THE INTERNET OF THINGS

EXTRACTING BUSINESS VALUE IN SOUTH AFRICA

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INTRODUCTION

With over 9 billion connected devices in 2015 and estimates that this may grow to between 25 billion and 50 billion by 2025[1], soon enough Internet nodes are bound to reside in the most familiar, everyday things such as food packaging, home appliances and vehicles. For business, the opportunities are two-fold: IoT technologies are already used to transform business processes, for example through improved utilisation of assets; or alternatively they are capable of enabling new business models, allowing new entrants and innovative incumbents to gain a competitive advantage[2].

WHAT IS THE INTERNET OF THINGS (IOT)?

Explained simply, the Internet of Things is a network of internet-connected objects that are able to collect and exchange data[3]. The physical objects are uniquely identifiable via their respective IP (internet protocol) addresses. In technical terms, what distinguishes IoT from earlier technologies such as M2M (machine-to-machine) and telematics is the integrating role of IP.

The McKinsey Global Institute identified nine settings where IoT creates value, ranging from healthcare and retail to smart cities and worksites. It estimates the IoT's total potential economic impact of between $3.9 trillion to $11.1 trillion per year in 2025.

However, challenges remain, notably around information security and protecting the privacy of individuals. The US Federal Trade Commission warned in a 2015 report that the IoT presents a number of potential security risks for consumers. These include enabling unauthorised access and misuse of personal information, facilitating attacks on other systems, and creating risks to personal safety[4]. Unauthorised access to a patient's pacemaker, for example, could not only lead to a breach of his/her personal medical information, but could also seriously harm the person.

In this paper, we take an in-depth look at the development and adoption of IoT technologies in South Africa, and the opportunities and challenges the IoT presents to business.

> "IOT ALLOWS BUSINESSES TO DERIVE VALUE FROM THE DIGITISATION OF PHYSICAL OBJECTS AND TO DELIVER IT TO CONSUMERS IN WAYS THAT WERE NOT PREVIOUSLY POSSIBLE"

[1] McKinsey Global Institute
[2] McKinsey Global Institute
[3] The Internet of Things 2015 report, BI Intelligence
[4] Federal Trade Commission, 2015

IOT BUSINESS ECOSYSTEMS

"By merging physical and digital boundaries, IoT forces companies to innovate. It requires them to develop and implement new ways of thinking about their core capabilities, strategies, business models, value creation and value capture systems."

In order to expand our understanding of IoT business innovations, we propose the notion of a business ecosystem. This is a view anchored in the understanding that a company cannot be viewed as a member of any single industry; rather, its activities cross the boundaries of a number of industries, and an even greater number of supply and value chains[5].

IoT technologies enable cross-industry stakeholders to share information and add value. By merging physical and digital boundaries, IoT forces companies to innovate. It requires them to develop and implement new ways of thinking about their core capabilities, strategies, business models, value creation and value capture systems, as well as to respond to a changing world and redefine their organisational models.

Following the model, IoT allows companies to rethink their core mission. Is the aim of an insurance company to simply provide car insurance to its clients? Or are there other ways in which the car insurer (and even the automotive manufacturer or a life insurance company) can benefit from driver behaviour data? By enabling the sharing of intelligence information and analytics, IoT allows companies to form new collaborative, as well as competitive relationships. Consequently, strategic partnerships are formed beyond a company's immediate supply chains or value chains[5].

Furthermore, IoT data can be used towards the alleviation of 'wicked' social problems which are beyond the capacity of any single stakeholder to solve. Problems such as urban mobility, traffic congestion, safety and security could be addressed using driving behaviour data.

A LAYERED TECHNOLOGY ECOSYSTEM

From the car insurer example used above, it is clear that the IoT provides an opportunity to completely rethink business models and the ecosystem in which companies operate. But what technologies are required to make this a reality?
A simplified version of the layers encountered in the IoT technology ecosystem is captured in Figure 2.

EDGE DEVICES: MOBILE, WEARABLES AND SENSORS

IoT systems consist of a layer of edge devices for control and instrumentation. This is largely the domain of existing appliance manufacturers. These companies are increasingly integrating data-generating features into their products (e.g. RFID tags, sensors and tracking devices) and embedding them into household appliances, personal accessories, mobile phones and vehicles.

MIDDLE LAYER: SOFTWARE FOR DATA PROCESSING AND INSIGHT DISCOVERY

In order to control the edge devices remotely and to manage the flow of data to and from them, businesses need an IoT gateway or platform. Such middleware components are offered primarily by specialist M2M and IoT providers and technology vendors. By sourcing large quantities of data from connected devices, these providers drive the adoption of big data and analytics to store the data and analyse the data to enable real-time decision-making.

BASE LAYER: CONNECTIVITY AND HARDWARE INFRASTRUCTURE

As this layer serves to connect sensing devices with backend platforms, convergence between mobile and fixed-line networks has been the leading story in this space. Nonetheless, it remains highly contested in terms of technical standards and specifications, as they can serve as organising factors for ecosystems and alliances of partners. In terms of connectivity provisioning to the IoT space, there is substantial interest including from fixed-line internet service providers (ISPs), mobile network operators (MNOs) and VSAT satellite connectivity providers. Additional data processing facilities such as data centres and cloud services also form part of this layer.

"IOT SYSTEMS CONSIST OF A LAYER OF EDGE DEVICES FOR CONTROL AND INSTRUMENTATION. THIS IS LARGELY THE DOMAIN OF EXISTING APPLIANCE MANUFACTURERS.

[5] Moore, 1993
[6] Kelly, 2015

FIGURE 1: BUSINESS ECOSYSTEM TRENDS[6]

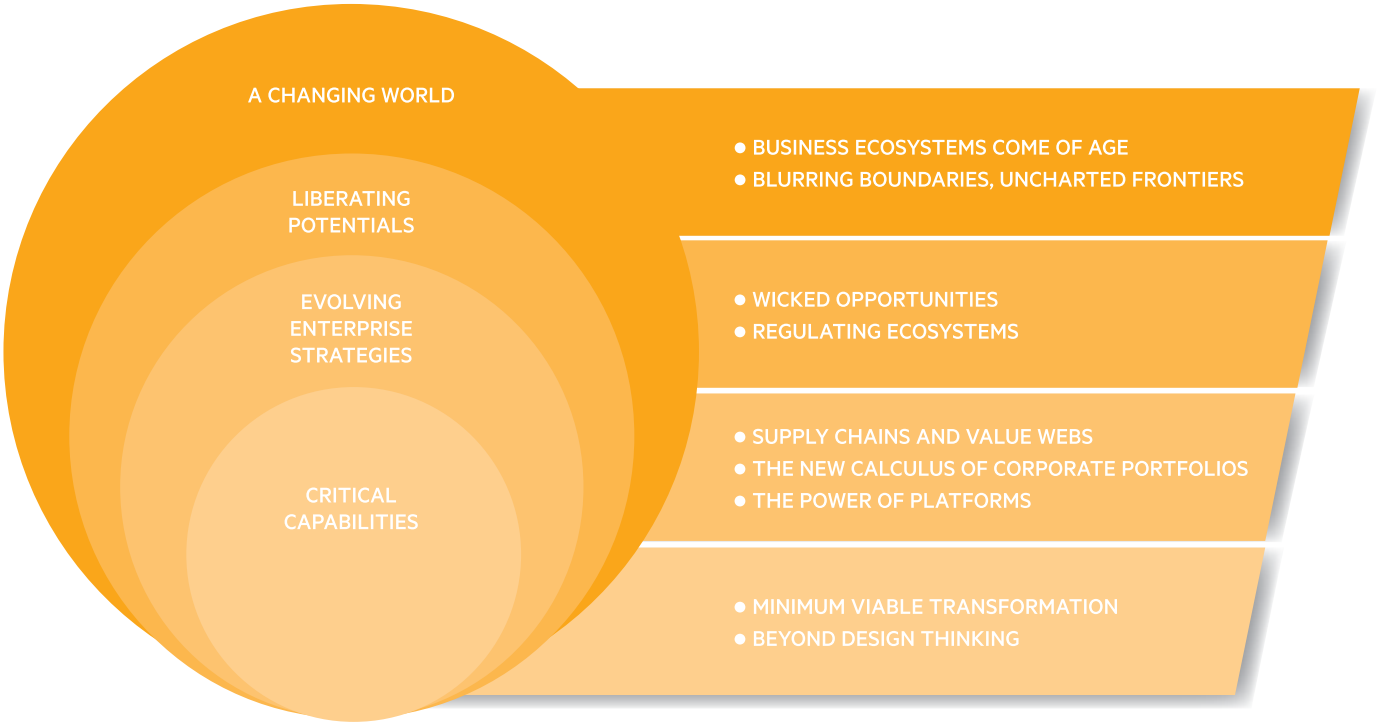


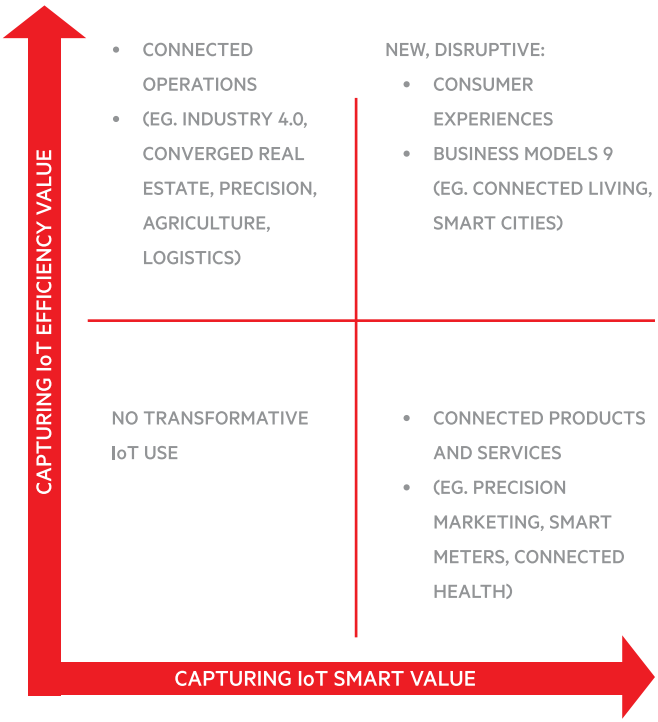
FIGURE 2: LAYERS OF TECHNOLOGIES

EDGE DEVICES:
MOBILE, WEARABLES, SENSORS

MIDDLE LAYER:
SOFTWARE, PLATFORMS FOR DATA PROCESSING AND INSIGHT DISCOVERY

BASE LAYER:
CONNECTIVITY AND HARDWARE INFRASTRUCTURE

FIGURE 3: IoT BUSINESS VALUE



In order to understand the impact of IoT on business, we propose a simple 2x2 approach (See figure 3).

On the one hand (vertical axis), IoT solutions are capable of providing business value by improving the efficiency of operations and driving down costs and/or risks. These solutions provide business value on the basis of information derived from the industrial environment. They are capable of streamlining—or revolutionising—operations by slashing costs, increasing efficiencies, and reducing dependence on labour.

On the other hand (horizontal axis), IoT solutions are capable of creating business value from information derived from the commercial environment. IoT allows businesses to derive value from the digitisation of physical objects and to deliver it to consumers in ways that were not previously possible. By fostering diverse, cross-industry partnerships within the ecosystem, IoT technologies can create new 'smart' consumer experiences of value[7].

Incremental innovation occurs when businesses capture either efficiency value through enhanced operations, or 'smart' value by introducing new, connected products or services. Disruptive business innovations can be observed when businesses take advantage of value creation opportunities and leverage them to introduce new industry cross-cutting and ecosystem-wide business models.

When companies can consider their ecosystem in its entirety, they are often able to analyse and share the intelligence with others within the ecosystem via open APIs (application programme interfaces).

The business ecosystem approach allows executives to start making strategic technology choices by systematically questioning their own and their competitors' positions in the cyber-physical ecosystem, as well as its openness and the outlook of the ecosystem:

[6] Hui, 2014

CAPTURING BUSINESS VALUE

- Does the company provide/receive automatic updates to/from the very best suppliers and partners in the ecosystem?
- Is the company capturing valuable commercial data from customers and suppliers?
- What direct information links with customers and suppliers have been developed by competitors?
- Over the long run, how can such data be translated into bargaining power, autonomy and financial returns?
- What transformative digital innovations might make the current businesses obsolete?
- What would it take to catalyse a cluster of digital assets into a new, viable business proposition?

> "WHEN YOU BRING THE INDUSTRIAL INFORMATION TOGETHER WITH THE COMMERCIAL INFORMATION, YOU CREATE A POWERFUL DECISION-MAKING [TOOL]."
>
> – BRUCE TAYLOR, DIMENSION DATA

A STUDY OF IOT IN SOUTH AFRICA

We asked 11 representatives of South African technology companies about their views of IoT business and technology ecosystems, the role of standards, local challenges and informative use cases from their practice. Based on the interviews, we classify use cases for IoT in various industries into the categories defined earlier: efficiency value, 'smart' value and disruptive value.

CAPTURING IOT EFFICIENCY VALUE

EXTRACTION INDUSTRIES

Resource extraction industries such as oil and gas and mining are constantly faced with the challenge of finding new reserves of natural resources and balancing the cost of their extraction with volatility in demand and prices, as well as with environmental risks (e.g. the need to reduce their carbon footprint). IoT technologies can contribute to the management of exploration, drilling and completion of projects, equipment maintenance, as well as linking up the flow of stock to mid-stream (e.g. refineries) and downstream (e.g. gas stations) industries.

Besides the management of extraction processes, extraction industries such as mining can derive value from data intensive tasks, such as prospecting and sample analysis. Platform vendors like SAP and IBM have been able to capture value for mining operations thanks to their analytic capabilities. By applying cognitive analytics to mining data, systems are able to improve the productivity of a mine and determine optimal mining strategies.

By pulling together data from the cyber-physical environment at a mine, IoT systems are able to provide security, health and safety benefits. Sensor systems are able to address problems related to illegal mining, enable the early detection of toxic gases such as carbon monoxide, ensure safe equipment handling and compliance to local health and safety regulations.

IOT FOR MINING: THE SAP EXPERIENCE

With 700 mining customers in 65 countries, SAP solutions are well established in the industry. The key IoT use cases are in the areas of predictive maintenance, health and safety, and smart logistics.

The data generated by mining equipment has multiplied by a huge factor. Machines are equipped with sensors which capture individual messages. For example, a truck in the mine produces data on whether it is loaded or not, how its engine is running, what the air pressure in its tyres is, etc. Meanwhile, data is generated by RFID tags in the helmets worn by people working in the mine. As an example, SAP solutions can integrate these two data streams in order to generate alerts preventing a truck from running over a person. The near-misses are recorded in an incident management system, which facilitate the redesign of operations so that incident hotspots do not occur.

Another example is SAP's predictive maintenance applications. The equipment generates data on its operational state, allowing IoT technologies to detect when maintenance is necessary. Savings are realised by either shortening or lengthening equipment maintenance cycles.

Smart logistics are used to enhance the efficiency of both inbound and outbound shipments. Using telematics, geofencing (technology that allows the administrator to build virtual barriers), and integration with traffic data from other systems, customers and other carriers, for example port authorities, mining companies are able to optimise logistics and reduce bottlenecks.

AGRICULTURE

Precision agriculture is a farm management concept aimed at optimising returns on inputs while preserving resources. The reality of farming is that seemingly simple crop management tasks, such as defining areas where different operational practices should apply, can be challenging, especially over vast areas of land. IoT technologies can be used in agriculture to drive management decisions by catering to surveying and monitoring needs; contributing to the detection of pests and disease; facilitating the management of field operations and their alignment with weather patterns and conditions; and delivering guidance and advice to field workers and small-scale farmers.

CONVERGED REAL ESTATE

The notion of smart real estate has been linked to environmental sustainability (saving energy, time, land, material and transportation) and social trends (independent living, healthy living, work from home, quality of life).[8]

While 'green' buildings and 'smart' buildings have a lot in common, smart buildings integrate technology systems geared towards operational efficiencies (such as smart lights, lifts and escalators), enhanced management and occupant functions. Such concepts view a converged network of data, voice and video as the fourth utility in the building, alongside water, electricity and gas. Converged real estate provides savings opportunities for landlords and tenants as they provide tools to control maintenance costs[9].

[8] Allameh, Jozam, de Vries, Timmermans, & Beetz, 2011
[9] Andric, 2012


453 €
52 €
30
Benefits -0
180 240 300 360 420 480 540 600
Sales
Sold Sales Total Benefits
0 0 € 1 € -1 €
30 1.560 € 13.591 € -12.031 €
60 3.120 € 27.181 € -24.061 €
90 4.680 € 40.771 € -36.091 €
120 6.240 € 54.361 € -48.121 €
150 7.800 € 67.951 € -60.151 €
180 9.360 € 81.541 € -72.181 €
210 10.920 € 95.131 € -84.211 €
240 12.480 € 108.721 € -96.241 €
270 14.040 € 122.311 € -108.271 €
300 15.600 € 135.901 € -120.301 €
330 17.160 € 149.491 € -132.331 €
360 18.720 € 163.081 € -144.361 €
390 20.280 € 176.671 € -156.391 €
420 21.840 € 190.261 € -168.421 €
450 23.400 € 203.851 € -180.451 €
480 24.960 € 217.441 € -192.481 €
510 26.520 € 231.031 € -204.511 €
540 28.080 € 244.621 € -216.541 €
570 29.640 € 258.211 € -228.571 €
600 31.200 € 271.801 € -240.601 €

DRONES FOR BUSINESS INTELLIGENCE: TERRACAM

Founded in 2012 by the aeronautical engineer Rolf Schlub, TerraCam is a start-up focused on the use of unmanned aerial vehicles (UAVs), or drones, for gathering various sensor outputs and processing the data to derive business insights.

AERIAL SURVEYING. The core business of TerraCam consists of conducting aerial surveys for clients in the mining, agriculture and safety and security industries, using advanced micro-drones. UAV deployments are capable of delivering aerial survey data at as little as 20% of the cost of traditional survey methods. Aerial surveys are used regularly to monitor open-pit mining operations.

SURVEILLANCE. Residential estates and developments are able to integrate UAVs into their armed response systems. By deploying drones, security companies are able to provide 24-hour patrols and target tracking services, as well as record data via multispectral sensors and thermal sensors [for example through the use of infrared technology].

Precision agriculture. UAVs are able to fly all year round and continuously monitor every stage of farming operations (e.g. planting, applying fertilizers and harvesting) and crop development (germination, disease and infestations).

SENSOR DATA ANALYSIS AND BUSINESS INSIGHTS. For their business customers, TerraCam's deployments of UAVs generate value by providing essential planning inputs and monitoring outputs for their operations. By building realistic and accurate 3D-models of the spatial elements of planned operations – e.g. capturing mines' terrain, pinpointing drilling locations, or modelling the geospatial contour lines of farming fields – TerraCam assists its clients in ensuring precision in the execution of their operations.

MANUFACTURING

Manufacturing is in a position to derive value from IoT through improved operations and streamlined processes. As production tends to be capital-intensive and their operational environments tend to be highly controlled, IoT solutions are capable of resolving management problems such as planning, stock flow and just-in-time production. In manufacturing plants, monitoring, positional and control sensors are enabling data-driven maintenance, identifying sub-optimalities and improving safety and security. Predictive maintenance of manufacturing equipment is allowing for higher availability (less downtime), better guarantees on quality, lower process variability, and improvements in utilisation (efficiency). Equipment vendors are increasingly drawing their revenues from the sale of service agreements for manufacturers and performance guarantees over the lifetime and usage of production assets. Achieving optimal efficiency and availability of these assets is critical to both equipment vendors and their clients, the manufacturers. IoT enables a reduction in production costs through the effective planning of maintenance, performing fast and effective root-cause analysis, and detecting warranty issues as early as possible.

LOGISTICS, ASSET AND FLEET MANAGEMENT

In the context of fleet management, IoT can monitor performance, correlate with historic data and predict anomalies. In logistics, real-time tracking (through e.g. RFID technology) of parts and raw materials can pre-empt problems and address demand fluctuations. Similarly, real-time inventory tracking data from warehouses can be integrated with high resolution sensor data from transport and delivery networks. In South Africa, MiX Telematics have introduced in-vehicle hardware solutions that collect, record and transmit data about vehicles, drivers and jobs. Key business insights are derived with reporting tools that enable fleet operators and owners to make informed and timely decisions about their operations. Fleet efficiencies are boosted, driver safety is improved, and productivity is further enhanced by streamlined communication between drivers and head offices.

SMART WAREHOUSES: CUBEXX

SAP is partnering with a diverse set of IoT vendors in the manufacturing space, such as Jasper, Siemens and STILL. Working alongside STILL, they have been able to transform the mobile forklift truck robot CubeXX by connecting it to IoT and the SAP HANA Cloud Platform.

Predictive maintenance solutions provide insight into machine needs and help employees service and fix machines before they break. The entire vehicle fleet is mapped, monitoring the current real-time status of each vehicle, operating hours, availability, and fleet capacity utilization.

Additionally, the CubeXX fleet is able to use adaptive logistics in order to determine the appropriate number of vehicles necessary for each inventory project. When a transport order is sent to the fleet, the vehicles communicate with one other and reassign the transport order amongst them in order to increase efficiency in the active fleet. This allows for the transport of inventory in warehouses to be executed with little to no manual labour.

CubeXX also enables STILL to optimise its business. STILL is able to offer forklifts not only as a product, but also as a service offering. Customers can "pay per move" and optimize the way warehouses are managed.

FIGURE 4: CUBEXX

CAPTURING IOT SMART VALUE

While efficiency value can be captured by IoT technologies implemented within the context of internal operations, they can also be introduced with the intention of capturing 'smart' value, based on gathering information about the commercial environment external to the company. This could be information about customers, their real-time demand, use and experience of products. It could be intelligence information capturing competitors' activities and the business environment, as well as information of relevance to stakeholders in the broader business ecosystem. Such information is instrumental in informing the decisions of business executives, and use cases tend to bring more transformative experiences for customers.

RETAIL AND MARKETING

Precision marketing and data-driven shopping experiences are an area of IoT use which is based on collecting information about consumer behaviour and is increasingly becoming a reality in connected markets. While shoppers' purchasing patterns have been collected by retailers through loyalty schemes for some time, IoT offers retailers the opportunity to integrate such data into their real-time business decision-making processes.

Past purchasing information can be integrated with social media data and location-based information in order to create targeted recommendations and marketing campaigns (such as messages and coupons), tailored to create unique consumer experiences that are well-aligned with personal preferences. Proximity-based technologies (e.g. iBeacon) have been instrumental in enabling the effective monitoring of shopper traffic, the delivery of precision marketing through instantaneous push notification of coupons and discounts, as well as effective product positioning.

VIEW OF RETAIL INNOVATIONS FROM PICK N PAY

Retail chain Pick n Pay, which operates in a sector where margins are low and trends are fast-moving, is focused on technologies with a strong business case which contribute to the bottom line.

Foremost, it relies on technology innovations in order to improve its in-store processes. It has found value in the 'smart shelves' concept, where sensors are used to assess when stock levels on the shelves are low or empty. Using the Wi-Fi network in the store, 'smart shelves' generate alerts and reports for store managers who are then able to ensure that stock is replenished.

Critical to the rollout of such operational innovations to stores throughout the country is the ability of location-specific deployments to cover their large infrastructural overheads (such as the wireless network and the sensors that are deployed on the shelves). Enhancing operations with additional self-service offerings is envisaged: "For me the big step forward would be the use of customer phones to transact, to shop, to scan – the whole concept of self-scanning and online shopping in store." [Wesley Grisdale, Pick n Pay]

Pilots of precision marketing technologies such as iBeacon have enabled Pick n Pay to communicate with customers during their shopping trips. Push notifications have been trialled with location-specific messages such as promotions, coupons and requests to rate the experience. However, the applications are considered to be not quite 'retail-ready' yet due to their text-based interface.

HEALTHCARE

Healthcare is another sector where major benefits can be derived from IoT by linking devices that monitor patients' daily activities and physical surroundings. Wearable technologies contribute to the efforts of healthcare providers to move beyond the monitoring and recording of a patient's health status to the development of comprehensive health management and advisory systems.

Solutions tend to integrate pervasive sensor data from temperature monitors, blood glucose-levels monitors, foetal monitors, electrocardiograms (ECG) and even electroencephalography (EEG) devices, with advisory information.

These are compelling IoT use cases for caregivers and health organisations because they enable remote, up-to-the-minute health monitoring with channels for patient engagement, increased participation and ownership of the healthcare process. According to a research report by Research and Markets in August 2015, the market for remote patient monitoring technology is forecast to grow at a compound annual growth rate of around 10% to reach about $980 million by 2019[10].

Besides monitoring use cases, IoT technologies have been prominent in the improved detection and diagnosis of health conditions such as cardiovascular disease, diabetes, and infectious diseases. However, major privacy, security and regulatory compliance obstacles need to be overcome in forging the use of IoT in the healthcare sector.

INSURANCE

Technology is set to be one of the biggest game changers for the insurance industry, transforming the way insurance products are designed and the way insurance companies maintain their relationships with their customers[11]. IoT offers insurers growth opportunities by improving their ability to customise previously generic insurance products and engage on a more personal level with policyholders.

Insurance customers are becoming more and more open to the use of telematics devices as they tend to allow for more tailored insurance solutions and lower premiums. Telematics data (e.g. data on location, driving behaviour and speeding) enables insurers to estimate the risk that they are underwriting more accurately and price vehicle insurance premiums accordingly. Similarly, the mechanisms for pricing health also have the potential of evolving from simple age and health-based pricing to pricing based on real-time mobile and behavioural micro data (e.g. data from wearables, food purchases and gym visits).

The challenge with deriving benefits from such customer-centered data lies in the fact that it is largely unstructured and requires advanced analytics.

For example, Aviva, one of the world's largest life insurance providers, used unstructured data from the online behaviour (online shopping and social media activities) of approximately 60,000 insurance applicants in order to categorise customers as runners/hikers, dieters or couch potatoes. Predictive modelling tools were applied to estimate the customers' longevity and to determine coverage on the basis of lifestyle pattern and life expectancy[12].

Other insurance sub-sectors which are being transformed by the influx of IoT technologies include agricultural crop insurance, home and property insurance.

DISRUPTIVE IOT INNOVATIONS

Disruptive IoT innovations manage to transform business ecosystems by capturing and distributing value across the different stakeholders. Truly disruptive innovations are able to leverage opportunities for capturing diverse value propositions, and integrate multiple revenue streams into fairly intricate business models and business cases.

#MTNIOT: BUSINESS MODEL TRANSFORMATION

In 2015, MTN and the Chinese telecommunications provider ZTE announced the launch of an IoT platform for Africa. The platform connects to edge IoT devices via a global M2M SIM card, providing customers with a blanket rate for M2M activity across MTN's African network of 22 countries.

For MTN the launch presents a case of business model transformation away from simply selling SIM cards in consumer markets towards supporting business applications on their network. By offering a cloud-based software platform with open APIs for developers, GSM links to IoT devices in over 20 countries and services ranging from connectivity to end-to-end solutions, MTN is enabling businesses to deploy IoT solutions and take advantage of next-generation services.

MTN has developed a clear strategy for repositioning their M2M business in the B2B, rather than the B2C market:

"The approach of the new platform [...] earns a lot of revenue off device manufacturer bundling, and some revenue off big data analysis [...]. Providing end-to-end solutions to different customers [is another revenue stream]. [...] If you combine all of those, then you suddenly have a very good business case. The old model failed in that it was very narrow. It was just looking at data revenues and that is not sustainable at all." [Yusuf Kaka, MTN]

"TRULY DISRUPTIVE INNOVATIONS ARE ABLE TO LEVERAGE OPPORTUNITIES FOR CAPTURING DIVERSE VALUE PROPOSITIONS, AND INTEGRATE MULTIPLE REVENUE STREAMS INTO FAIRLY INTRICATE BUSINESS MODELS AND BUSINESS CASES.

UTILITIES AND ENERGY

IoT innovations in the utilities sector, particularly with regards to energy, can be considered disruptive as it offers both efficiency value and smart value.

IoT offers efficiency benefits in terms of optimising operations (e.g. improving energy use in companies) and grid management (e.g. load forecasting and outage management). Such benefits are particularly relevant in the context of transforming energy generation in South Africa and the increase in electricity supply from renewable sources. The foreseen smart benefits are linked to managing demand through smart metering and the delivery to consumers of real-time information about their energy use.

One customer benefit of smart metering is the provisioning of up-to-date information on electricity consumption. In doing so, they can help people to manage their energy use and reduce their bills. Conversely, smart metering enables selective pricing at certain times of the day, or the season, when power generation is constrained or use is over-extended. Proponents say that sending customers 'price signals' can moderate their energy use and instil more responsible energy consumption habits. Studies conducted in Australia have shown a reduction of 3-5% on average in energy bills[13].

SMART ELECTRICITY GRIDS

The notion of a smart grid captures the arising complexity of the generation process and seeks to align it with consumer demand, which varies throughout the day. It involves adding a layer of intelligence onto the grid which allows the monitoring of supply and demand through sensors, and adjusting supply through appropriate switches.

AS-IS GRID		SMART GRID
Electro-Mechanical	▸	Digital
Centralised Generation	▸	Distributed generation
Hierachical	▸	Networked
Few sensors	▸	Many sensors
Manual verification	▸	remote verification
reactive response	▸	Pro-active response
manual restroration	▸	Automated restoraion
Focus on outages	▸	Focus on power quality
Fragmented data	▸	Consolidated data
Uneducated customers	▸	Informed customers

SOURCE: STEVE APPS

[13] McKerracher & Torriti, 2013

April harbour, Santander, Spain

CONNECTED LIVING

The consumer experience of 'connected living' is imagined as being able to integrate video, voice, and data services, delivered via the numerous information devices in one's life, in order to receive a coherent and compelling new experience, which is accessible and ubiquitous, anytime and anywhere.[14]

For example, Yusuf Kaka of MTN Group cites the use case where, in collaboration with Stellenbosch University, they were able to develop and patent a smart metering system for monitoring home geysers. The smart metering of electricity meters is a well-defined revenue stream for MTN, yet through the geyser monitoring prototype they were able to capture data not only about electricity consumption but also about water flows. Consequently, through analysis of the collected data they were able to detect misalignments of water flows and electricity consumption, which are indicative of leaking geysers and installation malfunctions.

Such data could inform predictive maintenance and be particularly valuable to insurance companies who often cover property damage due to burst geysers. For MTN, the new, combined smart meter and related data analytics offer potential for new revenue streams. The case illustrates how a complex innovation partnership is able to deliver an integrated experience for consumers across the sectors of utilities and insurance. The business model innovation carries disruptive potential for two ecosystems.

SMART CITIES

Governments have been a surprising early adopter of IoT technologies, with spending geared towards improving quality of life, building sustainable and environment-friendly cities, reducing congestion and pollution, improving disaster planning, building intelligent transportation systems and improving public safety[15], according to market intelligence firm IDC.

One example is the city of Santander in Spain, which is piloting an IoT testbed business model where the city provides access to infrastructure and consumers to commercial stakeholders for testing their IoT innovations[16].

The SmartSantander facility supports experimentation with IoT applications by offering a testbed with infrastructure consisting of a network deployment of 12 000 sensors in objects including electricity poles, building walls, buses, taxis, parking lots and garbage bins, and key support services such as identity management and security. The deployed sensors are able to monitor traffic density, parking spaces, detect emergency cars, as well as participatory sensing.

PERSONAL SAFETY AND SECURITY

Complex partnerships around IoT deployments are capable of addressing paramount issues such as the issue of personal safety and security. Governments, traffic departments, private security companies, CCTV installations and local entrepreneurs are capable of co-opting useful real-time data and spatial intelligence to software platforms. Police officers usually do not collect any of this information, and when they do they write it in a book.

By applying analytics to that data and working with software partners, IoT and analytics experts can derive relevant predictive insights about security and safety and develop proactive mechanisms for alerting citizens, police officers and private security firms about safety issues.

TRAFFIC AND PARKING

Another challenge that can be addressed through the use of IoT technologies is the issue of urban mobility, transportation and traffic congestion. IoT technologies can deliver benefits such as reduced energy consumption through dynamic pricing for road use and parking, frequent updated traffic information and route optimisation.

Public transportation services such as the Rea Vaya bus service in Johannesburg are also in a position to benefit from IoT. With the city's plan to install 1 000 Wi-Fi hotspots throughout Johannesburg by 2017, they are not only in a position to do condition-based monitoring on their buses but also to deliver new and improved travel experiences to passengers.

CHALLENGES TO IoT ADOPTION IN SOUTH AFRICA

The South African environment presents a number of challenges to businesses when it comes to the adoption of IoT technologies. Foremost among the challenges is developing a clear and convincing business case which identifies measurable value to be derived from IoT implementation. It can be hard to justify IoT investments, particularly since labour costs and productivity gains often fail to provide sufficient incentives for investments in IT, particularly in risky innovative areas such as IoT.

Businesses tend to be prepared to invest when they are able to operate the systems reliably, within self-contained and controlled operational environments such as manufacturing or mining. Therefore, preparing IoT business cases for capturing efficiency value is more readily achievable. Preparing business cases focused on deriving 'smart' value from customer intelligence and the commercial environment appears more challenging.

Connectivity infrastructure challenges are common for businesses throughout South Africa. While in the past businesses have got accustomed to processing their data in batches at central locations, 'the IoT way of doing things is in real time', according to SAP's Paul McKane. Unfortunately, in South Africa the connectivity and capacity to handle real-time data processing remains constrained.

As IoT deployments require reliable, uninterrupted connectivity, businesses are experimenting with fixed-line, mobile and satellite connectivity models. While coverage in urban areas is relatively assured, the country still battles with connectivity and mobile quality problems.

Another perceived risk of IoT implementation in South Africa is linked to the relative immaturity of the IoT technology stack and the fragmentation of standards across the different layers of technology. The technical complexity and the lack of standardisation introduce additional risk in strategic business and investment decisions:

> "THERE IS DEFINITELY HESITATION [...] BECAUSE THERE IS NO CENTRAL [INFRASTRUCTURE] STANDARD. SO I CAN'T INVEST IN SOMETHING BECAUSE IT MIGHT BE THE BETAMAX AND TWO YEARS DOWN THE LINE IT IS NOT THERE AND I HAVE INVESTED. [BUSINESSES] AT THE MOMENT DON'T KNOW WHERE THE BETAMAXES ARE AND WHERE THE VHS'S ARE." – PAUL MCKANE, SAP

In terms of regulation, the South African environment also presents a number of challenges to IoT implementations. Signed on 26 November 2013, the Protection of Personal Information Act (POPI) seeks to regulate the processing of personal information in the country. POPI is expected to influence IoT deployments by mandating that information is collected for a specific purpose only; that only the minimum information required is stored; and that information is held for only as long as necessary. Companies are expected to ensure security and be able to provide access to personal information.

Another regulatory challenge to IoT deployments in South Africa is the Civil Aviation Authority's regulations on drone use[17], which came into effect on 1 July 2015. The licensing regulations have been viewed by stakeholders in the drone industry as prohibitive and unhelpful in growing the industry. In order to be able to fly even micro-drones, operators would be subject to procedures for registration, inspection and certification similar to those applied to aircraft operators. As a new, developing and insufficiently understood industry, the drone industry could benefit from a more exploratory regulation approach which is capable of supporting its growth to maturity.

[17] http://www.caa.co.za/Media%20Statements/2015/Speech%20by%20the%20Director%20of%20Civil%20Aviation%20regarding%20RPAS%20Regulations.pdf

CONCLUSION

We find that IoT offers efficiency value, in terms of operational improvements, in relatively self-contained settings. The business ecosystems involve few partners, largely within the same industry, and IoT offers them an opportunity to monitor production processes more closely. The business case for such implementations is well-justifiable in terms of cost-cutting and has been made previously for technology antecedents of IoT such as RFID. Among the industries in South Africa, we identified mining, agriculture, converged real estate, manufacturing and logistics as offering opportunities to use IoT to unlock efficiency value.

IoT offers smart value, in terms of enabling new products and experiences, in consumer-oriented industries. The settings tend to be more open and challenging to the reliability of IoT implementations. The business case for such propositions is more innovative and difficult to make, often based on analytic insights. Such business use of IoT often necessitates partnerships within the business ecosystem but outside the specific industry. In South Africa, we suggest that the retail, healthcare and insurance industries are in a position to pursue such 'smart' value.

Considering the complexity involved in successful IoT implementations, we were surprised to find little evidence of extensive technologies or business partnerships within the South African IoT space. The companies interviewed were often inclined to cite partnerships with overseas stakeholders, rather than local initiatives, as examples of their work.

Customer-oriented services stand to be transformed by the use of data and analytics in the development of new products, services and consumer experiences. In some sectors, such as retail and public transport, customer experiences are becoming a differential factor. Innovative 'smart' value is beginning to be captured by heavily data-driven sectors such as life insurance.

We identified innovations occurring in more complex ecosystems, with increasing openness, as disruptive. Developments in and the impact of IoT in new sectors such as connected living and smart cities remain hard to define. Capturing such disruptive value can be a challenge, especially due to the number of government, public sector and commercial partners involved in generating the value.

The increasing openness of the South African electricity grid and its specific challenges of balancing, in real-time, electricity supply and demand at the critical grid frequency of 50 Hz, make it the most prominent example of disruptive IoT innovation in South Africa.

SPECIAL THANKS TO

In order to examine how IoT business ecosystems and the opportunities they bring relate to the South African context, we conducted 11 interviews with suppliers of IoT technologies. We sampled companies from the different technology layers and approached executives via LinkedIn and snowballing techniques, where interviewees referred the researcher to their contacts. (See Figure 5 for a list of participants.) The interviews were carried out between 24 June and 20 August 2015.

FIGURE 5

	INTERVIEWS	REPRESENTATIVE	POSITION
Edge devices	MiX Telematics	Werner du Plessis	Global business development manager
	TerraCam	Rolf Schlub	Founder and director
Middle layer	SAP (mining)	Georg Gradl	Director: SAP for Mining and Metals
	SAP (retail)	Paul McKane	Industry principal: Consumer Industries
	CSIR	Louis Coetzee	Research Group Leader: Internet of Things Research Group, CSIR Meraka
	IBM	Ben Mann	Program director of Africa software offerings
	Dimension Data	Bruce Taylor	Chief solutions and marketing officer
Connectivity	FastNet	Prashil Gareeb	Head: Swiftnet Products Portfolio Management
	Sentech	Yokow Quansah	Head: Innovation & Solutions
	MTN	Yusuf Kaka	Senior manager: service delivery – ICT services
	Ericsson	Shiletsi Makhofane	Ericsson sub-Saharan Africa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connected.

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