teams will be able to radically improve prevention and care, in addition to providing another pathway to higher consumer expectations.

Philip Elmer-DeWitt, long-time Apple watcher and online columnist for Fortune, asks: *"What if the more important market – the one that's ripe for disruption and big enough to warrant Apple's attention – is people for whom things like pulse oximetry are a matter of life and death?"* He goes on to add: *"Real-time triage. Long-term observation. Correlation with hospital records. With the baby-boom generation about to move en masse into government-subsidized health insurance programs, nursing homes and hospice care, those are serious growth markets. And if a generation of young, healthy joggers could be trained to watch for trouble signs before – not after – they get sick, we'd all be better off."* (fortune.com, 3 February 2014)

And remember, many life-preserving and life-enhancing activities don't require the intervention of doctors. Could a company like Apple persuade a substantial number of consumers to open up their medical records, share their biometric data, and treat their iPhones as their main point of contact with care, then persuade them it's fun and cool?

In a few years, consumers will look back and realise how antiquated the medical system used to be: measure a handful of numbers (such as high- and low-density lipoproteins, triglycerides, glucose, and the A1c diabetes blood test) every 12 to 18 months, hear a few admonitions about diet and exercise, and forget them without any follow-up or coaching. Is that really how we did things? Why didn't we think to demand more?

IMPLICATIONS FOR INCUMBENTS

When an industry is hit by a transition like the one facing healthcare, incumbents face tough challenges. Instances of existing players navigating these successfully are rare and worthy of note: IBM made it from tabulating machines to mainframes to minicomputers to PCs to outsourcing to big data. Apple went from computers to smartphones to personalised streaming to active lifestyle management (dashboards, shopping, and so on) to dynamic social communities. What will it take for healthcare incumbents to prosper in the new world?

We think existing players need to understand how the new entrants are redefining consumer expectations of value, and then consider participating in a redrawing of the landscape in which both

can win by creating new magnetic offerings for consumers. External innovators are lithe and well funded. They know consumers but not healthcare. They are unlikely to displace the incumbents, with their risk reserves, actuarial science, contracted networks, medical licences, and power to save lives.

For incumbents, the first priority is to be honest about what they bring to the table and what parts of their legacy business models may play a lesser role going forward. Leaders need to understand the relationship between value creation, strategic control, and the new profit zones. Value capture, in particular, is highly sensitive to strategic control. Too many organisations do the heavy lifting required to create competitive advantage, then fail to fully capture the value.

Unlocking the incumbent's dilemma is no easy task. The rate of failure far exceeds that of success. Through in-depth leadership discussions with existing players and innovators and careful study of non-healthcare success stories, we found the following five insights to unlocking the incumbent's dilemma.

CHANGE YOUR FRAME OF REFERENCE

The future world combines health and wellness, includes retail, and shifts the market from supply-led to demand-led. It also breaks the "healthcare is local" paradigm through web services, mobile apps, big data, and remote healthcare. If you are operating your business within the realities of today, reframing what the future world will look like is critical.

Exhibit 3: Health plan skip generation plays

Incremental improvements on the current business model are not sufficient; skip generation plays through strategic partnerships are essential in health market 2.0
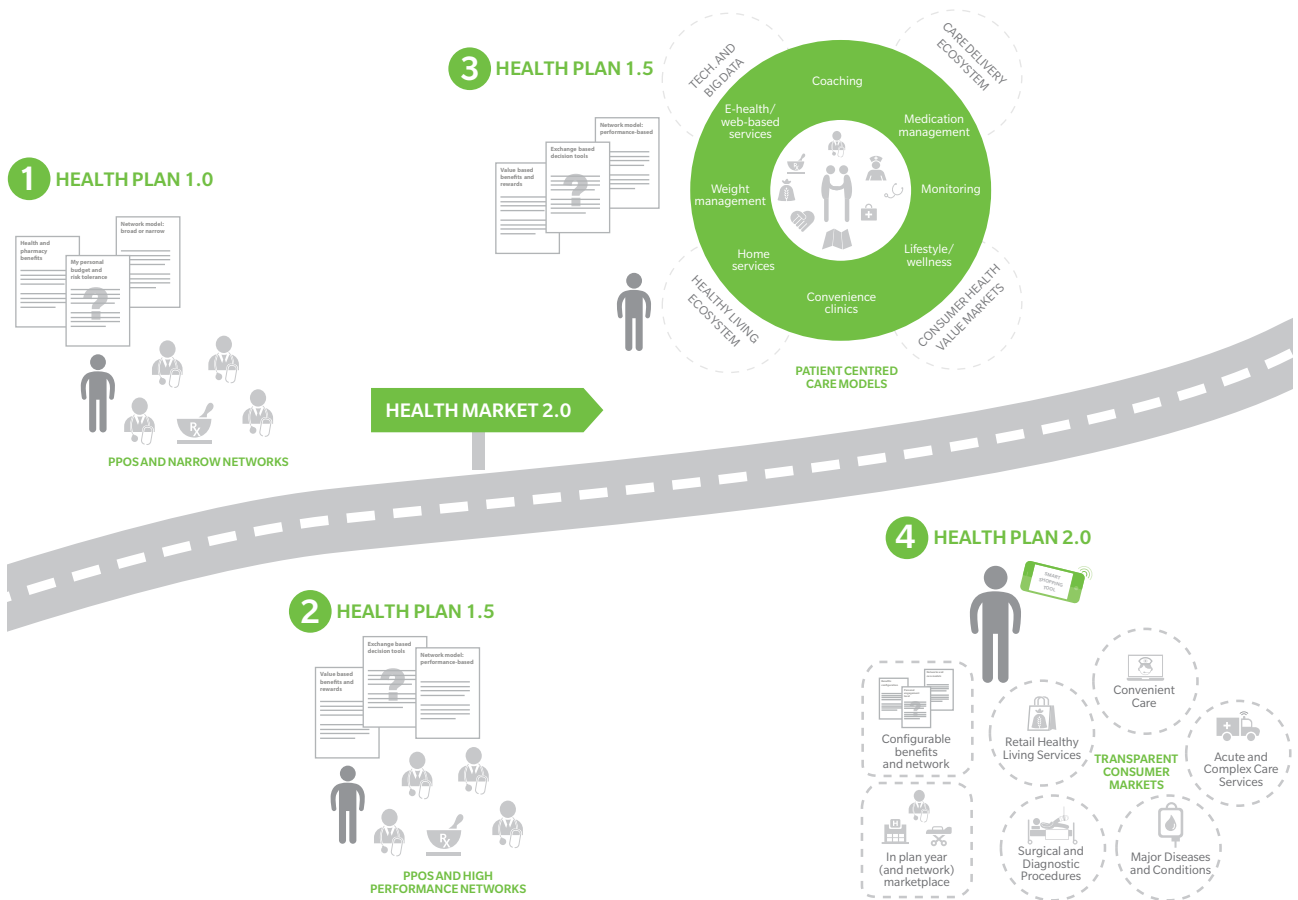
BE AWARE OF YOUR PLACE ON THE VALUE LADDER

Thinking you are best-in-class and an industry standard while you are about to be commoditised by a better-value alternative is a peril of markets undergoing transformational change. What happens when Walmart redefines the convenient care market? Or Theranos cuts the cost of diagnostics in half while improving the value by a factor of ten?

KNOW IT'S NOT A LEVEL PLAYING FIELD

Many of the new players are consumer web service companies competing at silicon speeds, in a global marketplace, using ecosystem thinking, and constantly innovating. For these companies, five cents of capital produces a dollar of revenue – compared to many of the incumbents where it takes a dollar of capital to produce a dollar of revenue. Not surprisingly, capital markets favour the new players. Partnering then allows incumbents to participate in that capital market advantage.

SKIP A GENERATION

Continued improvements on the current business model are required but not sufficient (see Exhibit 3). Getting better at sickness care or offering lower-cost health plans is great in the short run but won't drive a winning position in the new race for consumer value. Why not build a future market strategy document – a "playbook" – based on next-generation technology and introducing big data, passive monitoring, and retail pharmacy integration as part of the patient-centred medical home strategy?

DON'T GO IT ALONE

Bridging health and wellness, becoming a consumer company, redefining personalisation, and deploying big data, complex adaptive workflow, and passive monitoring to prevent most acute events; these are massive changes. When you take a careful look at most incumbents through a readiness lens, you realise there is a long list of missing competencies. When you look at the new players, you realise you don't have to build it on your own – and the capital markets are already doing the heavy lifting.
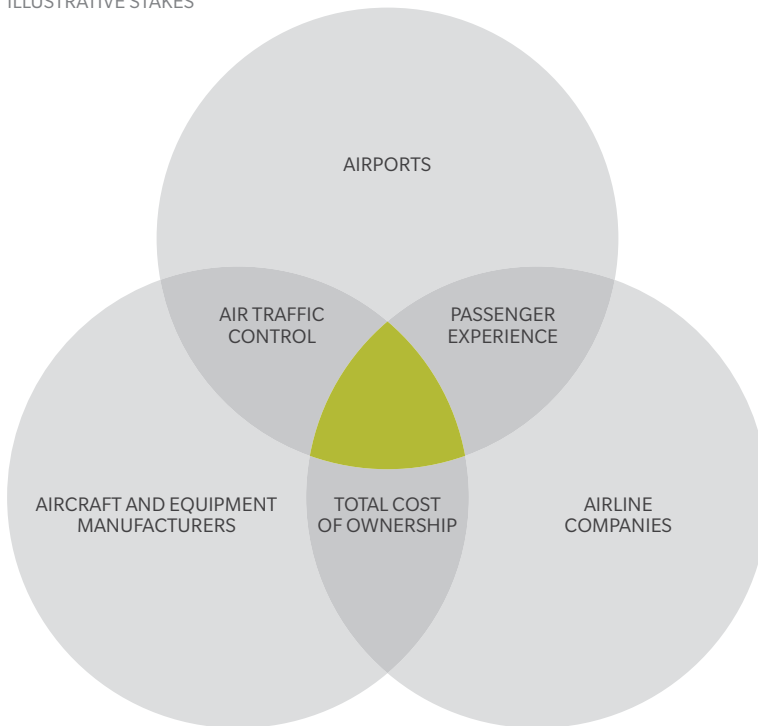
AIR TRANSPORT

STEP UP THE PACE OF GROWTH IN THE ALREADY FLOURISHING AIR TRAVEL INDUSTRY

SÉBASTIEN MAIRE

Exhibit 1: IoT in industry

KEY VALUE CREATION DRIVERS
ILLUSTRATIVE STAKES

Source Oliver Wyman

IoT presents a considerable opportunity to create value for the air travel industry (see Exhibit 1). All players – designers, manufacturers, suppliers, airlines, airports – could capitalise upon IoT in many ways to optimise their operations, understand their customers better, and develop new sources of revenue. The idea of using smart objects is not new. GE Aviation has used sensors in its most innovative flight management systems since 2007. Today, however, the real value of IoT lies in the way objects are connected and data is collected, aggregated, and analysed, making it possible to boost the performance of the entire industry or even reinvent the business model.

Air transportation firms will be able to cash in on new IoT technologies. According to GE, optimising flight itineraries would allow airlines to reduce their fuel consumption by 1%, saving $30 BN over the next 15 years. Reducing the number of technical incidents or the time needed to solve them would also have a real impact on maintenance costs, aircraft utilisation rates, and overall customer satisfaction. Data has thus become the most invaluable component of tomorrow's air travel value chain, and industry players must learn how to collect, process, and monetise it.

Imagine a world where airlines pay their fleet by usage, the number of flights, or even the number of passengers, and so have nothing to do but manage the customer relationship. A world where engine and aircraft manufacturers such as Rolls-Royce, GE, Airbus, and Boeing can identify and fix technical incidents before they even occur. A world where airports adapt the customer experience to the preferences of individuals, who waste no more time waiting or seeking information. This is the world of air travel in the era of the Internet of Things (IoT).

IoT can be applied in several domains of air travel. All of the principal industry players – aircraft manufacturers like Airbus, Boeing, Bombardier, and Embraer, airlines like American Airlines and Emirates, or today's large airports – use IoT to optimise the business and reinvent their customer proposition.

OPTIMISE OPERATIONS

Reducing operating costs (like energy and maintenance) and optimising flight itineraries, crew management, and aircraft life cycles will rationalise air operations and ensure that assets are better managed.

REDUCE AIRCRAFT OPERATING COSTS

Real-time in-flight analytics use thousands of sensors and captors to study the itinerary of each flight and recommend an ideal itinerary to pilots in real time. For example, by coupling aircraft parameters with weather conditions such as wind speed, the duration of flights can be reduced and fuel saved. GE's Flight Efficiency Services, for instance, make it possible for airlines to optimise their itineraries and adjust their flight parameters – like the wing flap angle prior to landing – to consume less fuel. Alitalia also managed to reduce fuel costs by 1.5% in one year and has saved $46 MM since.

OPTIMISE THE AIRCRAFT LIFE CYCLE

Made possible by IoT, predictive maintenance tracks key aircraft parameters in real time. The A350, the latest generation of Airbus planes, can record 600,000 parameters, or twice as many as the A380. Moreover, the speed at which data is transmitted between aircraft and the control tower is accelerating continuously, from less than 1 Mbps in 2002 to 5 Mbps in 2007, and is even faster today.

Structural health monitoring instruments enable Airbus to detect engineering problems in the areas around doors with the installation of fibre optics in key components to collect real-time data and perform acoustic tests.

This process reduces unplanned maintenance costs and makes it possible to track the state of all key aircraft parts in real time. With the average cost of maintenance at $1,200 per flight hour (including 43% ascribable to engines alone) for commercial aircraft, improving engine maintenance efficiency by just 1% would generate savings of $250 MM.

Taleris, a partnership between GE Aviation and Accenture, also offers a data analysis and visualisation solution for predictive maintenance activities. This tool improves general aircraft reliability and reduces turn-around time as well as grounding time, which includes air turn-back and "aircraft on the ground", or AOG. (See Exhibits 2 and 3.)

MAXIMISE THE VALUE OF THE AIRCRAFT

By collecting information on the state of each aircraft component such as maintenance history, it becomes possible to quantify the residual value of individual parts, re-certify them, and finally recycle or reuse them. A true commercial opportunity emerges as existing fleets age and as airlines, as well as manufacturers, seek new ways to reduce costs and maximise the residual value of fleets.

LOOK EVEN FURTHER

When a very broad set of data is known and utilised, the total cost of ownership of aircraft fleets can be optimised and risks managed much better. It is then possible to imagine moving to usage-based pricing. Rather than selling aircraft, manufacturers could rent them to airlines, whose operations will therefore become more agile and better adapted to the needs of the business. Predictive maintenance will optimise the aircraft life cycle. Finally, new IoT technologies will make the spare parts market economically viable and more attractive than it is today.

MEET CUSTOMER EXPECTATIONS MORE EFFECTIVELY

With IoT, it becomes easier for airport operators, incumbent airlines, and possibly newcomers (recent start-ups or large, diversified opportunistic players) to offer a multitude of innovative pre-flight and post-flight services. Better knowledge of customers will facilitate the reduction or even elimination of many constraints. Today, how can we change a taxi reservation in the event of a delay if a passenger cannot communicate during the flight? All industry players will have new ways to make passenger experience more pleasant and, most importantly, more closely adapted to the specific expectations of each customer.

Exhibit 2: Example of a regular aircraft maintenance plan – without IoT

PERFORMANCE
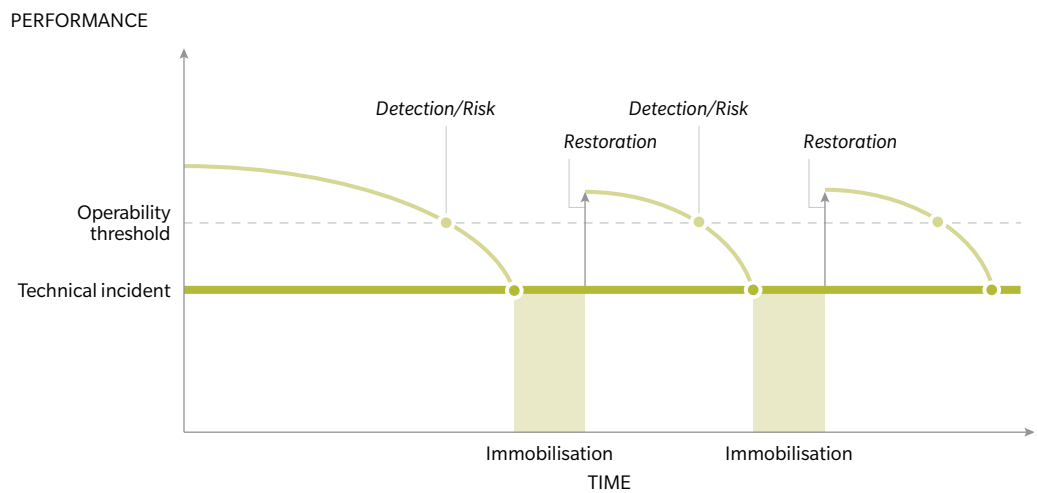
Source Oliver Wyman

Exhibit 3: Example of a regular aircraft maintenance plan – with IoT

PERFORMANCE
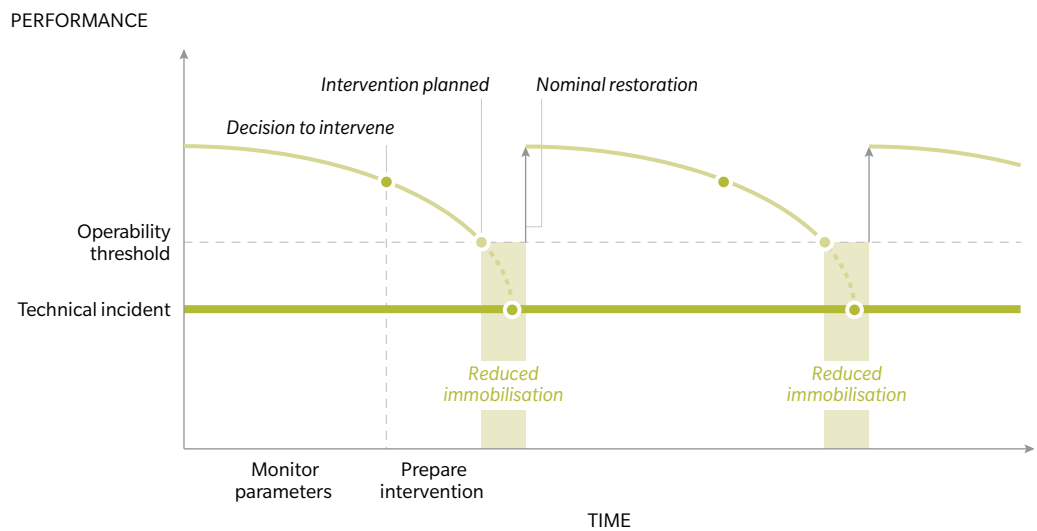
Source Oliver Wyman

MOVE TOWARD PROACTIVE AND INTERACTIVE AIRPORTS

Airports are now establishing solutions to make it easier and more efficient for passengers to move around.

Google glasses improve the individualisation and quality of service when customers check in to business class. Automating check-in and security check procedures has a positive impact on sales. Indeed, according to SITA, a passenger who has to wait ten additional minutes in the security check queue purchases 30% less before the flight. Optimising baggage loading procedures or loading luggage on planes only once passengers have boarded (a solution provided by Amadeus and SITA) helps to reduce delays. The Danish company BlipSystems proposes solutions to collect data from passengers to predict and optimise security check flows. These solutions helped the Cincinnati airport save passengers more than 150,000 hours of waiting. Likewise, IoT supports London City Airport in its goal to become the fastest airport in the world.

LAUNCH NEW PRE-FLIGHT AND POST-FLIGHT SERVICES

Airlines and start-ups can offer complete end-to-end service to high-value customers to make their trip as comfortable as possible. In the event of delay, on-board sensors could communicate with airport services during the flight to adjust the post-flight itinerary of passengers, for example, to notify the participants of an important meeting that the flight of an attendee is likely to arrive late. These services allow incumbent players to reinforce the customer relationship and differentiate themselves, and in turn generate new sources of revenue.

CONTROL AIR TRAFFIC MORE EFFECTIVELY

IoT will help to densify – and thus expand – airspace capacity, by making it more transparent and secure. IoT will also support the efficient use of existing airport infrastructures and reduce the need to invest in new landing strips; these are burning issues for Heathrow and Munich. This is all the more critical given the rapid rise in the number of commercial passenger and cargo flights in certain regions of the world. New geolocation solutions, such as automatic dependent surveillance, will make it easier to track the exact position of individual flights in real time.

These solutions will also help to reduce delays due to the still-wide distance between landing planes. Using IoT, London Heathrow airport eliminates 80,000 minutes of delay every year. Finally, new support technologies, such as the electronic flight bag, and real-time information guarantee safer air travel.

The rise of IoT in air travel is accompanied by the gradual transformation of incumbent business models. Indeed, IoT affects aircraft and equipment manufacturers as much as it does airlines. IoT can potentially make the aeronautical and aviation ecosystem more flexible and responsive, in particular by reducing delivery time and enabling manufacturers, airlines, and airports to collaborate together more effectively. It also creates opportunities for players in other industries, such as Accenture, Cisco, or IBM, to enter the market and very rapidly capture a share of the value generated by IoT.

VALUE IS SHIFTING TOWARD DATA ANALYSIS

The quantity of information generated by aircraft sensors is two to three times larger than it was just a few years ago. For

reference, a Boeing 787 generates over 500 gigabytes of data per flight today.

Considering the complexity of information, the value of the future model will be proportional to the ability to aggregate this data and draw valid and relevant conclusions from it. By supporting airlines in their activities, a player like Boeing can create new sources of recurrent revenues and reinforce customer relations. For example, GE currently has a 1,500-terabyte database (ten million flights between 2013 and 2015) available for such analyses.

Certain components of the value chain can, however, be collected by new companies that are specialists in the analysis of such data. As an illustration, understanding operational and maintenance histories would make the re-certified spare parts market

A Boeing 787 generates over 500 gigabytes of data per flight today

more profitable and support the emergence of specialised players (the Google of aeronautical maintenance) with the potential to dominate this industry in the future.

REBUILD THE CUSTOMER RELATIONSHIP

Today's airlines face a growing risk of intermediation, as new start-ups, in particular TripIt or WorldMate, introduce innovative pre-flight and post-flight services. Even if companies like

British Airways propose increasingly sophisticated group holidays, competition is intensifying for adjacent opportunities (such as hotel reservations, car rental, and shopping). Consequently, one of the key objectives of airlines is to find a way to monetise flight time while reinforcing the customer relationship.

Passengers, until recently passive players in an infotainment system with low interactive content, are becoming active and captive consumers of connected services. IoT thus enables the emergence of very lucrative new opportunities. The future will tell which of the multiple players – airlines, manufacturers, telecommunications operators, and so on – will be able to seize them.

THE PRODUCT INNOVATION AND DESIGN CYCLE IS EVOLVING

Augmented reality and 3D printing have become increasingly available to small and medium-sized industrial players, which previously did not have access to such technologies. These companies, which are second-tier suppliers or marginal partners in the aeronautical world, now have more ways to innovate. They can considerably reduce the time needed between the initial concept, prototyping, and serial production.

Aircraft manufacturers, however, could soon be ambushed on the aeronautical market by these players who used to be relegated to the sidelines. If this happens, manufacturers like Airbus and Boeing as well as major equipment suppliers like Safran, Thalès, Zodiac Aerospace, Honeywell, and UTC should consider creating partnerships or open innovation networks. By including other players in their sphere of control, they will reinforce their own innovation capacities while sharing the revenues.

RETAIL

TECHNOLOGICAL EVOLUTION, BEHAVIOURAL REVOLUTION

XAVIER MUSSARD

If only your grocery list could be automatically compiled by all your household appliances, put up for auction, and prepared by multiple retailers or local producers able to offer the best price and quality. Picture the scene as Uber delivers these groceries right to your door. And Fast Moving Consumer Goods (FMCG) brands such as L'Oréal and P&G know more about their customers than Walmart or Carrefour, so they can make customised offers. We can achieve all this with the help of the Internet of Things (IoT) in retail.

IoT has the potential to modify the retail landscape and FMCG. In the immediate term, IoT will find its place in stores and help improve sales by 10% to 20%, as well as boost margins by ensuring better control of product availability, reducing markdowns, and improving the customer experience. Nevertheless, the full potential of IoT is still to come. IoT will facilitate access to customer data – the key to customer relationship management (or CRM) is currently the exclusive domain of retailers – and redefine the purchasing process from end to end. This is enough to challenge the balance of power between retailers and FMCG manufacturers and even the role of retailers in the value chain.

IOT ENABLES DIFFERENTIATED CUSTOMER EXPERIENCE

Retail is special in that it has already experienced IoT v0.0 for over 15 years, with the installation of radio-frequency identification (RFID) technology. Far from initial assurances and the promised big bang, RFID has had mixed beginnings. But over the past decade and a half, the technology has gained in maturity, RFID chips cost eight times less, and complementary technologies such as near field communication (NFC) and beacons have been developed, with the potential to transform the world of retail. To the initial objective of inventory transparency is now added the capacity to interact with smartphones and any connected wearable carried by customers.

Exhibit 1: IoT in retail and the customer relationship

REINFORCED CUSTOMER
RELATIONSHIP

PARTIAL
RE-INTERMEDIATION

TRANSACTION-BASED
TO RELATIONSHIP-BASED

RFID chips
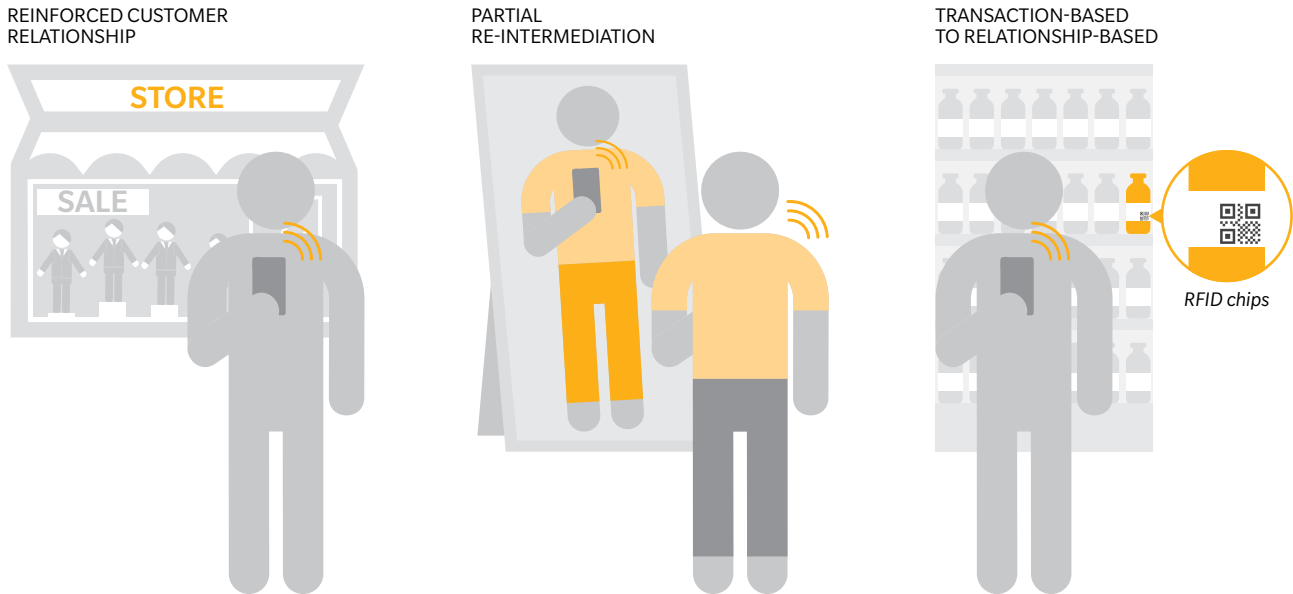
As a result, Apple's iBeacon makes the customer experience more fluid and intuitive. A geolocation system able to interact with customers can propose personalised offers, suggestions, and promotions based on personal buying history. Retailers such as Macy's, Tesco, and Virgin Atlantic are testing or deploying hundreds of beacons in their stores to enrich interactions with their customers. In London, a growing number of brands are doing the same thing on Regent Street. Shopkick, one of the iBeacon marketing platforms, is used in 3,000 stores, and boasts that it has increased retail partner revenues by over $500 MM in 2014.

Similarly, the use of RFID codes and smart mirrors allows retail clothing distributors to create a more memorable customer experience. On the mirrors of its fitting rooms, Burberry projects a short film underlining the value of the product, its origin, and its unique aspects. Adidas NEO stores propose complete outfits that

could go with the product selected by the customer. Retail is thus accelerating the move toward relationship-based practices (see Exhibit 1).

Another key component, the real-time location of inventory, makes it possible to anticipate potential availability issues. Now, according to benchmarks, stock shortages cause earnings losses of about 5% for many retailers. With the ability to locate inventory precisely, retailers can play with pricing and promotion models, for example, to push products close to their expiration date, perhaps with an alert. In this way, retailers can work more effectively with their suppliers and reduce waste. According to advance estimates, markdowns could be reduced by as much as 50%.

These in-store initiatives offer both retailers and suppliers many opportunities to improve their sales and margins. However, behind the tactical possibilities offered by IoT lies a large-scale strategic upheaval.

IOT EMPOWERS FMCG BRANDS

The development of IoT is supported by the exponential growth of accessible data, shifting the balance of power between retailers and FMCG manufacturers. In the pre-IoT world, FMCG firms had few ways to access precise data on customer buying behaviour. Retailers, on the other hand, had direct access to consumers and a detailed vision of their behaviours – data largely exploited for targeted marketing campaigns and trade negotiations.

IoT upsets the status quo by enabling FMCG brands to capture the data at the point of consumption, without having to depend on retailers any longer. This is where the potential of IoT resides for them. According to Accenture, 81% of branded product purchasing decisions are made at home, compared to just 19% in the store.

For instance, household appliance manufacturers are developing refrigerators that integrate connected technologies functioning in cold environments, like General Electric's ChillHub, to identify refrigerator contents and update grocery lists. Another example, the Egg Minder egg rack keeps customers informed remotely in real time on the number and expiry date of the eggs in their refrigerator.

How much longer until we have connected cupboards, plates, forks, bottles, and rubbish bins, which are now regularly displayed at electronics fairs or are currently being financed on crowdfunding platforms?

In addition to capturing detailed data on user behaviour, connected objects provide immediate service to their users through the applications that support them. FMCG brands appear to be very actively installing connected objects and applications to (re) create direct contact with their consumers. L'Oréal's Makeup Genius application uses the telephone as a mirror and suggests make-up to go with the user's outfit. The Pampers Village online community allows parents to share advice and offer adapted products.

As well as the behavioural data collected, these solutions provide a service valued by consumers while constituting a less commercial context than the store to offer its products.

Direct access to consumers allows FMCG firms to disintermediate retailers and gain control of various commercial drivers. They are now able to target their promotions – an enormous advantage to the extent that the promotional budgets of these players can exceed €1 BN in some countries. It is also easier for them to identify opportunities to develop products to satisfy specific segments and propose new services. Finally, knowledge of the customer is used during negotiations with retailers and to build merchandising plans.

Retailers are not nevertheless inactive and are developing their own solutions based on connected objects. The objective for them is to preserve the direct link with existing customers and attract new ones.

Darty, a consumer electronics retailer, for example, has the Darty button (with 30,000 customers to date), which enables customers with a simple press to be contacted by Darty aftersales service concerning any questions about the operation of one of the brand's products. This service monetises aftersales service and underlines its quality, while collecting information on all of the customer's products, including those bought outside its network.

To cite another example, Amazon recently launched Echo, a connected speaker that can respond to vocal commands through a virtual assistant called Alexa, with features similar to Siri or Google Now. Echo collects demands and anticipates the future needs of its customers. In parallel, Amazon has registered a patent for a method to anticipate shipping of an order even before the customer makes the purchase.

IOT TRANSFORMS THE PURCHASING PROCESS

The most fundamental change – but also the most remote – generated by connected objects is the modification of the purchasing process. Connected objects are increasingly automating the preparation of shopping lists and order placement. These modifications could endanger the traditional store model, while taking the digital rationale engaged by omnichannel and e-business even further (see Exhibit 2).

Retailers and FMCG brands use the opportunity offered by IoT to integrate the purchasing process as far upstream as possible, and they do this starting in the home, where products are most often consumed.

Danone, for instance, developed Smart Drop, a connected button attached to the refrigerator door to facilitate ordering of Evian water on direct delivery site evianchezvous.com.

Amazon has also developed the concept of the connected button with Dash, which makes it possible to configure buttons for any product in the home (such as a washing machine or refrigerator) to order corresponding products and consumables automatically (like Tide detergent, Gillette razors, and L'Oréal moisturiser). The order is then delivered to the customer, who doesn't need to do anything after pushing the button. Amazon therefore positions itself upstream from its traditional competitors, with multiple optical instruments (Dash, Echo, Dash

Exhibit 2: The changing stakes of retail

AUTOMATED TRANSACTIONS
STAKES OF DOMINATING THE ECOSYSTEM

Who will occupy this space? | *Amazon*

SIMPLIFIED HOME PURCHASING
STAKES OF DEVELOPING E-COMMERCE REVENUES

Darty | *P&G*

IMPROVED IN-STORE CUSTOMER EXPERIENCE
IMPACT ON PRODUCT SALES, MARKDOWNS, AVAILABILITY

Carrefour | *Sephora*

TIME
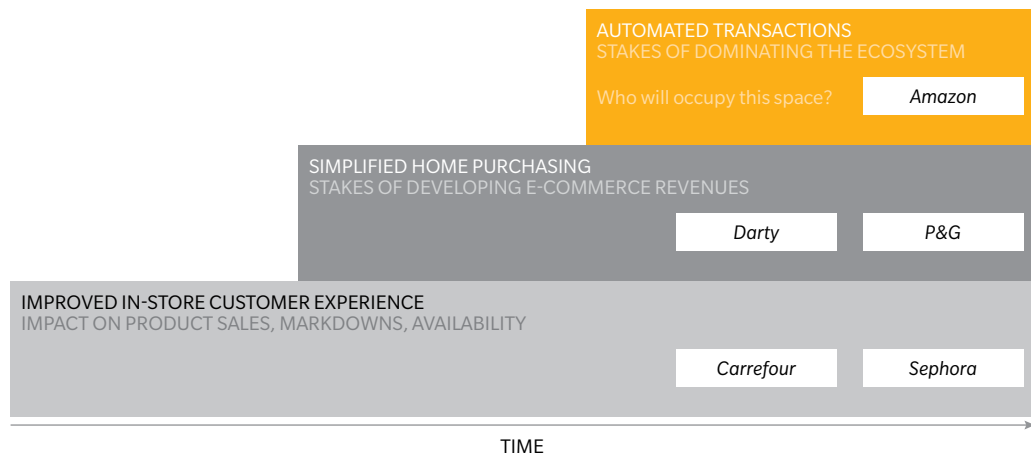
Source Oliver Wyman

Button, and Amazon Fresh or Prime) to secure a dominant position in the connected home.

These innovations nevertheless run the risk of fragmenting the purchase of everyday consumer products. For example, customers can order Evian water and other consumer goods through Amazon Dash, but buy fresh fruit and produce from specialised local suppliers. As things stand today, the cost of delivering the last mile makes several small deliveries relatively unprofitable compared to one big shipment.

That said, the development of delivery offers relying on the zero marginal cost economy (Uber, Airbnb, Blablacar, and so on) could constitute the missing building block for IoT to develop direct sales. A new delivery approach could thus challenge the one-stop shop advantage proposed by bricks-and-mortar stores and supermarkets. Start-ups such as Onfleet have already established flexible parcel deliveries that combine all requests from users – regardless of the service used – and ensure delivery after establishing an optimised and profitable road map.

In the longer term, and by pushing the FMCG order automation rationale as far as it can go, human intervention may potentially be reduced to a bare minimum in the purchasing process. On the basis of preset parameters, all the everyday product needs of consumers would be captured and incorporated by connected objects and their applications. The latter would generate automatic requests, to be sent to retailers or the suppliers offering the best deal. This change of practice would sharply reduce the influence of retailers and focus attention on the network able to provide customers with the best price-to-availability ratio on their products.

Over time, traditional retail players face the twofold risk of sacrificing market share to the new channels opened up by IoT, but also of being disintermediated and losing the central role played in the customer relationship.

Retailers can, however, anticipate the changes to come and take a dominant position in the value chain redefined by IoT, in particular by:

- Exploiting in-store opportunities offered by IoT to develop their sales, increase their margins, and improve the customer experience
- Capitalising on their omnichannel know-how and extending the playing field to the new uses generated by IoT in the home, preventing other players from taking control of the customer relationship and purchasing process, integrating the uses of IoT into existing online solutions, and thus preserving the advantages of the one-stop shop
- Building the ecosystem of tomorrow by exploiting the features of IoT and redefining how they are used, namely to control the data capture objects, exploit information, and support traffic generation while providing a value-added service, specifically through strategic partnerships with other IoT players.

In an ecosystem undergoing a major transformation, retailers must adopt a proactive approach to the changes to come and reinvent their profession to avoid finding themselves isolated from new distribution practices. Learning how to test various strategies and concepts will enable them to identify what is feasible and what works while having a clear vision of the desired objective.
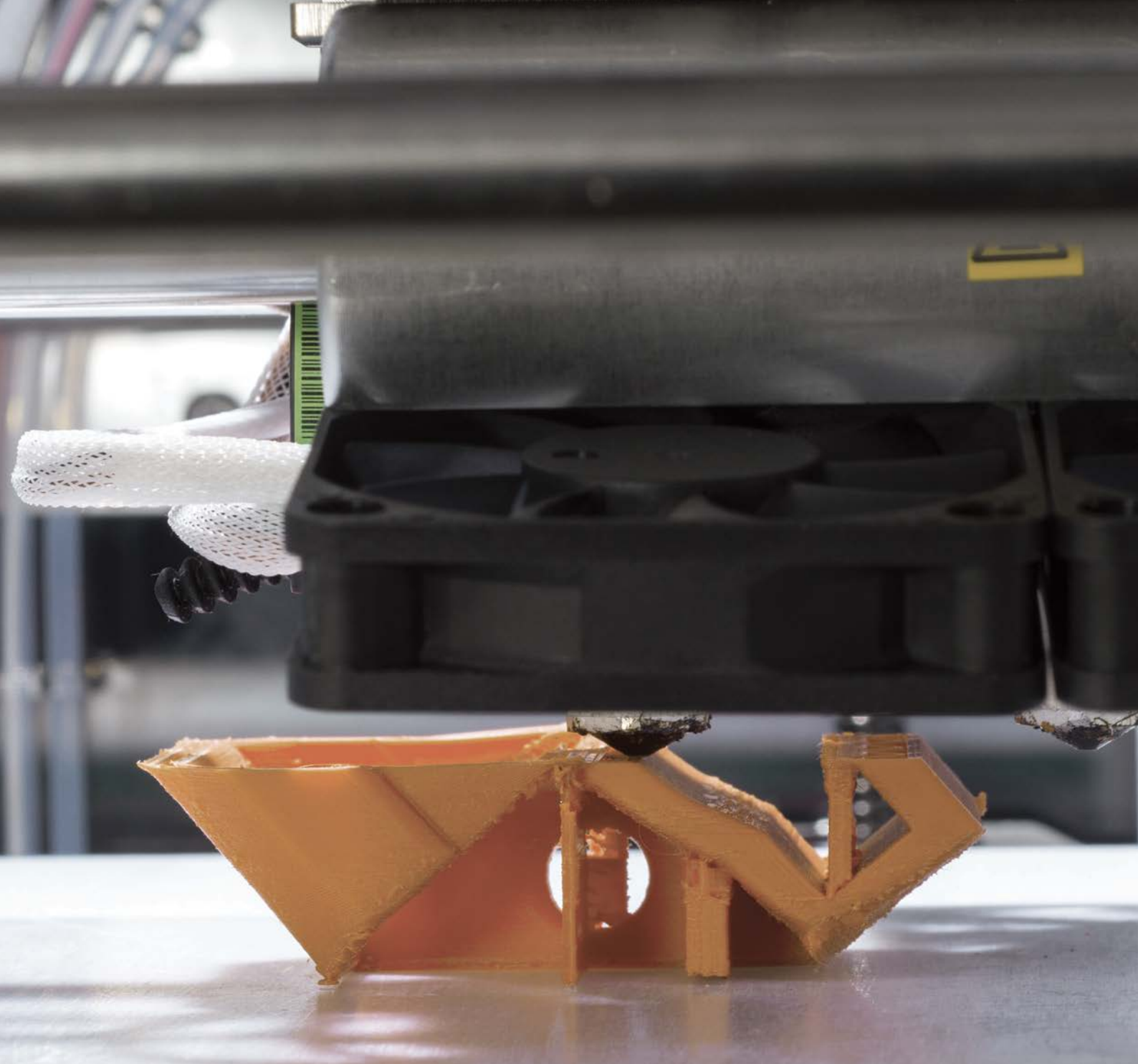
A FOURTH INDUSTRIAL REVOLUTION?

GUILLAUME THIBAULT
XAVIER RUAUX

FROM TRANSACTION-BASED TO RELATIONSHIP-BASED

INDUSTRY IN THE AGE OF THE CUSTOMER RELATIONSHIP

In a few short years, digitalisation has disrupted service markets: retail (Amazon), tourism (Booking), music (Apple), media (Google), transportation (Uber), and so on. It has also affected professional services (cloud computing, for example). However, its full effects have not yet been felt in the industrial world, given, on the one hand, the tangible nature of the products sold and, on the other hand, the barrier often posed by distributors obstructing the relationship between manufacturers and end customers.

IoT is changing the game by making industry enter the digital era head first. The possibility of connecting objects to the internet opens a vast range of commercial opportunities. Equipped with a chip or sensor, all goods can now give rise to new services, which enhance the way these products are used or reposition them as service terminals.

Alerts and notifications. Smart Whirlpool appliances notify their users when a washing cycle is complete or when the refrigerator door is open, using an iPhone application. The m2ocity telecommunications operator (a Veolia and Orange joint venture) can notify the local maintenance team when there are technical incidents concerning public utilities (leaking water pipes, for instance).

Remote configuration or control. Airbus has developed e-solutions, a suite of services to optimise flight and ground operations (including fleet management, engineering, maintenance preparation, and flight operations), while Airbus' AIRMAN-web offer (for AIRcraft Maintenance ANalysis)

tracks flight operations online and corrects bugs remotely.

Maintenance and renovation. Using data captured by sensors and analysed remotely, ThyssenKrupp automatically launches maintenance on its elevators, reducing costs by 30% and breakdowns by almost 70%.

Solutions. Having data on how their equipment is used enables manufacturers to offer customers complementary services and even complete solutions. Sanofi created a centre of excellence dedicated to integrated care. This model connects digital tools to terminals, for example, to track blood sugar levels and send alerts to doctors automatically.

IoT has the power to reposition certain products into service platforms, open to proprietary residential applications. In business-to-consumer (B2C), the smartphone will become the aggregator of preference for services (home, health, leisure, transportation, and so on). In industrial markets, many products will play a similar role (for instance, in production or logistical cockpits, machine tools, vehicles, and other capital equipment).

As a service platform, the connected object opens the door to new revenue models: payment by usage, paid services (by customers or through commissions paid to application providers), and monetisation of data collected from third parties. Safran and Michelin, for example, invoice their products according to flight time or miles driven.

So a new era is dawning for manufacturers. Until now, the products were sold on a transactional basis, according to their intrinsic characteristics (like price or quality). Manufacturers, with little visibility on how their products were used, suffered from a high risk of attrition.

INDUSTRY 4.0

Industry 4.0 is originally the name of a work group formed in January 2012 in Germany by the National Academy of Engineering Sciences (Acatech) and supported by the Ministry of Education and Research. This group includes manufacturers (Siemens, ThyssenKrupp, BMW), equipment suppliers (Bosch, Trumpf), technological services (HP, Cisco, DAP) and major federations like Bitkom (high technologies), VDMA (machine tools) and ZVEI (electro-industry). Its purpose is to take advantage of the country's relative advantage in the field of integrated software systems to break IoT down for industrial processes. The group initiated several common research programs for an investment which will attain €2.6 BN by 2020. Partnerships formed in 2015 concern communication tools (DT and SAP), cyber-security (DT and Infineon Tech) and production software (SAP and Huawei). According to estimates, the program could generate annual growth of 2.2% for German industry by 2020, as well as a productivity gain of 18% over the same period. The "Factory of the Future" plan revealed by the French government in May 2015 was inspired by this program.

Conversely, the products of tomorrow will derive their value from the services they host. Associated with the potential of big data, the connectivity of these products will allow manufacturers to establish a longstanding relationship with their owners. Manufacturers will have a better understanding of how their products are used and will be able to interact with owners by sending them alerts, proposals, and personalised offers in push mode.

GE Aviation is one of the companies that has managed to transform its business model, and has successfully branched out from aircraft engine sales to operations analysis and optimisation through the Flight Efficiency Services or Intelligent Operations Services offered by Taleris, its joint venture with Accenture.

A NEW OPERATIONAL MODEL

INDUSTRY 4.0

Product networking constitutes the real IoT revolution. The principle behind cyber-physical systems is what connects objects and enables them to interact without human intervention for a specific purpose, such as optimising smart grids or enabling autonomous movement of vehicles or robots. Industry 4.0 is another application of this. According to this vision, the value chain is entirely digitalised, connecting the supply chain, production, and customers from end to end and opening the door to a potential fourth industrial revolution.

In the customer's home, connected products will generate data that will be aggregated remotely not only to recommend new services (advice, maintenance, or inventory control) but also to optimise production planning.

In certain cases, automatic renewal will be offered to the customer and production orders will be sent directly to the factory. In others, the customer will initiate orders through a digital channel, such as an e-commerce gateway or by electronic data interchange (EDI). In all cases, complete digitalisation of the order will enable production to be conducted according to a lean approach, free of inventory.

SAP-FESTO CONSORTIUM

SAP and Festo (production solutions provider) have developed an Open Integrated Factory offering designed to build automated production lines. On these lines, all parts are equipped with an RFID chip connected to ERP and ME (production process management) systems. The chip contains the instructions necessary to manufacture the finished product, which is communicated to all workstations on the line (furnace, laser, etc). These workstations carry out the designated tasks and communicate in turn on their realisation. According to Chen Jun, the CEO of the first factory in China have this type of production line, this system saves 40% on the production costs of a customised Land Rover.

At the factory, completely automated production will be enabled by a new generation of production lines and smart robots, such as KUKA's robotic assistant LBR iiwa. Production lines will react to information received in real time (such as order book status, characteristics of materials entering the production line, and the status of other machines) to adapt their parameter settings in terms of rate, quality, labelling, packaging, signage, and so on. Better production line synchronisation by reducing downtime – already in place at Siemens – will help to reduce energy consumption by more than 10%.

The machine of the future will be general-purpose and permit the production of individual batches according to customer needs. SAP is already developing production lines that can manufacture remote control units or cell phone cases from the same plastic cases.

Of these new processes, 3D printing is the most dynamic and is growing annually by more than 20%. 3D printing helps to reduce industrial waste, drive down manufacturing costs, and increase flexibility and responsiveness. This technology, increasingly widespread in industrial processes, is expected to represent a €10 BN market worldwide in 2020, with more than 30% of it in Europe. GE hopes to realise 50% of its worldwide production in this manner in five years' time.

At the factory door, logistics will be optimised by being digitally integrated with the preceding stages of production. A continuous flow of information, from the customer order to distribution, will make it possible to reduce the volume of inventory. Centralised and digitalised, forwarding will be optimised using algorithms to minimise manual intervention. During handling, products will themselves contribute to the efficiency of the process by sending alerts and instructions to stakeholders. Transmitted information will concern details like the location and destination of goods, the operations required for their packaging, and their quality and status.

Industry 4.0 could hence generate productivity gains of 20% to 40%. Combined with the trend toward higher wages in emerging countries and transportation costs, these transformations could restore Europe's competitive standing and drive the reindustrialisation of the continent.

A SIZEABLE CHALLENGE FOR INCUMBENTS

The prospects offered by IoT represent a considerable challenge for traditional manufacturers. The obstacles they face are simultaneously strategic, technical, and human.
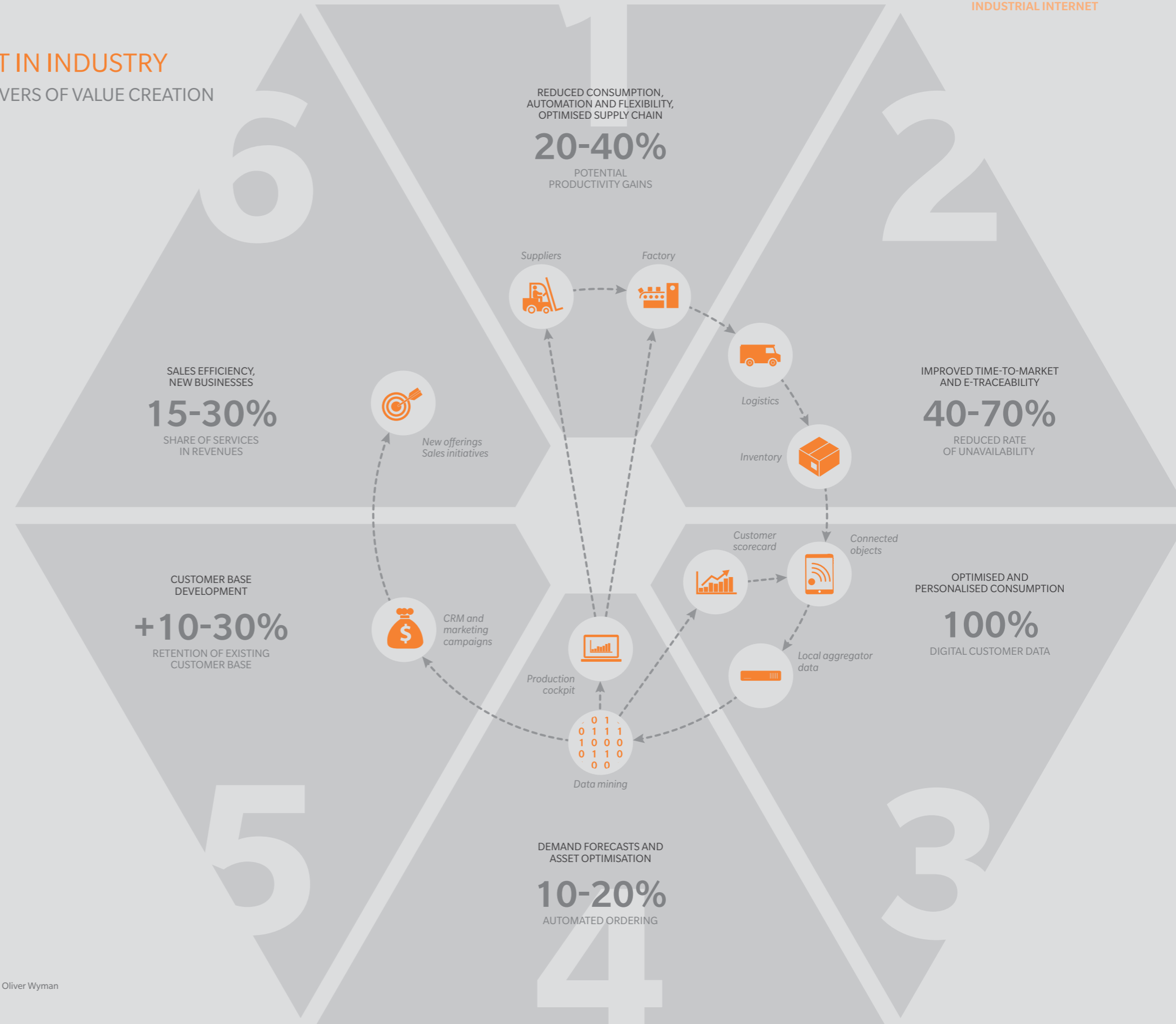
Above all, the challenge of IoT is transformational. European corporations inherited organisations that were structured to standardise processes, reduce risk, and manage security, with a long-term perspective. Disrupting traditional patterns, IoT confronts these companies with challengers as recent as Google, Amazon, and Fab Labs[1]. How do we transform a culture of engineering, production, and control into a digital, open-innovation service culture? How can we get away from and stop trying to optimise a marketing approach that is often product-centred when what is required is an approach focused on customer needs?

The technology issues that internal teams are ill-prepared to resolve range from the links with existing systems to the modelling of cyber-physical systems, not to mention standardisation, virtualisation, high-speed infrastructures, and cyber-security. The market has not yet provided satisfactory answers to these problems. In addition, people are often focused on maintaining professional tools and enterprise resource planning (ERP) in good working order, even though these systems are often cumbersome and difficult to modify.

Finally, incumbent manufacturers encounter human issues when seeking to recruit people with new skills (in digital marketing or data mining, for example), to work transversally (across marketing, R&D, and IT) and overcome reticence, review existing roadmaps, develop risk taking, and encourage test-and-learn approaches.

1   Shared production workshops, or Fab Labs, provide entrepreneurs, craftspeople, and private individuals with all sorts of tools, specifically computer-assisted machine tools, to design and make objects (prototypes, limited series, or spare parts).

IOT IN INDUSTRY
DRIVERS OF VALUE CREATION

REDUCED CONSUMPTION, AUTOMATION AND FLEXIBILITY, OPTIMISED SUPPLY CHAIN

20-40%
POTENTIAL PRODUCTIVITY GAINS

SALES EFFICIENCY, NEW BUSINESSES

15-30%
SHARE OF SERVICES IN REVENUES

IMPROVED TIME-TO-MARKET AND E-TRACEABILITY

40-70%
REDUCED RATE OF UNAVAILABILITY

CUSTOMER BASE DEVELOPMENT

+10-30%
RETENTION OF EXISTING CUSTOMER BASE

OPTIMISED AND PERSONALISED CONSUMPTION

100%
DIGITAL CUSTOMER DATA

DEMAND FORECASTS AND ASSET OPTIMISATION

10-20%
AUTOMATED ORDERING

Suppliers · Factory · Logistics · Inventory · Connected objects · Local aggregator data · Data mining · Production cockpit · Customer scorecard · CRM and marketing campaigns · New offerings Sales initiatives

Source Oliver Wyman

A NEW SPARE PARTS STRATEGY FOR SIEMENS

Siemens uses Selective Laser Sintering (SLS) technology to repair its customers' gas turbine blades. Rather than replace an entire part (such as the burner), Siemens simply removes the damaged part then uses SLS to 3D print the replacement part using more resistant materials, called superalloys. This technology reduces turnaround time from 44 to four weeks and cuts maintenance costs. The new process also helped Siemens redefine its spare parts replacement business model from a centralised system with a single storage space and very high volumes to a decentralised, on-demand production system.

MAIN RISKS OF NOT TAKING A PRE-EMPTIVE POSITION

Under these circumstances, why not wait and let start-ups find their position before imitating them – or even acquiring them? We believe that inaction is much riskier than anticipation. The first movers will be able to take advantage of scale effects linked to network economics. On the other hand, the development of connected products will probably accelerate the commoditisation of products that fail to turn the corner in time.

If nothing is done, IoT is likely to fragment and reintermediate the value chain, with the rise of new competition.

R&D. 3D printing lowers entry barriers by making product innovation faster and more economical (by 30% to 50% for Solomon, for example). The development of Fab Labs exposes the laboratories of large corporations to new competition by nimbler local entrepreneurs.

Production. The Factory of the Future offers the prospect of developing low-cost operators, which play on the complete digitalisation of their production and distribution processes to compete with incumbent players whose production units cost too much to modernise.

Customer relationship. Unless adequate in-house skills are developed, the customer relationship risks being gradually outsourced, and precious data aggregated and analysed by specialised big data players (like Google). To avoid this, it's a good idea to imitate Apple, which succeeded in keeping complete control of the customer data collected on its terminals, in order to monetise them to third parties.

Aftersales services. In many industries, the sale of spare parts is a lucrative and tightly controlled business (50% to 80% in the aircraft industry). In this respect, 3D printing offers local players the opportunity to provide parts within much more attractive costings and timeframes.

LAUNCHING IOT PROJECTS: THREE KEYS TO SUCCESS

START AGAIN FROM A CUSTOMER PERSPECTIVE

From conversations with our clients, we understand there is an extremely strong temptation to initiate IoT projects with the question "To what objects could we add sensors?" before wondering "What could we do with the collected data?" This type of approach won't build a business that is sufficiently robust to justify the required investments.

The problem must be put differently: "What new services would bring value to our customers?" A good starting point can be the organisation of discussion forums with sales teams and customers. The latter will advance expectations usually discredited or considered to be foreign to the company's business model: new or personalised services, mobility, ergonomics, payment by use, and so on.

This preliminary work will pave the way for thinking about new offers and ultimately for repositioning the company strategy from the viewpoint of solutions. Simultaneously analysing the portfolio of internal assets and technical opportunities will make it possible to imagine potential digitalisation scenarios.

TAKE ONE STEP AT A TIME

Integrating IoT opportunities into current business models will take time and a certain number of iterations; hence the importance of taking the first steps quickly. Moreover, we recommend adopting a flexible and modular approach in a pilot environment, working

with standard tools paid according to use, and moving forward step by step in test-and-learn mode. Concerning the content, short-term optimisation projects with an impact on revenues (predictive maintenance, new products, and so on) could be conducted alongside longer-term projects with an impact on operational effectiveness (including automation of production and connected logistics).

ADOPT NEW OPERATING PRACTICES

In addition to revisiting the vision for 2025 in the light of Industry 4.0, a major transformation in operating process is required to instil an entrepreneurial spirit, agility, and speed of execution.

Industrial divisions will have to open up to the outside world to assemble consortia with technological leaders and take part in smart manufacturing. This is what Siemens did with McAfee for data security, and Festor with SAP to automate production. Human resource models will have to support the development of internal entrepreneurship, risk-taking, and transversal and project-oriented work approaches with better knowledge sharing. A certain number of large business organisations will become flatter, more networked, and more supportive of intrapreneurial initiatives.

SMART BUILDINGS

WHAT ARE THE IMPACTS?
WHAT ARE THE STAKES?

DAVID KAUFMANN

In a connected office, the security system recognises employees who have just entered the building and it starts heating or air-conditioning their work area or the conference room they have reserved. At home, smart appliances use the energy provided by new-generation batteries, stored from the previous night after being obtained from the network at the lowest possible price or produced by the home's own solar panels. In shopping malls, beacons recognise the individual who approaches them and offer personalised recommendations or promotions. Airports trace the movement of each passenger's bags in real time and notify passengers of estimated waiting time as soon as they debark from the aircraft.

This was the vision of the near future for real estate and construction industries in the age of the Internet of Things (IoT). And now the vision is becoming reality. A visit to the most modern buildings is enough to be convinced that the building market is undergoing a substantial transformation. Whereas real estate has always represented the core value, this value now appears to be migrating to new components.

Buildings are no longer defined exclusively by the materials that compose them but also by the possibilities they offer. They must not only shelter and protect but also make their occupants' lives easier, preserve their health, respect the environment, melt seamlessly into the cityscape, and be used as interfaces with new web technologies, including IoT sensors. We should add that these multifunctional buildings also need to be increasingly modular. While they used to be built to last, they are now designed to evolve.

WHAT'S ALL THE FUSS ABOUT?

The IoT revolution in construction and the transition to connected buildings is part of a much broader revolution in housing, which is decreasingly static and increasingly dynamic. Still in its infancy, the connected building market is fast becoming democratised and raises strategic issues. It consequently comes as no surprise that a growing number of players are vying for a position to benefit from this potential windfall.

THE SMART BUILDING

"Smart building" features vary by segment
(such as individual or collective housing, shopping
malls, hospitals, airports, schools, and prisons).

SECURITY AND ACCESS

"SMART GRID" CONNECTIONS
(AND THE "SMART CITY")

HEALTH

Air quality,
specific types
of tracking

ENERGY AND UTILITIES

Air-conditioning, heating,
lighting, water

HOME EQUIPMENT

"Infotainment", work systems,
physical comfort and hygiene

PEOPLE TRACKING

Flow management,
direct marketing

There are, primarily, three factors that explain the interest in connected buildings. Mentalities have changed due to the importance of the stakes and regulatory constraints (buildings account for 40% of total energy consumption and almost as much CO2 emissions). The rising penetration rate of smartphones facilitates connectivity and management of IoT throughout the home. The cost of various sensors is dropping as the speed of processing corresponding data rises (a sensor costs €0.5 today on average, which is a drop of approximately 50% in ten years). The arrival on this market of giants Google (which acquired Nest for $3.2 BN in February 2014) and Apple (with the announcement of HomeKit in June 2014) have confirmed and accelerated this trend.

WHAT DO WE MEAN BY "CONNECTED BUILDINGS"?

A connected building refers to five complementary areas of activity, shown in Exhibit 1: energy and related services linked to the immediate environment of the occupants (heating and cooling, water, lighting, and so on); security and access; piloting of equipment (such as infotainment in the home, professional materials at work, and devices supporting physical comfort and hygiene); people tracking (including flow management and direct marketing); and finally, health (air quality, specific movement sensors, and so on).

It should be noted that the concept of the connected building is dependent on the specific needs of each building, based on its function. This confers a variable importance to each of the areas cited above. For example, hospitals will require systems dedicated to tracking patient activity and alerts concerning disease-causing agents; police stations and prisons will need equipment related mainly to security; while shopping malls and airports will stress security but also geolocalised or even individualised advertising, and the need to direct passengers and customers on site.

Smart facility management has existed for a number of years without any mention of connected buildings as we define them here. Indeed, the five areas of activity described above generally function singly in a non-integrated manner (lighting, alarm systems, and sound systems, for example, have been separate). The suggested solutions thus did not always exploit all of the possibilities offered by technology. This is no longer true for the most recent systems, which, instead of regulating activities with static programming, take real user needs into account and even possess the capacity to learn.

WHAT DOES IOT HAVE IN STORE FOR CONNECTED BUILDINGS?

Energy costs are incontestably on the front line in the IoT revolution in construction, with total expected impacts of about 40% on buildings that are equipped with the latest technologies. Personalised systems are the key to maximise savings. A lighting system that adjusts lighting according to time of day or human presence is estimated to save approximately 15% additionally. Likewise, using a smart thermostat like the one produced by Nest would make it possible to cut an energy bill by 10% to 15% more.

The promises of IoT are not restricted to energy. IoT will improve the general physical comfort of users: fresh air, tracked health, lighting adapted to their activities, greater security, improved for example by directing occupants dynamically in case of fire. Dedicated business systems suggest, moreover, that improving the physical comfort of employees reduces sick leave and increases productivity.

For very specific connected buildings, such as shopping malls, the impact will also be measurable in revenue terms, in particular through inexpensive and highly effective advertisements targeted in real time.

We must not forget, however, that the principal impact of a building is social. All of these effects, although enormous, often go unnoticed because they are not immediately visible. What could be said, for instance, of the completely new savings that IoT could generate if connected buildings helped the elderly to remain at home, if only for one or two more years?

Reasoning on the scale of a building – even a connected one – is insufficient, however, because it is our whole urban lifestyle that is changing through IoT. The move toward smart cities is under way, with different "islands" – homes, vehicles, roads, buildings – that will be interconnected tomorrow to amplify the effects of this transformation.

In the context of urban growth, IoT will be an essential component, for example, in combating traffic congestion and managing parking spaces by directing vehicles. IoT will also be able to accelerate the deployment of police, firefighting, and emergency services

thanks to instantaneous information on site and according to the type of need. The energy consumption of buildings could also be modulated according to peaks of consumption in the city as a whole.

HOW WILL THE CONNECTED BUILDING MARKET EVOLVE IN THE MEDIUM TERM?

The connected building market is currently going through a transition. Five to ten years from now, we expect a gradual lowering of the barriers to the establishment of a fully integrated and optimised environment enabling greater penetration of IoT solutions into urban life. A number of obstacles to development will gradually be lifted.

Initially, communication protocols between connected objects will slowly be standardised, then interfaces will become more ergonomic to culminate in a simple and effective all-in-one piloting system, covering all areas of connected building activity. Capacity analysis will rise significantly, and the security and trust aspect will be reinforced, little by little, through agreements on the use of personal data and protection of systems against intrusions.

WHAT ARE THE STAKES FOR CONSTRUCTION PLAYERS TODAY?

While IoT is triggering a major transformation of the smart building market, we are witnessing a migration of value toward specific new segments. This transformation represents both an opportunity and a risk, namely the opportunity to collect this new value or the risk of seeing it fall into the hands of competitors. The risk may be even more acute if the value created is not completely additional and if the value of the goods or service previously provided declines simultaneously. To capture value migrations, all construction market players in the broadest sense are currently investing in the connected building, from property developers to manufacturers of objects for the home, not to mention public service network operators and major telephony and internet players.

Four areas of value migration in particular are highly likely to be targeted for the growth and risk management strategies of these players.

A first target would be the hubs allowing integrated management of all connected objects in a building. Many players want to build simple and effective hubs, more or less open and complete, to overcome current silos. Security and lighting, for example, still too often function with separate proprietary applications. The goal of these players is to offer innovative solutions by interconnecting various objects that were previously unlinked. For instance, Nest is planning to use its agreement with Mercedes-Benz to enable a gradual increase in the temperature of the home according to the estimated time of arrival of the occupant.

The aim is to centralise the various services so that they can be managed from a single central cockpit – where construction and real estate players can capture real value. The Bouygues Construction Energy-Pass tool is a case in point, making it possible to track electrical energy and thermal consumption. Apple has HomeKit, and the Google Nest Works network partners with brands like Whirlpool, Mercedes, and Philips. Let's not forget SmartThings, acquired by Samsung in late 2014, AT&T's Digital Life, ARCHOS' Smart Home, Staples' Connect, Cisco's Smart+Connected, Castorama's Blyss integrated home automation solution, Legrand's My Home, Somfy's TaHomA interface, SFR's Home and Orange's Smart Home, not to mention the facility management systems of Schneider Electric and ABB. The offer is plentiful, and it is still difficult at the moment for potential customers to have a simple and clear vision of proposed options.

Analysis and optimisation systems enabling the processing of collected data form the second strategic dimension of the IoT revolution. Sensors installed in connected buildings generate a profusion of data that can prove highly valuable if sorted with an adapted analysis tool. Various companies have been created to address this promising niche, such as the French Fludia, Effineo, and Actility, or the American Bidgely. It is also important to note the investments made by companies like Ondeo (a subsidiary of Suez Environnement) in smart water, Edelia (a subsidiary of EDF) in the optimisation of resource and energy consumption, and m2ocity (a joint venture of Véolia Eau and Orange) in the analysis of gas and water meter readings.

We generally believe that decision-making software will gradually replace the equipment at the heart of the system. Service will be increasingly responsible for adding value in the future, while the equipment will probably be provided free of charge rather than sold to users.

Less visible, the digital revolution that manufacturers are experiencing and to which they must adapt goes beyond IoT. New technologies are on the way to transform the construction industry profoundly, from initial contact with the customer until final delivery, including facility management and operation, and even the end of the product life cycle. It is no longer a matter of experiencing each step of the process separately, but of integrating all processes into a centralised digital model.

Growth strategies specifically target four high-potential value migration zones

Significant gains are expected in terms of cost, quality, and cycle time (including increased precision, more effective execution, and faster time-to-market) but also in terms of revenues (with better customer communication, greater simulation and display capacity, and more transparent offering and price).

IoT will also play an increasingly important part in construction processes by optimising, for example, construction site logistics and energy management, predictive equipment maintenance, various materials and wiring tests, as well as security management.

At a time when the IoT market in the construction industry is being structured, the essential issue for companies is to get themselves in battle order – quickly, given the speed of technological changes and competitor initiatives – so they can capitalise on the migration of underlying value while managing the risks. This will require determining the market environment precisely (its growing segments and competition) and redefining the strategic plan clearly (including its objectives and positioning) before defining the methods to deploy it (such as partnerships to be signed, potential acquisitions, which skills and tools to acquire, and the necessary organisational adaptations).

UTILITIES AND SMART GRIDS
A NEW WORLD

GUNESH DWARIKA
JAN KRAL

Think of a world where Google becomes the key player in energy services in both the residential and business markets. Positioning itself as a direct intermediary between a local energy supplier and the end customer, it would rely on its data centres and machine learning algorithms to predict individual demand, and thus predict needs in advance. It would use its own production, distribution, and energy storage capacities or, in certain cases, those of its partners, to reduce the energy bill of its customers in an entirely new way.

In this world, energy would be produced by a multitude of decentralised producers, potentially including private individuals. It would be bought at the best possible price, then stored in new generation batteries before being used at the most convenient time. The price of energy would therefore evolve constantly according to the fluctuation of supply and demand. The first building blocks of this not-so-futuristic smart utilities vision are already being established in some countries.

GAFA (Google, Apple, Facebook, Amazon) have relied on machine learning for several years to optimise the energy consumption of their data centres. Energy storage solutions are becoming increasingly reliable and offer industrial-scale potential. Operators are innovating with peak and off-peak pricing offers, which already exist in Sweden, Italy, France and other markets.

Technological innovations and professions related to the Internet of Things (IoT) are gradually transforming the public utilities market (electrical power, water, and gas) in two ways. On one hand, smart meters and numerous sensors throughout the home enable managed resource utilisation and responsible energy consumption. On the other hand, more flexible transmission and distribution infrastructures (smart grids) also emerge.

All value chain players benefit from these innovations, including producers or distributors of energy or water, equipment manufacturers, support service providers, or data analysis experts. But the distribution of the total value created, which will determine the winners and losers, is not yet complete.

SMART ELECTRICITY METERS AS A CORNERSTONE

Connected power infrastructures weren't invented yesterday, and examples abound in Italy, Sweden, Canada, or Australia. But a recent European directive requires the penetration rate of smart meters to reach at least 80% by 2020. Combined with new consumer expectations concerning environmental responsibility, the regulation is reviving debate throughout Europe.

The implementation of advanced metering infrastructure (AMI) is the first step toward innovative services for consumers and optimised operations for energy players (see Exhibit 1).

Exhibit 1: Smart grid applications

| POWER MANAGEMENT POWER SUPPLY AND DEMAND | NETWORK MANAGEMENT, NETWORK VOLTAGE (HIGH AND LOW) | ADVANCED METERING INFRASTRUCTURE |
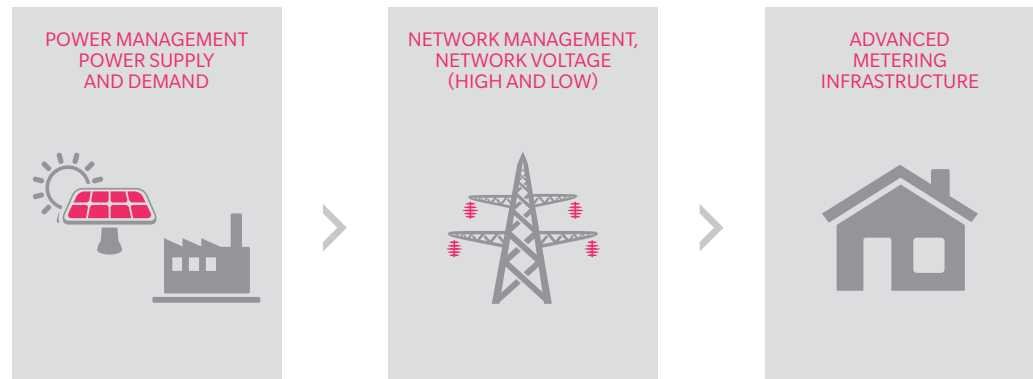
Source Oliver Wyman

Residential water, gas, and electricity measurement points bring consumers closer to the distributor or producer, with an almost immediate relationship. Consumers gain a more detailed and reliable view of their consumption and the option of receiving alerts if they exceed a defined threshold. They are given an opportunity to play an active role in managing their budget, through services such as demand response, or to switch operators. For example, the American start-up Ohmconnect sends text messages to its customers during periods of peak energy demand to allow them to reduce their consumption in real time and save money.

Constrained by a strict smart meter deployment calendar, the electric power community has gained an edge on gas and water players. In this market, IoT will probably reshuffle the cards while shifting the allocation of market share in favour of operators through a process of contract cancellation, more fluid subscription, and more competitive offers (off-peak hours or peak hours). In a similar vein, the British regulator Ofgem requires that, from 2018, consumers are able to switch suppliers in less than 24 hours.

The management of remote meters will make it possible for consumers to change their options or switch operators more easily. With meters managed remotely, the time required to transfer to a different energy company could be reduced from a few days to a few hours because a technician no longer needs to intervene. Anticipating this change, the European Regional Development Fund (ERDF) launched a "technician 3.0" contest for start-ups and small and medium-sized enterprises, inviting them to rethink the profession of technician.

Transmitting customer data by smart meters creates new opportunities for innovation and personalised services. In an environment where consumers are often faced with an offering that is difficult to decipher, new players could take better

advantage of the range of possibilities than the incumbents. Regulation authorities in some countries have provided for third-party players, such as the comparison engine uSwitch in the UK, to have access to customer data and all market offers to facilitate consumer choice.

In this context, incumbent players must expand their portfolio of services based on more precise customer knowledge and advanced features in order to differentiate themselves and maintain their market share. IoT will accelerate the penetration of offers with dynamic pricing and consulting services, enabling customers to smooth out variations in their electricity consumption and, ultimately, reduce the final bill. Customers in Sweden have had access to dynamic pricing since 2012 and can adjust their usage according to their choices. In France for example, ENGIE (GDF Suez) says customers who subscribe to its DolceWeekend tariff could make savings ranging from €60 to €130, based on an annual bill of €1,500.

Electrical power operators should also supplement their offering with enriched services, or even with other products that, although previously unknown in the energy market, customers recognise as credible. This could involve, for example, supplying services to manage home electrical appliances or selling insurance. Direct Energie's Tribu and EDF's e.quilibre allow customers to compare their consumption with that of other households and integrate information from their home appliances. We expect prepaid offerings to emerge on some markets, with the objective of giving customers more control over their energy bill.

In addition to customer acquisition opportunities, operators will be able to optimise their customer mix and margins through individual offerings. For example, low-margin customers – whose consumption takes place almost exclusively during peak hours – will get less attractive rebates. These new pricing models will require skills that many industry players do not yet possess, such as the ability to aggregate and analyse huge volumes of data. The survival of incumbents will therefore depend on their ability to deploy these skills, either in-house or through targeted acquisitions or alliances.

By proposing new services and extended home automation packages to consumers, and enabling operators to market products outside their core business, IoT will disrupt the traditional business model and challenge the established position of more than one industry player.

THE SMART GRID
ACCELERATING DECENTRALISED PRODUCTION AND PREDICTIVE MAINTENANCE

IoT represents a unique opportunity for distributors and producers to propose additional services to operators and to realise major productivity gains. Distributors are gradually investing not just in smart meters but also in solutions designed to reinforce the connectivity of equipment for transmission and distribution networks. These investments will considerably optimise network management.

A transparent view of demand gives distributors the ability to significantly improve monitoring and to manage the network more effectively. This means they can better plan network maintenance and limit unnecessary systems intervention. Some start-ups, like UPETEC, a software publisher specialising in predictive maintenance, report cost savings of around 30% for distributors such as ERDF.

Distributors will also be able to pool features like billing or managing geographical customer information on behalf of several operators, and hence diversify their revenues while lowering operator costs substantially. The most important changes will probably come from producers, who will be faced with competition from alternative producers and storage players, particularly in the electricity network.

IoT makes electricity supply more flexible and helps small producers of alternative sources of energy sell their offering more effectively. Storing energy in off-peak periods and using it at predefined times allows these producers to more easily smooth out variations in power consumption by distributors.

The greater variety of production methods will call for new regulation and control directives. In other words, distributors will have to be even more robust and flexible if they are to master the growing complexity of supply and the announced diversification of production equipment.

IoT will help to optimise the scale of the production equipment of the industry as a whole. The corresponding gain will lighten consumer energy bills and make society more environmentally responsible. The British government, for example, estimates that introducing new technologies will generate a net value of £6.7 BN by 2030 in the UK. The core of this new model relies on data and, consequently, on analytical skills, including for distributors. The latter are thus torn between the need to understand a customer view of the network and the difficulty in accessing data in countries that have complex legal frameworks.

The issue is a major one for power distributors, which must find reliable partners who can help make their network renovation investments profitable. The need for analytical skills is an opportunity for web and cloud computing players who have experience in processing huge volumes of data in real time: experience which can be applied to the utilities industry.

PREDICTIVE MAINTENANCE AS AN END IN ITSELF, NOT JUST FOR READING WATER AND GAS METERS REMOTELY

The penetration of smart meters is currently less advanced in water and gas. As with electricity, smart meters will support a more active market with easier and faster cancellation and activation processes. The opportunities to generate additional income from services and innovative customer offers have not yet been clearly identified. In addition, ecosystems are structured in very different ways in different countries. For example, electricity and gas meters should be deployed together in the UK and Ireland, while France chose combined gas and water meter deployment.

Pilot tests and alliances are proliferating to seize opportunities to optimise operational costs and future investments. Water and gas operators are working to find a business model able to reduce the operating cost of, for example, controlling water quality or precisely tracking network yield by measuring flow at various points.

When incidents occur (leaks, theft, natural catastrophe, and so on), it is now possible to pinpoint their location more quickly and thus shorten the time required to intervene. The use of drones in maintenance and surveillance solutions is currently being studied, in particular for gas distribution networks. Investments are being made in projects like GDF Suez New Ventures' Redbird and in partnerships such as the Veolia and Orange m2ocity project.

HOW CAN YOU TACKLE SUCH A COMPLEX SUBJECT?

In a new era of IoT, the power industry is still in its infancy. Operators will face competition from digital players such as Google or IBM. Incumbent local or regional players like EDF and British Gas will be confronted with alternative energy producers. For these incumbents, IoT represents a triple threat:

1. **Customer relationships will be intermediated by digital players** such as Ecoisme or Nest (Google), which are in a better position to meet customer expectations with relevant offers (for example in production, distribution, usage, management, and support)

Exhibit 2: A value chain undergoing major transformation
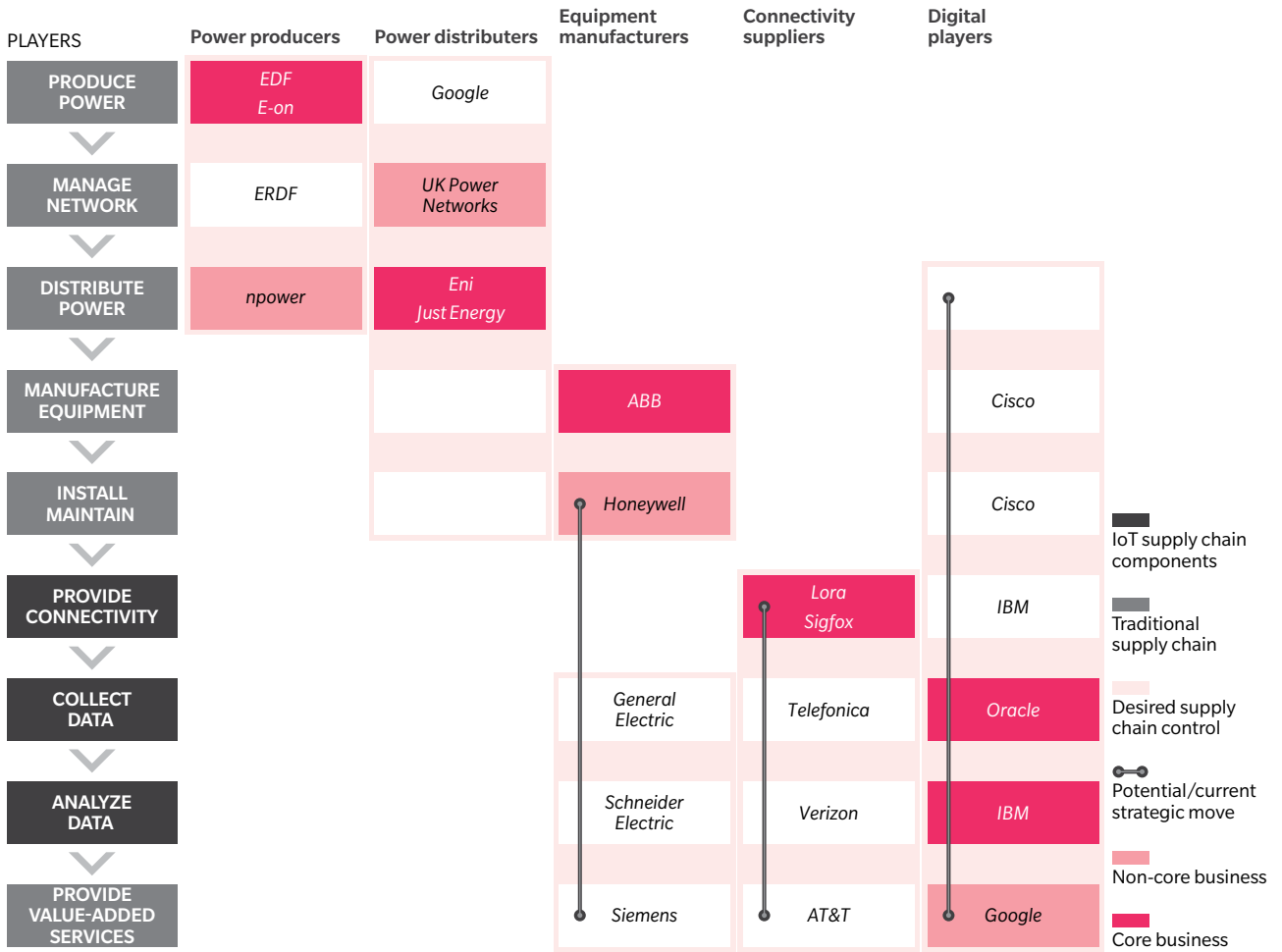
PLAYERS	Power producers	Power distributers	Equipment manufacturers	Connectivity suppliers	Digital players
PRODUCE POWER	EDF E-on	Google			
MANAGE NETWORK	ERDF	UK Power Networks			
DISTRIBUTE POWER	npower	Eni Just Energy			
MANUFACTURE EQUIPMENT			ABB		Cisco
INSTALL MAINTAIN			Honeywell		Cisco
PROVIDE CONNECTIVITY				Lora Sigfox	IBM
COLLECT DATA			General Electric	Telefonica	Oracle
ANALYZE DATA			Schneider Electric	Verizon	IBM
PROVIDE VALUE-ADDED SERVICES			Siemens	AT&T	Google

Legend:
- ▬ IoT supply chain components
- ▬ Traditional supply chain
- ▬ Desired supply chain control
- ●▬● Potential/current strategic move
- ▬ Non-core business
- ▬ Core business

2. **There will be less direct revenue from power consumption** following a bitter commercial battle, so the need to generate income from analysis, support, and assistance services will be even more pressing

3. **A share of the production market will be lost**, specifically for peak periods, negatively affecting the profitability of long-term investments in calibrated production equipment (which can be 20 to 30 years for a power plant).

Innovation in services will come from collecting and processing data in real time using smart meters or networks, or both. Players that possess the required analytical skills, and obtain a power distribution licence, could potentially be formidable competitors, able to disrupt traditional markets with packaged solutions. Google is in this category. With Nest, Google Energy, and teams working on new gen storage solutions, this giant can play a key role in the world of electrical power for a long time to come (see Exhibit 2).

To transition successfully toward the world of IoT, incumbent industry players must take action on several levels:

- **Commercialise new dynamically priced offerings** to differentiate themselves and attract high value-added customers with precise knowledge of consumers and the market

- **Propose new services beyond their core activity**, for example security or insurance services for operators, or invoicing and analytical services for distributors

- **Use IoT technologies to optimise operational costs** (such as payroll, subcontracting, and investment) with predictive maintenance, remote operations, and more effective network regulation

- **Build partnerships to integrate analytical skills quickly, and anticipate the required organisational changes** to support this transition (such as moving toward more qualified labour able to focus exclusively on increasingly complex network interventions).
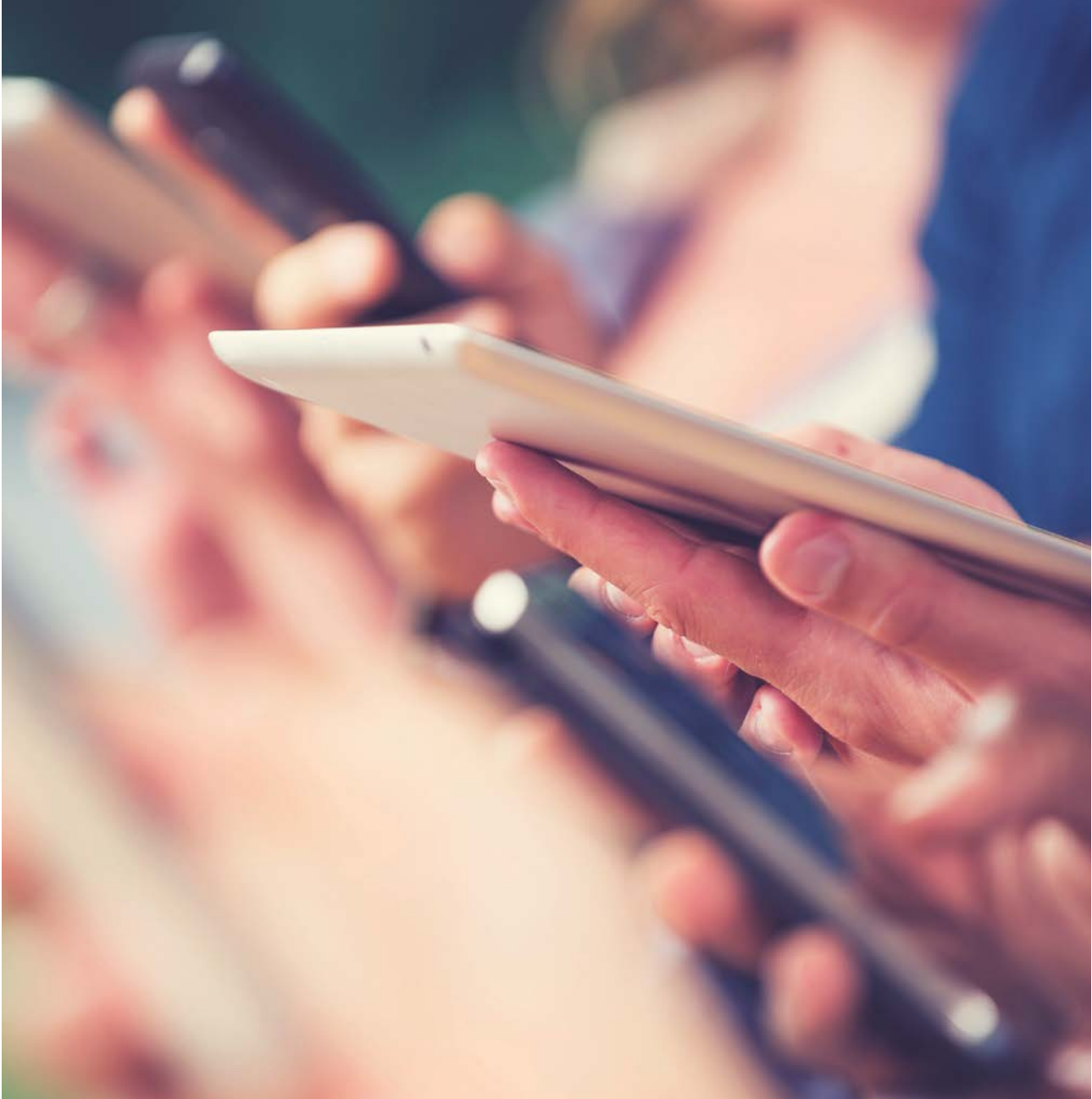
TELECOMMUNICATIONS

BEYOND CONNECTIVITY?

EMMANUEL AMIOT
LUIS BAENA
EMMANUELLE BERSIER
LAURENT GUERRY
JAN KRAL

Telecommunications (telecom) players enjoy a central role in the world of the Internet of Things (IoT), where they provide the fundamentals to individuals, households, and companies, namely security and connectivity solutions. These players are thus in an excellent position to become the facilitators or enablers of the connected experience, in both business-to-business (B2B) solutions and retail services.

Some may regard IoT as simply another version of machine-to-machine (M2M), a sort of M2M 2.0. IoT, however, goes well beyond M2M. Telecom operators such as AT&T have understood this clearly and present their M2M and IoT solutions separately.

IoT enables all companies and industries to transform existing business models and develop a more powerful value proposition based on service and an unprecedented wealth of data generated and collected by connected objects and digital sensors.

Companies in all industries need support from technological partners to build innovative services around IoT. The issue for telecom operators is how to seize the opportunities offered by IoT to expand their positioning beyond connectivity solutions. The additional revenue potential, particularly in B2B, is significant.

B2C. The key question for telecom operators is how to define their positioning in the home, car, and mobile ecosystems. The connected home is nothing new. Can operators position themselves as major players in the smart home? Can they establish a strategy to combine different ecosystems? Or is their legitimacy restricted to only a few?

B2B. A first issue for operators is to position themselves beyond connectivity and security, by offering new value-added services and end-to-end solutions (design, integration, maintenance, and so on). To reach these value layers, adequate knowledge of the relevant verticals or sectors is critical, and there appears to be three ways for operators to obtain it:
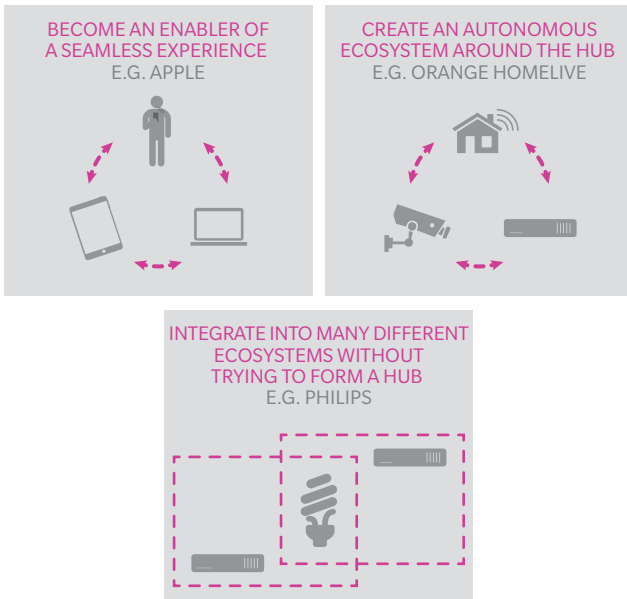
- Acquire a thorough understanding of targeted verticals, using internal teams and skills (with a detailed understanding of the industry, processes, and specific legal constraints for each market)
- Establish partnerships to acquire this understanding
- Establish platforms allowing trade players to develop their own applications.

A second issue is how to transform this data into relevant, usable information.

If operators don't manage to grab this opportunity, other players will seize it, potentially relegating operators to the role of connectivity provider. Is it really so unlikely that vertical players (such as industrial specialists like Siemens or GE) become holistic IoT solution providers limiting the role of telecom operators to wholesale connectivity? GE, with its Predix data collection and analysis platform for industrial internet applications, is only one example among many of industrial players now taking a position in the IoT value chain.
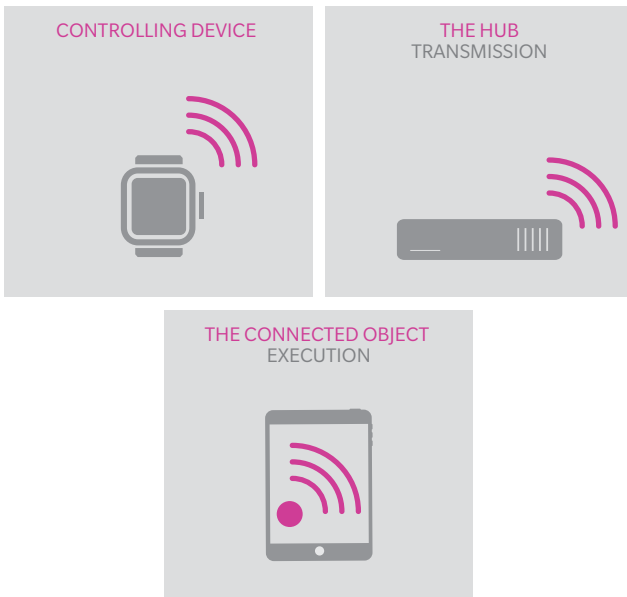
In the past, telecom operators have been threatened by over-the-top (OTT) services. How can they prevent a recurrence of the OTT scenario?

Exhibit 1: Different connected hub strategies

BECOME AN ENABLER OF A SEAMLESS EXPERIENCE
E.G. APPLE

CREATE AN AUTONOMOUS ECOSYSTEM AROUND THE HUB
E.G. ORANGE HOMELIVE

INTEGRATE INTO MANY DIFFERENT ECOSYSTEMS WITHOUT TRYING TO FORM A HUB
E.G. PHILIPS

Source Oliver Wyman

Exhibit 2: IoT chain of control

CONTROLLING DEVICE

THE HUB
TRANSMISSION

THE CONNECTED OBJECT
EXECUTION

Source Oliver Wyman

SEIZE B2C OPPORTUNITIES

Under these conditions, how should operators approach the IoT opportunity? The objective for the B2C segment is to define its positioning within several adjacent ecosystems: the individual (through portable technologies, or wearables), the home, and the connected car.

For example, the connected home is attracting players from all sides to develop services: telecom operators (such as AT&T with its Digital Life home automation solution, and Orange Homelive), manufacturers of household appliances (GE, Honeywell, Philips, and LG for instance), high-tech giants (Google with the Nest intelligent thermostat, plus Apple and its HomeKit to create devices that can be controlled with an iPhone), traditional and online retailers (like Amazon and Home Depot), insurers (such as Allianz and Axa), and power distributors (for example, British Gas). This is also true for connected car ecosystems, where new platforms are coming on the market (take HomeKit and CarPlay from Apple for instance) and new partnerships are being created (Nest with Mercedes-Benz and Whirlpool, Android Auto with BMW, and Audi with VW).

Behind this proliferation of players with more or less clearly defined approaches, it is possible to observe a certain strategic convergence toward hubs ensuring intelligent interactions among objects, regardless of manufacturer (see Exhibit 1).

Hubs enable different objects to communicate and interact together. Although some problems must still be worked out (including certifying objects and making sure that everything works intuitively, in a "plug and play" manner), the progress is very real. Convergence toward an IoT world is starting (see Exhibit 2).

Controlling a hub means controlling access to customer data, which is essential to create new innovative and personalised services, ensure customer satisfaction, and reinforce the customer relationship.

CONVERGENCE TOWARD A UNIQUE VALUE PROPOSITION

The smart home offering is converging to a unique ideal value proposition, in which solutions must be easy to install, understand and use; innovative and diversified in terms of choices (for example, in brands and types of devices); perfectly integrated; safe; and affordable. The main contenders will be able to capture market share either based on their existing customer base (such as Samsung, Belgacom, Apple, and Home Depot) or by differentiating themselves with a superior product (like Google or Wink).

The connected home market is thus expected to be captured by several players rather than dominated by a single one. However, if various ecosystems or hubs are not sufficiently attractive (in terms of customer experience or usage), a scenario in which a single powerful ecosystem dominates and becomes a de facto standard is also possible.

The diversity of objects, usages, and players makes it difficult to guess if there will be one or several winners in the connected home, or if there will be one hub or as many hubs as usage situations (kitchen hub, home automation hub, power hub, and so on). It is also difficult to predict the importance of mobility for these hubs.

MANY OVERLAPPING ECOSYSTEMS

Will some players have the potential to cover all intelligent home services? To answer this question, we need to distinguish two elements.

The customer experience integration layer (for example, Wink integrates different ecosystems in its application). True value can be created by saving customers the trouble of having to juggle different applications (such as a Philips application for lighting or a Somfy application for blinds and shutters). This integration could be proposed by the most attractive underlying ecosystem (telecom operator, Nest, and so on) or by an OTT player with no hub control (Wink, for example).

Underlying ecosystems. For the underlying ecosystems, players must choose their battles according to the business model they want to build. Even the high-tech giants, whether building omnipresent ecosystems (like Apple) or redrawing the lines in entire industries (like Google), will have to choose their battles.

For instance, Google is positioning itself as a power optimisation facilitator and enabler with a whole energy arsenal (including Nest platform, power distribution licence, and new-generation batteries) but also as a security and remote surveillance provider with its cameras. Other domains could be explored by Google to reinforce its ability to collect relevant data for its current business model. Amazon wants to be the premier household supplier of consumer goods and support services. Some operators are offering integrated automation, security, and infotainment solutions.

We are thus witnessing the emergence of a number of specialised ecosystems. The reason is simple: to create real value for the customer, the home must be not only intelligent but also useful. However, this requires making home management simple and natural. The complexity of integrating all of the complex connected home services into a single platform is leading to the creation of many overlapping ecosystems. The real value

A REVOLUTION FOR THE HOUSEHOLD APPLIANCE INDUSTRY?

Household appliances don't like to rock the boat, and there are few breakthrough technical innovations in this industry. In large appliances, induction cookers were invented over twenty years ago, and in small appliances, revolutionary products like SEB's Actifry remain the exception. Functional innovations like the bread machine are much more frequent, particularly in small household appliances.

But IoT will change the game dramatically. Beyond the buzz created by the rise of new players (Withings), connected products (Cookeo) or the commercialisation of the first intelligent refrigerators (Samsung), the real effects on the market are still anecdotal – for now. But the industry will be transformed in the years to come. These transformations will manifest themselves in several ways:

Functional product extensions. Products are becoming smarter and offer more features with new sensors. They are communicating with the outside world and can receive information, from a smartphone for example.

Development of services. Value-added services are offered that change how products are used or improve the user experience, like the Terraillon bathroom scale which offers healthcare coaching advice. The challenge will be to monetise these services when moving away from free-of-charge or freemium models.

Product updates. Tesla Motors blew the automobile community away by proposing regular software updates for the S model to optimise car performance. Dishwashers able to optimise water or power consumption or rectify design defects are about to arrive on the market. Soon, actual usage will be

measured so that a family of five won't receive the same parameter settings as a single person.

Optimised after-sale service. Real-time analysis of household appliances in operation will also enable manufacturers to detect weak signals and propose preventive interventions. In the event of breakdown, remote diagnosis will make it possible to prepare interventions, and in particular to guarantee the availability of spare parts required: it is estimated that 40% of maintenance activities could thus be carried out remotely.

Interoperability. Household appliances will be gradually attached to the sphere of the connected home and to sub-spheres like the connected kitchen or bathroom. Interconnected objects within the same sphere or sub-sphere will foster the emergence of hitherto unsuspected uses. New constraints will also emerge for manufacturers, such as the need to share data with other players, including direct competitors.

These changes will generate enormous value for industry players, as direct links are established with consumers, whose satisfaction will rise and whose usage habits will be better known to suppliers.

In order to capture this value, the latter must address many challenges, however:

- Imagine and develop new uses linked to connectivity, but also design new ways of marketing them and fostering their adoption
- Build innovative business models induced by IoT: transfer of pricing from objects to services, payment based on usage, and so on
- Rethink relationships with distributor clients with a win-win mindset

- Face newcomers by reinforcing strategic control points (brands, products, services, and so on) which will vary from one market to another
- Radically rethink product development processes by adopting an intrapreneurial organisation, but compatible with the constraints of dealing with dozens of diverse markets and millions of end customers (standards, uses, sales channels, and so on)
- Get geared up to collect, enrich, organise, and analyse data, which will be the source of all the new value created. This is a particularly delicate issue, because companies must form the right partnerships, make concessions while keeping key information, and in very different commercial and regulatory environments from one region to another.

Among the partners on whom the manufacturers of household appliances can rely, we feel that telecommunications operators could be the right allies. Indeed, they are in a good position to provide the required platforms and technical know-how – without representing a threat – by connecting products; collecting, storing, and analysing data; and even possibly participating in marketing.

resides in the customer experience and in getting rid of those little day-to-day hassles to improve the quality of life (health, child safety, energy costs, and so on). To do this, know-how and skills in several domains must be combined – power production, distribution and storage by programming household devices, household inventory logistics, and tracking (like Amazon). In our view, the future will see specialised players coexisting in the connected home.

WHAT ROLE FOR TELECOM OPERATORS?

Telecom operators are well placed to offer solutions that meet customer security, automation, communication, and infotainment needs. Compared to Wink or SmartThings hubs, AT&T and Orange solutions must continue to expand their range of compatible devices. The same applies to Nest and Apple.

Consequently, communications operators today have the opportunity to reinforce their existing edge, in terms of the customer relationship and customers' trust and to expand their position in the connected home.

They also have the ability to combine new offerings into triple- and quadruple-play deals to offer one-stop-shop solutions. For example, Orange offers a pack of connected devices, a platform and an app to manage them, as well as a support service. Other operators can position themselves credibly in the sphere of personal data protection and connected home security, and offer excellent customer service and an extensive distribution network, with seasoned teams on the ground.

Telecom operators have different means to succeed. They can target customers who want easy installation and support services; expand their offering by taking inspiration from SmartThings' Smart, Smarter, and Smartest packs; open their platforms to third parties; give developers access to their application programming interfaces (APIs); and form partnerships with equipment manufacturers. (See Exhibit 3.) AT&T has clearly understood this and recently opened its Digital Life platform to developers and selected partners. While keeping control of customer data (and thus control of the customer relationship), AT&T can therefore remain competitive against new home automation players.

Exhibit 3: Hub suppliers vs. telecom operators

SUPPLIERS OF "HUB" WINK/SMARTTHINGS

- Higher initial costs ($80-$300) but generally less expensive than with an operator
- No contract or commitment; customers are free to switch and have the most recent gadgets in their ecosystem
- A wide choice of connected objects and brands (multiple partners)
- A central management app available with multiple scenarios (open APIs)
- Little support for installation, potential integration problems
- No additional services (e.g. help line for emergencies)

CONVERGENCE

Hub suppliers sell their products in packs (e.g. Homelive) to make the product easier to install and manage (e.g. Wink)

Telecom operators are opening their platforms to third parties (e.g. AT&T) to expand the choice of available brands and connected objects

... even if they target different segments

TELECOM OPERATORS AT&T DIGITAL LIFE/ORANGE HOMELIVE

- Little or no initial cost, but customers must pay for a 12-24 month contract
- Customers contractually committed for a specific period with no option to leave or replace products with newer versions
- Relatively limited choice of connected object types, brands, and designs
- A central management app is provided, but few available scenarios (currently)
- Turnkey solutions offer a better guarantee of trouble-free operation
- Added-value services are often included in the contract or available on top

Source Oliver Wyman, Wink, Smart Things, Orange, AT&T

B2B OPPORTUNITIES

IoT and connected objects offer telecom players a vast range of opportunities on the B2B market, but also risks. Companies across the globe need new connectivity solutions, for instance, to enable the remote surveillance of patient health or power service infrastructures in the home.

Businesses increasingly demand new value-added services and sophisticated end-to-end solutions, such as efficient patient pool management in hospitals and healthcare centres. Operators who want to take advantage of the B2B opportunities offered by connected objects must now define their game strategy and determine the roles they want to adopt in each case.

UNDERSTAND ECOSYSTEM DYNAMICS

The IoT ecosystem includes a set of links between connected devices. Exhibit 4 illustrates the most important links of the connected ecosystem.

Exhibit 4

IOT VALUE CHAIN

CONNECTED DEVICES

They include intelligent devices, objects, and sensors; autonomous connected devices enabling, for example, intelligent meters to be read remotely or street lighting to be controlled with intelligent sensors

CONNECTIVITY

Telecom and safety capacities required to connect devices to the network; central connectivity platform and communication equipment to aggregate the flow of data collected from different devices

ACCESS TO SERVICES

Platforms of connected objects are supported by a set of technical solutions, a nourishing environment for business development, and a commercialisation space; in favourable markets, developers can meet the specific needs of users

DATA COLLECTION

A variety of data collection, storage, and integration solutions providers, ranging from small specialised firms to integrated players such as technology suppliers or telecom operators

DATA ANALYSIS

The providers of model definition and analysis solutions are often small specialised structures

ENHANCEMENT OF VALUE-ADDED PRODUCTS AND SERVICES

The ecosystem finishing line includes the production of high-value-added products and services

Source Oliver Wyman

Until now, no agent has successfully established an end-to-end presence connecting all of these links. In the current status quo, telecom operators, because they control a portion of connectivity, are very well positioned to establish a foothold in each of them. However, players outside the telecoms industry are starting to expand into this field with their own connectivity resale solutions or through partnerships with telecom operators. Google is investing in Project Fi and plans to serve as a mobile virtual network operator (MVNO) in the United States. GE has relied on AT&T connectivity services since 2013 to offer its customers one-stop-shop solutions for connected objects.

Value is increasingly created by fully exploiting the data generated by connected devices. The players who capitalise on this asset will reap the benefits by designing innovative products and services whose added value is optimised for specific customer segments according to their needs. These targeted solutions in turn reinforce the customer relationship and enable the collection of more data. For example, rather than just selling a product, ThyssenKrupp Elevators uses connected sensors to offer advanced operational optimisation, preventive maintenance, and elevator surveillance services directly linked to elevator usage.

CHOOSE THE RIGHT STRATEGY

The ecosystem can be structured horizontally by IoT activity and vertically by industry, as illustrated in Exhibit 5. Depending on the selected strategy, each player takes its position in a well-defined segment.

The horizontals serve as the foundation for this IoT structure: connectivity and security; connected object markets or platforms; data aggregation and analysis; and application development and systems integration. Upon this foundation are the verticals, whose object, nature, industry, and level of maturity with regard to connected objects are highly variable. The verticals range from the car and manufacturing to sectors more closely linked to connected objects, such as intelligent cities and residential utilities (water, power, and so on).

Telecom operators must be careful in choosing the strategic positions to occupy in this structure. Although it is easier to bet on the lowest levels of the structure (connectivity and security), they must still be selective if they want to play a pivotal role as integrated vertical players. The higher they rise in the structure, the harder it will be for them to succeed.

Indeed, at the higher levels, there are incumbent or emerging players that have specific expertise which telecom operators do not yet possess.

What are the options for telecom operators, layer by layer?

Connectivity and security are the bread and butter of telecom operators. They can be delivered using their principal strategic asset (the 3G or 4G mobile network) by adapting it to the needs of IoT (by developing a specific core network, upgrading the RAN, or complementing it with the mesh network, and so on). These networks are supplemented by new alternatives, such as SIGFOX, or technologies like LoRa enabling high-quality connectivity at low cost, even for high data volumes. Companies like Actility allow operators to adapt their network for IoT.

With an exponential increase in the number of the connected devices and recent hacking incidents (Target, Home Depot, and Anthem, to cite just a few recent examples), security is becoming a paramount concern for businesses. Telecom operators can cash in on their credibility in the domain of cyber-security by offering reliable end-to-end solutions. Singtel managed to build its legitimacy through a set of acquisitions, including Trustwave, and by investing in start-ups. Similar examples abound.
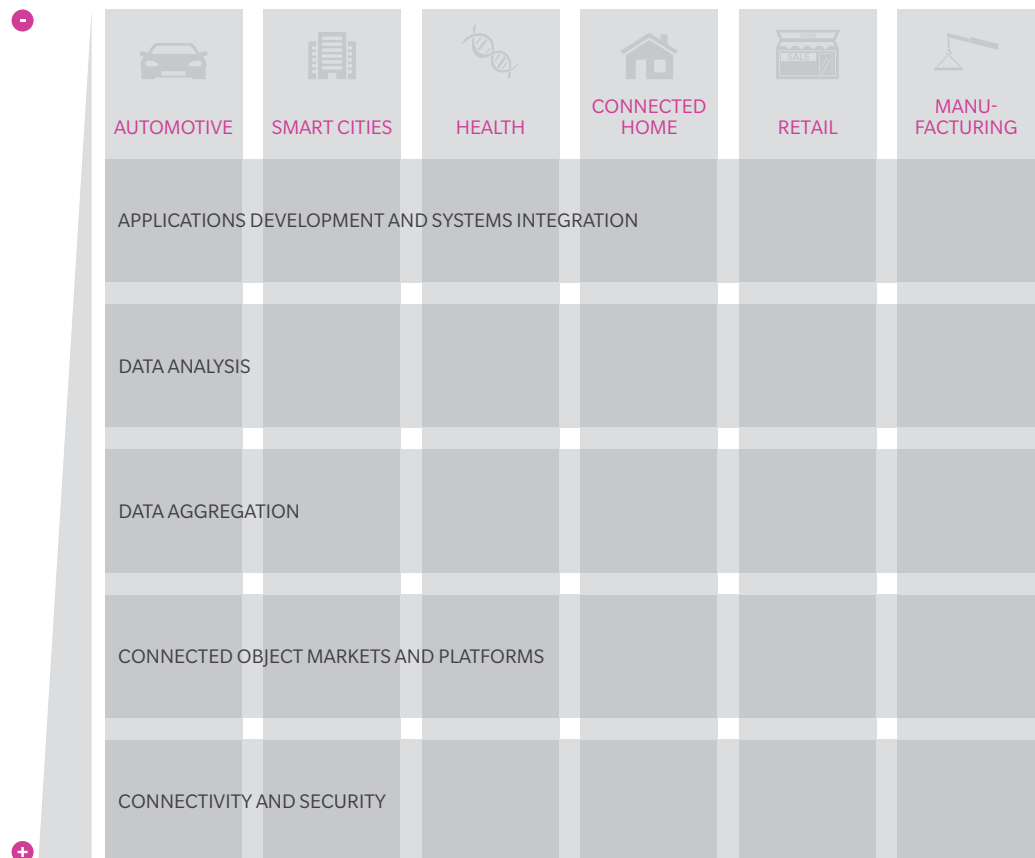
Operators can also play a role in providing **access to platforms or markets**. For instance, Deutsche Telekom launched a marketplace, while developing its business in some verticals.

Other major telecom players have invested in developing IoT platforms. Telefonica introduced a platform called Thinking Things to facilitate the creation of new products or services connected by multiple players, as did the Canadian TELUS. Outside the telecoms sector, new players specialised in these IoT platforms are booming, like PTC with ThingWorx or Jasper with its end-to-end connected object platform.

Aggregation and data storage. Operators can provide either data aggregation platforms for specific industries, such as AT&T's ForHealth solution, or data platforms cutting across the verticals, such as Datavenue launched by Orange. Datavenue

Exhibit 5: IoT ecosystem structure

FIT WITH OTHER TELECOM OPERATOR BUSINESSES

AUTOMOTIVE	SMART CITIES	HEALTH	CONNECTED HOME	RETAIL	MANU-FACTURING
APPLICATIONS DEVELOPMENT AND SYSTEMS INTEGRATION					
DATA ANALYSIS					
DATA AGGREGATION					
CONNECTED OBJECT MARKETS AND PLATFORMS					
CONNECTIVITY AND SECURITY					

Source Oliver Wyman

integrates open data like publicly available information and statistics with data from companies (banks, media, and service providers) and accessible customer data, in an anonymous and protected manner, for developers and other commercial players.

The **data analysis** layer is currently dominated by a set of players of various sizes whose specific expertise enables them to offer analysis solutions to companies in search of new revenue sources. Ranging from auto insurance (Treasure Data, Cobra, and SAS) to intelligent network management (Cisco, Oracle, and IBM for instance), these players will capture a large share of the value created by connected objects.

In order to materialise the potential of IoT, companies must make sure that the data and the intelligence obtained are used in their traditional processes, such as customer relationship management (CRM) and supply chain management. The **integration** layer, the natural market of software development, is hence becoming an opportunity for IoT enablers.

In this domain, communications operators are in an excellent position to become IoT enablers, allowing their customers to differentiate themselves with IoT, optimise their operational performance and costs, reinforce their customer relationships, and develop new sources of growth. Their customers are not necessarily equipped to manage the requisite equipment, device platforms, data collection, process integration systems, and so on. In a word, IoT is a major growth driver for communications operators, which have a unique opportunity to position themselves as service engines and play a driving role in the transformation of their customers.

At the same time, players outside telecoms, such as GE with its Predix platform and Schneider Electric with its Wonderware system platform, are gaining ground in integration and software. These companies and many others, including Cisco and IBM, aim to create platforms that will compete directly with operators in conquering this domain.

HOW SHOULD OPERATORS NAVIGATE THROUGH THE FLOURISHING IOT LANDSCAPE?

To move forward on such a complex subject and transition successfully to IoT, operators must advance simultaneously on five fronts:

Choose the right battles. Select a small number of the most promising domains or verticals, define value adding use cases, and design technical solutions. It will nonetheless be necessary to make some bets, including during the investment phase, and accept that some will fail. The value of IoT will essentially be found outside connectivity, in applications, service, and end-to-end solutions. Several options can be used to get there, including strong internal development of certain verticals, partnerships, horizontal platforms, and outsourcing the development of trade applications to external developers and third parties.

Start with the customer. Identify what B2C and B2B customers really value and which services could effectively meet their needs. Starting with available data, rather than the customer, is tantamount to mortgaging the future of innovative business models.

Build an ecosystem. Design a rich, well-integrated ecosystem offering many advantages in terms of improving customer choice in connected objects and corresponding services, gathering more data to analyse, getting better acquainted with customers, creating new customised service options, and reinforcing customer loyalty in the process.

Develop partnerships. Build a relevant network and clearly define the role of each network partner (as integrator, specialised service provider, enabler, and so on).

Adapt your organisation. Clearly define who will be in charge of the IoT strategy.
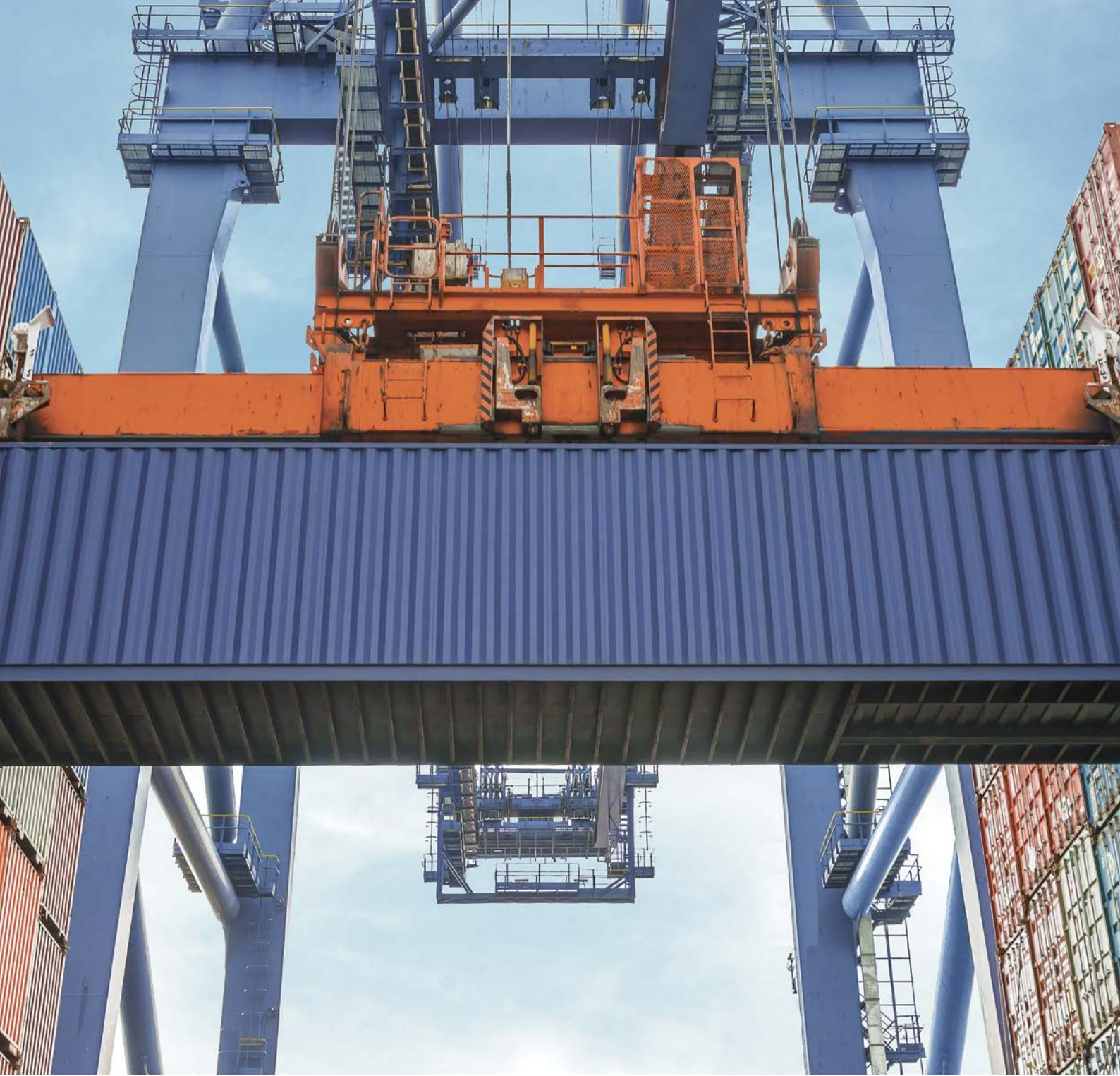
WHY AND HOW TO DEPLOY NEW SOLUTIONS

DAVID KAUFMANN

The Internet of Things (IoT) intrinsically has vast potential for the supply chain. From the supplier to the customer, from components to the finished product, and from the factory to the warehouse, the supply chain is the backbone of the company or the very nerve centre controlling the flow of processes and data.

As our interviews with clients have shown, most large corporations in a wide range of industries understand the importance of IoT for the supply chain and would like to take advantage of these opportunities. The speed of this realisation is accelerating as IoT technologies are becoming more widespread and as some competitors are already making a move, if only in part. The fact remains, however, that companies often hesitate to deploy the required roadmap because it appears confusing to them. It also necessitates profound and lasting transformation of the entire organisation's supply function.

HOW DOES IOT TRANSFORM THE SUPPLY CHAIN?

The IoT supply chain revolution is principally concerned with two dimensions: instantaneous information and the rising volume of available data.

The supply function has already learned how to manage constraints with thorough planning processes and sophisticated predictive models over time. Today, IoT sensors enable information to be gathered instantaneously. Data has become available in real time and thus enables almost immediate responsiveness. Various companies have made inroads in this market, such as the English Masternaut and the American Vnomics.

These companies specifically propose to track vehicle fleets (including their position, speed, distance covered, and history) and manage them in real time (taking account of traffic, accidents, various emergencies, and so on). This concept of instantaneous information is naturally not limited to shipping; it can potentially cover the entire range of relevant information at any step in the supply chain.

Combining this new concept of instantaneous information with the rising volume of available data is what will enable IoT to attain its full impact.

SHIPPING

It is no longer just a matter of geolocation in real time (something that has existed for many years) but also of transmitting real-time information concerning specific constraints (like temperature, humidity, and verification when a package is opened), utilisation of truck capacity, or even driver fatigue. The Driver Security Solution (DSS) system deployed by the Caterpillar equipment supplier, for instance, uses technology to track drivers' faces and eye movements to assess their level of fatigue.

IoT also impacts on delivery to the last mile. It can be used to track orders as they arrive in real time or geolocate connected drivers to determine their availability in the vicinity and turn them into potential delivery people (UberEATS). The Israeli start-up Olsi launched Postybell, a small sensor that can be put in mailboxes to notify users at any distance on their smartphone when their mail arrives. In the future, there is nothing to prevent these sensors from tracking things like humidity in the mailbox.

WAREHOUSES

With continuous flows of products and materials, warehouses will also be a core part of the IoT revolution. This revolution starts with forecasting the arrival time of trucks and automatically scanning tagged products when they arrive, using passive or active radio-frequency identification (RFID) technologies, for example, depending on the desired service. These technologies, more efficient than bar codes, no longer require individual and directional scanning.

Cameras can also be used to verify the absence of damage, manage inventory, and check compliance with certain storage conditions in real time. Alarm systems will automatically be triggered if predefined environmental thresholds are surpassed or when products are too heavy, badly positioned, or about to fall.

All of this is done today at a constantly rising level of granularity. Identification and tracking can be conducted on a level as detailed as the individual product and at increasingly affordable prices, sometimes just a few cents. Focused on this segment, the Norwegian Thin Film Electronics produces tags that can simultaneously define a product and collect a certain number of external data, such as temperature.

A key piece of warehouse equipment, the forklift is also undergoing a major transformation with IoT. Industry giants such as Toyota, Jungheinrich, and Fenwick Linde, as well as logistics automation specialists like Swisslog, are using IoT to raise the intelligence of forklifts (to include location tracking, speed adapted to ground conditions, analysis of usage data, accident reporting, and battery charge tracking). Swisslog's SmartLIFT technology and Toyota's T-Matics piloting tool are just two examples of this transformation. What is more, operators can also be connected to track their movements and alert them to risks such as collision.

BUILDINGS

IoT also contributes to a very significant advance in the optimisation of facility and equipment management. Indeed, the starting and operating intensity settings of systems (heating, ventilation, air-conditioning, lighting, and so on) will be increasingly correlated with actual site activity and the need for machines and operators, rather than being controlled by pre-programmed time cycles.

We should also mention the impact of IoT on logistics maintenance operations, which will use new technologies to move gradually from programmed to predictive activity based on the actual state of the particular item. Volvo Trucks and ThyssenKrupp Grain elevators, for example, are placing heavy bets on the potential of this transformation. In addition to optimising maintenance plans, the many sensors placed in buildings provide manufacturers with invaluable information concerning the use of their equipment and the real needs of their customers.

AUTOMATION

At the final stage of automation, IoT can also facilitate automated paths, ceilings, potential hazards, mapping and navigation. Take, for instance, Kiva Systems, which was acquired in 2012 for $775 MM by Amazon and whose robots currently automate picking operations in the internet giant's warehouses.

IoT also optimises planning by offering greater transparency concerning demand, stocks, and capacity. This in turn makes it possible to move from a forecasting and

estimation-based system, often relying on the past, to real-time responses with no distortion. In the future, planning will be aided, thanks to IoT, by systems facilitating the interconnection of various data-producing functions within the organisation (such as supply chain, production, purchasing, sales, marketing, and finance). Links are created throughout the supply chain from end to end, between the company and the entire ecosystem of suppliers and customers.

WHAT ARE THE IMPACTS?

This overview illustrates the importance of the changes induced by IoT in the supply chain (see Exhibit 1). Observed impacts include the cost and level of inventory as well as the rate of service and revenues of the company. IoT also contributes to the migration of

supply chain value toward data collection, aggregation, and analysis activities, which are key to establishing innovative new services.
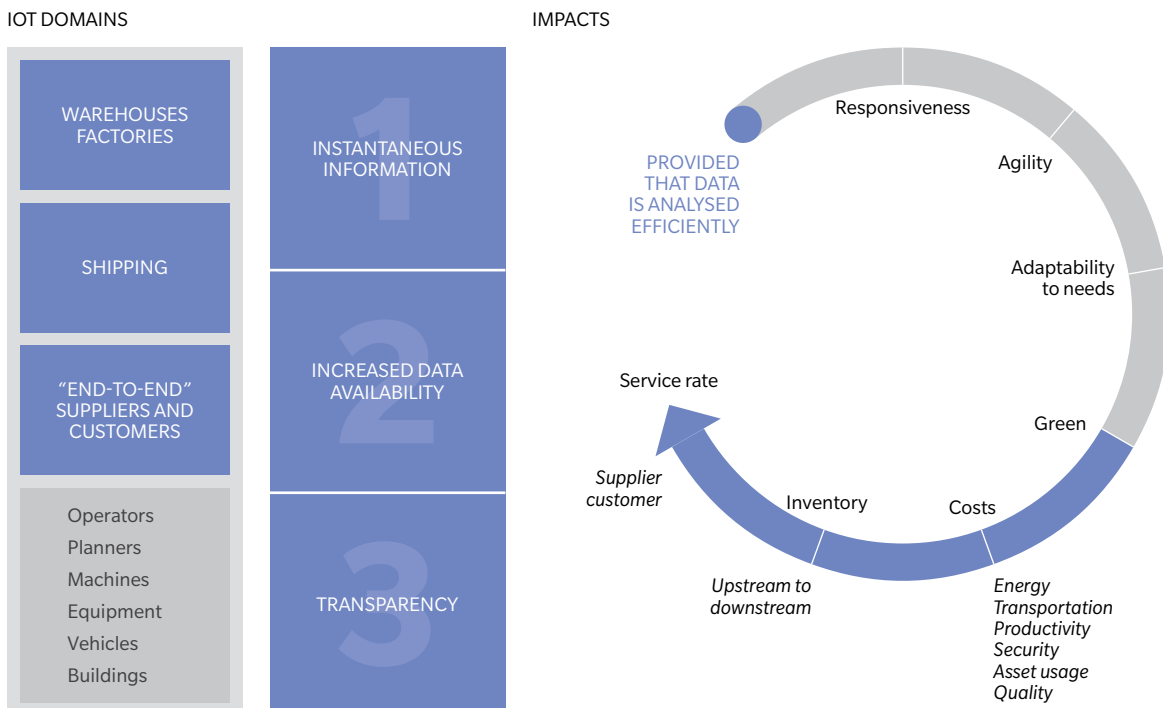
COSTS

Shipping productivity is generating the first cost improvements. Truck fleet management solutions are resulting in substantial fuel savings, around 10%. Added to this are better fleet usage, more efficient truck capacity usage, and fewer miles travelled empty. IoT also helps to automate shipping-related administrative procedures, leading to considerable savings. More transparent planning and improved tracking of product quality help to reduce the need to manage costly product returns. Operational productivity is improved due to the time saved on low value-added tasks (like finding inventory or counting stock keeping units) and by optimising the itineraries that operators and forklifts follow.

Exhibit 1: IoT in the supply chain

IOT DOMAINS

WAREHOUSES FACTORIES

SHIPPING

"END-TO-END" SUPPLIERS AND CUSTOMERS

Operators
Planners
Machines
Equipment
Vehicles
Buildings

1 INSTANTANEOUS INFORMATION

2 INCREASED DATA AVAILABILITY

3 TRANSPARENCY

IMPACTS

PROVIDED THAT DATA IS ANALYSED EFFICIENTLY

Responsiveness

Agility

Adaptability to needs

Green

Service rate

Supplier customer

Inventory

Costs

Upstream to downstream

Energy
Transportation
Productivity
Security
Asset usage
Quality

Source Oliver Wyman

A powerful platform for managing IoT data can offer real insight to facilitate the optimisation of flows, the elimination of conflicts and inefficiencies, and the automation of certain tasks. Bobcat, which deploys the SmartLIFT solution, reports that the productivity of its forklifts rose by 25% to 30% with return on investment in an estimated 18 months. The Kiva Systems robots used at Amazon are reported to reduce the cost of processing orders by approximately 30%.

There is a cost impact not only in productivity but also in improved security and risk management (through fewer accidents and less theft) and quality (by real-time tracking of delivery temperature and other data). The US firm Crown indicates that its InfoLink fleet management tools have reduced forklift accidents at its client Yamaha Motorcycles by 30%.

STOCK MANAGEMENT

Having a precise and shared vision of inventory levels in real time at suppliers and customers and within the company makes it possible to reduce strategic stock levels significantly and align them more effectively with actual needs. Increased transparency of this type, combined with information concerning expiration dates, for example, could also substantially reduce waste.

REVENUES

More than a cost centre, the supply chain is considered increasingly – and rightly so – as a company profit centre. For instance, better flow management with IoT is translated into optimised service rates on priority segments for customers and expanded sales. For a certain number

of service companies, efficient predictive maintenance on equipment under contract has a similar effect on revenues, by reducing the downtime of customer assets.

It is possible to imagine the emergence of a new range of offerings based on the potential to provide customers with higher added value. This is particularly relevant to the retail world, as IoT will revolutionise direct contact with customers at the time of purchase, while making it easier to get to the cash register and make payment.

Whether we're talking about optimising operations or establishing new services, IoT is accelerating the migration of value in the supply chain toward the players who collect, aggregate, and analyse data. As an example, fleet tracking solution providers such as Masternaut and Vnomics allow logistics players to improve their performance and thus offer end customers higher-quality service. However, the value generated by IoT is collected by Masternaut and Vnomics.

So the emergence of new IoT technologies represents a risk of commoditisation for incumbent players, some of which don't make much use of available data to improve their customer proposition. It is becoming critical for major supply chain players to keep control over key data and build a strategy aimed at monetising it by providing better service than their competitors.

WHICH INNOVATION APPROACH?

Although the IoT opportunity appears significant for the supply function and the company in general, it is advisable not

to neglect some essential aspects when undertaking IoT projects.

Initially, the most important objectives must be clearly defined, before even starting to identify the IoT systems that could be used to address these expectations. There are many potential suppliers and technologies on the market. Sufficient time must be taken to make a detailed assessment of existing offerings, without hesitating to invite some suppliers to present their services directly if relevant.

At this stage, we strongly advise our clients to emphasise the cross-company aspect of solutions. Will we be able to interconnect different company departments easily? Will it be possible to interface with suppliers and customers as well? Without losing sight of the performance of analysis platforms, what types of information will we be able to read? Will the analysis tool be modular and evolutionary?

IoT will provide an impressive volume of data. But without an efficient, adaptable, evolutionary, and ergonomic platform and without expert resources to analyse the collected data, it won't be of much use. Potential security issues should not be neglected, either, because it is important to ensure impermeability of the data flows to prevent hacking.

Solid fundamentals are necessary to deploy IoT in the supply chain. IT systems and processes must be ready to accommodate this change. More precisely, it is important to make sure that the system infrastructure is organised to process the new data and that the processes are simple, clear, and shared to ensure that the changes are integrated effectively. We have encountered companies who tried to switch too quickly

to IoT and then were forced to solve the resulting problems with a costly step backwards. Obstacles have included a proliferation of IT systems that can't mutually communicate and the extreme complexity of unshared processes.

Finally, deploying solutions based on IoT means designing a real organisational transformation programme. While it is possible – and even advisable – to carry out pilot tests at a particular facility, for example, the entire organisation must eventually evolve.

The supply function can spearhead this effort because technology management is destined to become a new component of its value proposition. But the project must not be restricted to the supply chain at the risk of greatly damaging implementation and missing out on the majority of potential improvements. More than a bunch of sensors, IoT represents a new way to think about flows from the supplier to the end customer. As a consequence, not just the supply chain but also production, purchasing, sales, marketing, and finance will have to be active stakeholders in the transformation, each function being involved according to its responsibilities.

Starting an IoT project also requires answers to a number of unavoidable strategic questions. What partnerships or alliances will we need? How can we transform the organisational system (including objectives, performance metrics, structures, processes, and tools)? How can we support the change (through project management, communication, or training)? These questions concern all company functions and, ultimately, senior management.

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