

Big data and smart technology; change, choice and cities

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ABSTRACT

Rapid growth in Smart Technology and the ability to capture Big Data is rapidly changing the approach to urban development and the expectation of the ever expanding urban population. Its intelligent application leads to fact-based management, which enables insight and opportunity to make decisions and lasting changes in ways that weren't considered possible a few years ago. You could say that education, experience and good judgement are fast giving way to this new electronic fabric. Optimising resources is particularly relevant for cities because of its impact on 'liveability', connectedness and resilience. There is no doubt that urban society development will incrementally, or possibly at speed, integrate services like energy supply, water, transport – the list goes on – improving services and delivering cost efficiencies. As the benefits of harnessing these technologies are realised, by both the public and private sector, organisations are struggling to determine what opportunities exist, let alone what they might benefit from. Will this rate of change continue to escalate? How should we respond? Or should we leave it to our children?

Introduction

Many organisations are in the process of considering how to respond to a landscape upon which Technology and Big Data are becoming disruptive industry norms. We are also in an environment of fiscal constraint and increasing levels of customer expectation. Real-time data, via integrated systems, has the ability to deliver market-leading solutions to age-old business challenges. Fact-based management will lead to operational efficiencies, improved maintenance routines, quality asset management practices and improved access to data to feed the ever-increasing appetite of customers for real-time information. The banking industry has highlighted this pace of change, adapting to the expectation of customers to access the majority of services through mobile phones.

Current trends

We have all seen the rapid technological change brought on by the introduction of the Smartphone. In 2014 sales of the Smartphone topped 1.2 billion which was up 28% from 2013. Putting this into context, over the last 3 years Smartphones sales would provide nearly every 15 to 44 year old on the planet with their own smartphone.

This rise in popularity has provided for an explosion in technology-related innovation, with the effect being a disruptive influence on many industries. We all know about the demise of Kodak, brought on in part by the uptake of smartphone built-in-cameras. We have seen vast changes in the way we now receive information, be that “pushed” or “pulled” to your smartphone. Social media updates, local and international news releases, all provided in real time with news agencies adapting to this rapidly changing environment.



UBER launched in May 2014 with the innovative business model of a taxi company not owning any vehicles, but instead using a smartphone app to provide quick access to mobility. This has led more traditional taxi companies to consider what they need to do to embrace this technology-lead transformation. Whilst attending the International driverless vehicle conference in Adelaide in November 2015 it was noted that a number of representatives of taxi organisations were attending and considering their future.

There are a number of discussions to be had about what the future will bring in the transport space with the introduction of driverless vehicles. Will this have a significant effect on public transport with the introduction of a range of automated vehicles with differing capacity available for public use? Will we be utilising “Mobility as a Service” combining the benefits of our current public transport system and driverless “taxis”?

What we do know is that we, your customers, our customers, are expecting more. We want access to real time information at our fingertips. We want flexibility, diversity, and connectedness all with a view to improve our liveability. To achieve this, what does the world’s most liveable city need to provide, and what level of resilience do we need to build in?

Driverless Vehicles

Volvo have announced that they will be trialling 100 autonomous vehicles on the roads in Sweden in 2017, with Tesla, Audi, BMW, Mercedes and others stating that they will be selling driverless vehicles by 2020. This means that we can offer mobility to those who otherwise do not have it, and eliminate bad driving from our roads in less than 5 years.



Deaths and injuries caused by vehicle accidents are expected to virtually disappear, these accounting for the majority of insurance claims. The NZ Ministry of Transport reports that the social cost of motor vehicle injury crashes in 2014 is almost \$3.14 bn, with 259 fatalities. These could become a thing of the past as driverless vehicles brake automatically, manoeuvre to avoid pedestrians or cyclists, and park themselves. Will this technology have the same disruptive effect as the introduction of the Smartphone; will we embrace this change even with the potentially very positive outcomes?

It is being suggested that the car ownership model would change because of driverless vehicles. Why own a car, which is parked for the majority of the day, when you can utilise an efficient autonomous public transport network. Call an autonomous taxi, or higher capacity vehicle as required. This could be similar to an automated UBER type model, but noting that without the cost of a driver and 24/7 operations, it would be significantly cheaper.

A recently commissioned report by the OECD on *Urban Mobility System Upgrade - How shared self-driving cars could change city traffic* found:

Nearly the same mobility can be delivered with 10% of the cars

“TaxiBots combined with high-capacity public transport could remove 9 out of every 10 cars in a mid-sized European city. Even in the scenario that least reduces the number of cars (AutoVots without high-capacity public transport), nearly eight out of ten cars could be removed.”

Self-driving vehicles could change public transport as we currently know it

“For small and medium-sized cities it is conceivable that a shared fleet of self-driving vehicles could completely obviate the need for traditional public transport.”

Impacts on congestion depend on system configuration

A TaxiBot system in combination with high-capacity public transport uses 65% fewer vehicles during peak hours. An AutoVots system without public transport would still remove 23% of the cars used today at peak hours.

Let us think of the impact of these statements.

We are all aware that if we can get more people to use public transport it would provide significant improvements on congestion. With the use of automated vehicles, the research is suggesting that we would have fewer vehicles in the fleet. The number of journeys would remain the same, but we would be more efficient in our use of transport modes, the dream of every transport agency.

The effect of this change will however have significant impacts on our city planning, automotive related industries, healthcare, insurance, tax collection, and the list goes on. Focusing on city planning:

- Following the example of car ownership becoming a shared model, this would mean that residential properties would not require garages/driveways. Freeing up land for higher density urban living.
- No on-street parking requirements would enable current roads to be reconfigured to include greater, or safer, cycling routes.
- Commuter parking requirements would significantly reduce, allowing for current multi-storey car parking or shopping centre parking to be repurposed.
- With a move to battery power, land will be freed up from redundant petrol stations. With charging stations being situated out of town, or by utilising charger roads as current under trial in the UK.

All these things allow city planners to consider the fabric of our cities in the technology age, and how we can improve our cities making them more liveable now and for our grandchildren.

We should also not forget the impact this technology will have on other industries.

- The use of battery power, with less demand for petrol will have an effect on the oil industry.
- With a significant reduction in traffic accidents, this will place fewer burdens on our emergency services, and the car repair industry.
- With less road fatalities, how does this affect our organ donor system?

With any change, there is also opportunity. New industries will flourish, an enlarged battery industry, big data mining, sorting and new forms of providing real time information to citizens, operators and maintainers.

Big Data

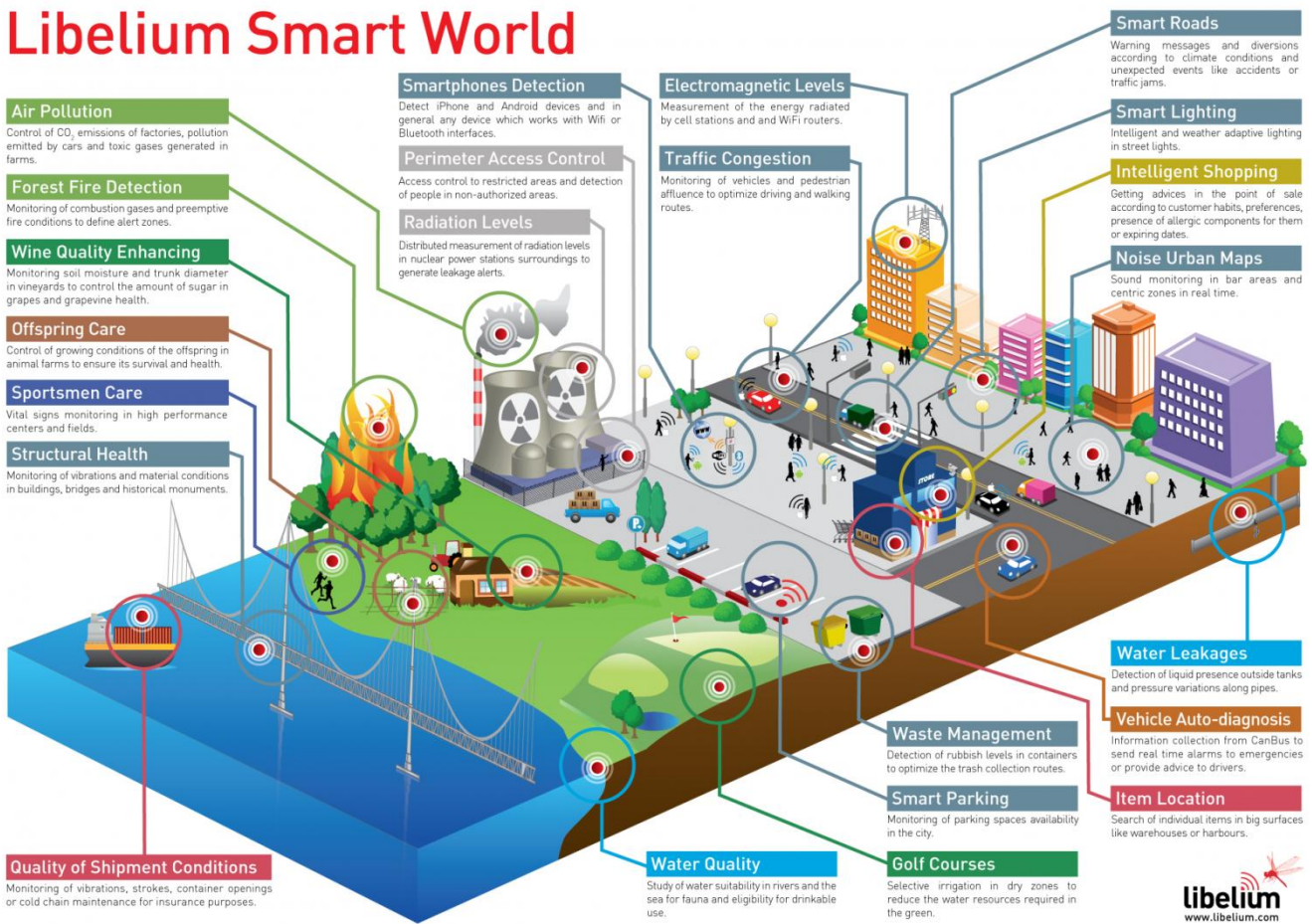
Land Rover are currently working on technology to detect, predict and share data on potholes. With connected vehicle technology, this can be shared with other road users, but using Vehicle to Infrastructure connectivity, this could be shared with road operators and maintainers. Using the fleet of vehicles that use our infrastructure every day, transport issues such as potholes, road rutting, skid resistance, broken drains, traffic speed, etc. can be captured by road operators. Similarly, preferred journey routes due to diversions, sporting events, hazards, maintenance works etc. can be communicated to vehicles, providing more predictable journey times and reduced traffic congestion.

Utilising a vehicle as a sensor, can provide for a far greater depth of network knowledge and as such better decisions can be made, in real time. Real time analysis of end-to-end journeys, allowing changes to be made in public transport routes to meet changing demands of a dynamic population. The data will also allow for better analysis of the state of our current transport network, and based around some key performance metrics direct maintenance spend accordingly.

This use of big data mining will extend into other key infrastructure requirements such as power, water, and public safety. Smart water meters are already showing their worth with significant water reductions being achieved just through customers being aware of their water use. Real time monitoring also allows households to identify that water flowing in the middle of the night may suggest a water leak on their property. Water providers and asset owners are also able to get a number of benefits from sensors on the network, reduced water consumption allows for delayed infrastructure upgrade spend. Detection of leaks on the network, and linking this to asset management information, can allow predictive maintenance regimes to be implemented across our

3 water networks. Real time sensing used with predictive tools such as future weather conditions can ensure the readiness of the network for an extreme weather event.

Libelium Smart World



Our power network can utilise similar sensing technology to obtain a predictive maintenance regime, and “smarter” operations. However, with improvements in battery technology and utilising solar panels, could our homes be running off solar energy stored in home battery packs? The residential power distribution network would therefore change significantly providing local power distribution for peak loads, instead of distributing power, as we currently know it.

Utilising the internet of things, Milton Keynes in the UK are currently trialling smart bins that send a message to rubbish collectors when they are full and ready for collection. Daily collection routes can then be optimised to provide for a more efficient collection process. Similarly we are seeing parking sensors appearing providing us feedback on which spaces are free. Extending this philosophy there are a myriad of opportunities to rethink the way we are currently operating and maintaining our cities by utilising the internet of things.

How do we respond?

We live in exponential times. The fast moving pace of technology will mean that as individuals we can never be *fully* informed. We must expect change in our home and work lives at a rate never experience before. This requires us to think differently, act differently, and ensure we consider change when solving today’s problems. By our actions, if we can set the right guidelines and policy to enable innovation and entrepreneurship to flourish we will allow our cities to prosper.

Taking the example of rubbish collection. If the tender stipulates we want the bins collected once a week then we are defining a solution. However, if we tendered the problem, we want our cities to be free from litter, and our rubbish bins should never overflow, then we have encouraged innovation and new ways of thinking.

We should also recognise that we will still get things wrong, and we have all learnt by our many experiences and mistakes. The fast pace of change will however allow us to fail faster, which means we can be more agile, and hence find success faster.

If we do not embrace these exponential times and utilise the benefits technology brings then I believe we will be a poorer country because of it. As an example if we embrace driverless vehicles, and as such remove drivers' error from our roads, we will be reducing road fatalities and injuries and bring the \$3.1bn cost of these accidents back to NZ pockets.

We continue to fund the improvement of the transport customer experience be that in cycle ways, public transport, more roads, or by the use of technology to either overtly or covertly reduce congestion. This is enabling progress and the development of cities, which will enable a Smarter sensing city and one which entrepreneurs and councils can optimise the cities assets and ensuring a positive impact on 'liveability', connectedness and resilience.

Should we leave it to our children?

If you are more comfortable allowing others to embrace these exponential times then do so. However, my advise would be don't be afraid to get involved, try something new, innovate, fail, learn, embrace the future, use the internet of things to its full potential, and most of all have fun in doing it.

Some thoughts for the future

Market forces will force change, and allow for innovation. Smartphones over a 5-year period have disrupted many industries. With driverless vehicles, and cognitive computing I am sure these technologies will have the same disruptive influence on many areas of our lives and industries. Within our individual sphere of control, have we created flexibility that can encourage innovation?

Driverless vehicles are being designed to suit our current road network because car manufacturers know that governments cannot move quickly enough to implement new technology to enable driverless vehicles. However, governments and transport agencies can implement technology to take great advantage of the new vehicle technologies. With the speed of technology change, do we need to reconsider how we evaluate *value* from our transport investments?

If the predictions are true and we will only need 10% of the current vehicle fleet to deliver the same transport mobility demands, are we funding the right projects?

Should we be more "disruptive" in our thinking? If we want to increase the use of public transport shall we provide; Free public transport for all? T3 lanes on all urban state highways? Redevelop all council car parks into residential blocks?