Position paper

smart city economics

a multi-sided approach to financing the smart city

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Atos

From idea to reality

The human race is becoming increasingly urbanised so we have a strong interest in making our cities safe, clean, prosperous and exciting places to live in.

That's the driving idea behind Smart City initiatives, which are designed to address many of the long-term issues associated with city life, while mobilising a wider range of forces to develop better, more sustainable services. Smart Cities are communities that are able to use all the possibilities of technology and community organisation to improve quality of life now and into the future.

Building successful Smart City initiatives requires collaboration between engaged individuals, city governments and a growing range of private commercial organisations. Yet there is a practical difficulty in all of this – finding a way to pay for Smart Cities - not an easy subject at a time when there is enormous pressure on public finances in countries all over the world. Most city and national governments are unable fund new initiatives of this kind from taxpayer income alone, and that leads them to seek partnerships and alliances with commercial bodies and technology specialists to design and deliver new services and new options. This is where problems start to arise.

Technology companies are interested in partnering with city governments for their own reasons. They want to test their ideas, gain proofs of concept, access useful development data and other research requirements for building their own businesses. The organisations that set them up do not necessarily have the same agendas as the cities, themselves, so pilot schemes may not be precisely what the partner city government wants. This approach can also lead to pilots being abandoned after a time because the external partner has achieved its own objectives, leaving cities and their citizens with unfinished projects and without sustainable outcomes.

So here is the issue that everyone involved in Smart City thinking, planning and execution needs to deal with: how can we find a better way of funding innovative projects that does not rely on tax revenue and does not depend on the whims of external partners. Is there an approach that has the potential to deliver a win-win for all concerned? Atos thinks there is.

The multi-sided market

We need to build a collaborative approach to Smart Cities that meets the essential criteria for developing and launching successful, sustainable innovation projects. We believe there are four factors that must be combined to create an effective multi-sided market, working in the best interests of all concerned:

Public interest. Each initiative must be demonstrably beneficial to the city and its people. There should be no compromise on goals, methods and outcomes, with measurable results that deliver clear improvements in at least one of the 8 key Smart City focus areas (health, education, safety, connectivity, sustainability, transportation, governance and economic opportunities).

Public engagement. The most successful initiatives are those in which ordinary citizens both participate and feel a measure of ownership. Social media is playing an increasing role in developing communities of interest, often on a global basis, able to contribute ideas and experiences that can lead to new kinds of services. A growing range of new apps makes it simpler for people to play an active part in improving everyday life, and this creates a snowball effect in which others are encouraged to get involved.

Business viability. Where strong support from commercial organisations is needed (and this is more or less everywhere) there must be real opportunities for profitable business and a reasonable return on investment. To avoid short-termism or investment in the wrong sort of activities, it is essential for each initiative to represent good business for corporate partners.

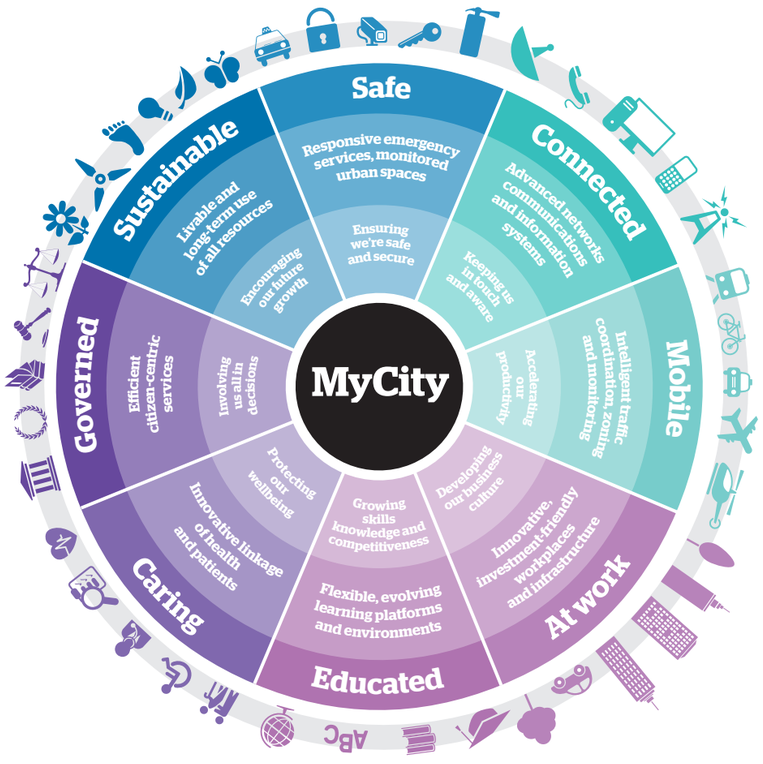
Market opportunities. One of the most important aspects of the multi-sided approach is that it creates a marketplace in which smaller players can engage and build their own businesses. This is where Smart City initiatives really start to evolve and take off: when innovative smaller companies see new opportunities for services and projects and start to expand and enrich existing initiatives.

When these four factors are in place we have an environment in which every participant, from ordinary citizens to major corporations, can engage in joint projects, targeting their own specific goals. Then funding options start to open up and momentum builds.

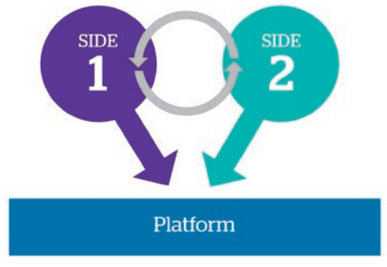
One final point: we all understand that many basic services are being contracted out to external bodies in cities all over the world. In most cases these have been done on a classic outsourcing basis, delivering much the same service as before but at lower risk and cost, while improving the city's own balance sheet by reducing capital liabilities.

The multi-sided market concept enables us to look at these external partnerships in a different way. From now on, the focus will be on innovation: how to work with commercial organisations to find better ways of structuring and delivering services. This holds the promise of harnessing technology to unlock new and higher quality service options, not simply reduce the cost of business as usual. This is one of the most important potential benefits to outcome of Smart City initiatives, funded by multi-sided market practices.

8 key Smart City focus areas



Multi-sided market practices



Data: a currency for cities

To build a multi-sided market every player needs to have something to trade, and city governments have an asset of enormous power and value: data. This is the key to all Smart City initiatives and is a natural by-product of delivering normal services in an increasingly connected environment.

To create smarter services we need to contribute, to be connected and to agree to share data, because this is the key to the feedback loops that enable rapid learning and iterative service improvements. But sharing data means that cities have to digitally transform. On-line services are available in most cities, but often only through select and limited channels. Ordinary citizens, however, are more and more connected and use parallel channels to communicate, and they expect (even demand) that cities to be open to this.

Cities have a significant amount of untapped data that, if made available for development under controlled conditions, could enable a wide range of service improvements. This might include data arising from outsourced services (such as garbage collection) right through to traffic data from sensors on traffic lights, which could be used to reduce hold-ups and improve air quality. Data is exactly what potential commercial partners need, as this helps them to refine and target their services, making these more attractive and therefore more profitable.

Data is also a very sensitive topic. Citizens are concerned about their privacy and do not want anyone to use confidential information without permission. Yet most of us have become used to trading our data for improved service options. We agree to collection and onward use of data through sensors in our smart meters and set top boxes, mobile devices, cars and household appliances. The lesson is that we, as individuals, will agree to data usage as long as legal and ethical requirements are observed and we can see real benefits.

City governments gather data in enormous quantities and they have the ability to trade this data for service and commercial benefits, just as individuals do. City governments do not have to compromise on ownership or break privacy rules, but opening up and allowing usage of this data will create new funding opportunities that could make all the difference to Smart City initiatives.

Real-world examples

These are early days so, although there are hundreds of Smart City initiatives being undertaken around the world right now, true multi-sided market initiatives are in their infancy. Yet there are examples, being executed in some of Europe's largest and most prosperous cities right now, that demonstrate the full potential in a real-world setting.

Energy and costs. This project began with a city government seeking to achieve a significant reduction in its energy bills. To do that, the best available option was to replace the existing conventional street lighting with new generation LED technology, which requires only 30% of the energy now being spent on lighting the city. Unfortunately, the city had no way of paying for such an ambitious project from its own current income, so it approached a leading technology company, headquartered in the city, and proposed a joint venture approach.

The result has evolved to become a true multi-sided solution, in which the new LED lighting also includes sensors that can be used to measure traffic flows at specific points in the city in real time. This data is then monetised in a variety of ways.

- The company providing the new lighting is able to sell sensor detail to manufacturers for use in navigation systems
- Automotive companies purchasing this data gain an extra differentiator and their products attract a price premium
- Drivers now lose less time in jams, as they are automatically routed around them, and are guided directly to available parking spaces
- The city, having upgraded its lighting and gained a permanent reduction in energy costs, also gains revenue from better utilisation of parking spaces and reduction in air pollution as cars don't need driving around to find a parking place
- More visitors are attracted to the city, which benefits many of the companies trading there.

This is a classic example of innovation driving benefits for all concerned.

Revitalising the city centre. Many cities are concerned about how to reverse the general trend towards city centres becoming less attractive to visitors and less profitable to traders, due to concerns about safety and a general reduction in prosperity as a result of the post 2008 recession.

The CityPulse initiative uses data from different sources such as cameras, 3D sound detection systems and social media. The cameras count the number of people passing specific points going in and out a designated area, calculating the length of time people stay in this area, the 3D sound system measures not only the sound level and how this changes but also identifies alterations in the sound spectrum: when people start shouting for instance. Combinations of data from this variety of sources will enable data to be analysed to identify specific patterns of behaviour and indicate anomalies, including incidents of violence.

When activity that can be seen as not normal is identified the city authorities can respond in a graded way. This can begin with changes to the intensity and colour of street lighting, move onto traffic diversions and go all the way up to deployment of emergency response personnel exactly where and when it's needed. In this way it is possible to manage the city and reduce the potential for incidents and deal with them fast and efficiently, making better use of limited resources and reducing problems for citizens

This approach contributes to public safety and makes the city a more attractive place to live. In turn, this leads to improved business prospects for traders in the city centre and encourages more people to spend time there.

Connected public transport. Efficient public transport is a basic and essential requirement for a successful city. Passengers in their many thousands spend time on trains and buses every day- sometimes a lot of time, depending on the levels of congestion and the distances being travelled. If this time is effectively wasted then the people concerned will be frustrated and the city will cease to be as attractive to businesses, their employees and ordinary citizens as it could be.

By providing a reliable, high quality wi-fi "Connected Transport Platform" to passengers throughout their journeys it is possible to improve quality of life, make more efficient use of time and attract new citizens and businesses to the city. Building a connected transport platform requires input from multiple providers, including train and bus manufacturers, infrastructure networks, communication operators and broadband providers. They all need to benefit from their investment.

Future Potential

New ideas are emerging all the time. For example:

Studies are now being carried out in more than one city to monitor passenger use of public transport and share this data, enabling transport services to be much more accurately and sensitively delivered. Services can become more flexible to reflect real usage patterns. Unsuccessful services can be identified fast and new, more appropriate services created or adapted to meet real needs. Measurement can also be carried out not simply by conventional SLA but also according to customer satisfaction, enabling providers to be selected for how well they perform in customer interaction and not just on cost.

Building on existing projects that use street lights and traffic indicators as the basis for new services, cities are now looking at how to connect these same smart systems to digital signage, as well. This approach can be used in communicating essential information and advertising, thereby opening up another new set of commercial opportunities, including vital revenue for the city.

Data is the key to this entire virtuous circle. Data enables more and more ingenious and innovative services, which make emerging Smart City initiatives become reality, offering commercial opportunities to a growing range of companies and improved services for citizens.

- Train and bus operators will gain revenue because passengers will be likely to select connected services rather than conventional travel options
- Service providers will gain additional traffic to their sites, increasing sales and other revenue sources
- The platform host (which could be the city government or partner) will gain revenue by charging for access to the platform
- Passengers will gain free broadband access in return for agreeing to the use of some of the data they provide:
  - This data can be sold under strictly controlled conditions to drive additional revenue growth
  - It is also provides a basis for development of new services provided by 3rd parties to traveller, like use of office desks at railway or bus stations in the event of delays.

This approach is a classic multi-party market win-win-win, with all concerned gaining new opportunities, higher quality services and additional revenue. Maintaining the connected transport platform has associated costs, but as long as the revenue received exceeds the costs of the platform, everybody taking part will profit.

New disciplines in data management

Growing connectivity is rapidly increasing the potential for development of new services, together with improvements to those that already exist. We can see these processes in action across many industrial sectors, with continuous feedback enabling manufacturers to understand how their products operate in reality, identify areas for potential improvement and speed development of product enhancements. From now on, it is essential that city governments should also find ways to gather, analyse and make positive, beneficial use of the data that are gathered every minute of every day through the systems already installed across most cities.

Machine learning. In the future we expect to see sensors not only measuring and providing factual information but also being enhanced to directly detect and report anomalies. This means sensor to cloud-secured connectivity is an important success factor, as we must be able to trust the information fed back by sensors, based on the algorithms we define. Updating and renewing the algorithms takes place by using machine-learning technologies, which makes it necessary to capture raw data from the sensors. This raw data does not need to be kept 'alive' for a long time, however, enabling us to reduce the size and slow the growth of the data lakes that are part of the enabling city data platform.

Managing privacy. Ensuring that privacy is observed and public confidence maintained is essential. Here, use of surveillance cameras is a case in point. When first introduced there was public disquiet about their use. Today, most misgivings have disappeared and a majority of citizens believes that the crime prevention and detection value of cameras outweighs the potential for invasion of privacy. Growing connectivity and cloud-based systems enable a more sensitive, real-time use of data gathered by cameras. Real-time data analysis will indicate abnormal patterns of behaviour and the potential risk for wellbeing, including possible criminal activity. That will contribute to public safety.

New data capabilities. As data becomes increasingly important in developing new services and enhancing those that exist already, so we see a new job description starting to appear: data scientists tasked with exploring the economy of data. In fact, some cities have already started to send staff back to university to be educated in this new discipline. Innovative services may be based on a new use for existing data sets or could lead to demands for a new data set. Data scientists must help understand what data elements are needed for new services, together with their value and any possible privacy risks. This will become an essential factor in city management for the future.

The power of innovation

Smart Cities are defined more than anything else by their attitude to innovation. You recognise a Smart City, not just by its ability to deliver conventional services well but by the way it fosters creativity from across the entire community. Better use of data enables new services, new business opportunities and will give a major boost to the entire economy. We have already seen how the power of data can have a transformational impact on transport, safety and sustainability, but that is just the beginning.

Creating economic value from data means we have to implement a business model that allows entrepreneurs to make profit, while providing a return to the city and the people who live there as enabler either in hard currency or in intangible results, such as measurable improvement of air quality or direct reduction in cost for operations.

Innovations needed to create this new economy will come from value webs, which take us from simple collaboration to active cooperation. When collaborating, people work together on a single shared goal. When cooperating, people are able to work on individual goals, but perform together to create added value in areas of common interest. Business reinvention for cities as enablers for the economy of data should be focused on supporting the setup of value webs.

A smart city is a city where collaboration and cooperation between universities, research labs, business communities and citizen communities is actively promoted and organised by the city. Value webs can be defined as a business ecosystem of actors exchanging objects of economic value towards a shared goal of profit generation. Once Smart Cities have established and helped to foster the creation of effective value webs, they will become much more attractive to new investors leading to a spin-up of local economic opportunity.

The city - a platform for creativity

As we have made clear throughout this paper, we see the role of Smart Cities in the future to be that of enabler and guide in the application of technology to drive service improvement. In a multi-sided market concept, it is the city that provides the platform for creation of value webs and development of cooperative working between multiple partners. This platform will be based on a number of simple principles:

- The Smart City monitors relationships between the different kinds of commercial participants (large enterprises, local businesses, or merchants, entrepreneurs, citizen bodies...)
- City data is designated as "open" and can be sold or given freely to be used by commercial participants for combination with their own proprietary data for the purpose of service development or improvement
- The city remains responsible for ensuring that laws and regulations are met and that data usage is compliant
- The city does NOT control the end-user relationship.

The Smart City Platform needed to support all this will be based on a number of important functional parts, including:

- Big Data analytics, enabling machine learning technologies to improve detection of patterns in data
- Security and access management is vital to underpin the need for control on privacy and use of data
- Secure connectivity of sensors and devices ensures that we can trust the data and also control access via apps and other means of end-user direct connection
- A scalable API management-system is an important part of this Smart City Platform to ensure all possible legal constraints on privacy can be met
- Continual risk assessment is another key success factor, as quality of services provided based on this Smart City Platform depends on this
- Finally, as services will often include payments, a secure on-line payment service also needs to be part of this Smart City Platform.

Building a multi-sided platform

The Smart Cities concept brings together the physical and virtual worlds, using connected technology (the Internet of Things) to automate key process stages and make service management more efficient. To enable creation and implementation of Smart City initiatives a robust and efficient collaboration platform will be needed, and the European FIWARE initiative is an interesting development in this respect.

FIWARE is an emerging system for creating city collaboration and cooperation platforms of the kind we have identified here.

FIWARE was set up and financed by the European Union but now extends to cover other geographies, bringing together government, academic and commercial bodies to create tools and methods that can be adapted, reused, evolved and owned by potential Smart Cities and their partners.

FIWARE provides an Open Source library of Application Programming Interfaces (APIs) known as "generic and specific enablers", which make it possible for developers to build targeted services on top of an existing connected infrastructure, using real-world events to drive digital applications. FIWARE in particular enables participating developers to make use of open data to create a multiplicity of new concepts and services for use within the Smart City context.

FIWARE brings together best practice technology components, backed by hands-on consultancy from Fiware Labs, providing a toolkit to cities and entrepreneurs that would otherwise be too costly and complex for any of them to build alone. In this way Smart Cities can avoid the need to "reinvent the wheel" and get straight to work with a set of tools that gets all participants to the starting point for their collaboration fast and at low cost.

Though not unique, as there are other collaborative platforms now available, FIWARE offers some specific advantages. In particular its catalogue of Generic Enablers (ready-made components that can be used to speed up development of new applications) help developers to accelerate time to market for potential Smart City services. In addition FIWARE helps to simplify cloud hosting (reducing cost and risk to participants), is extremely secure (building trust among users) and is designed for fast and efficient collaboration.

The existence of collaborative development platforms of this kind proves that moving from concept to practical reality is possible at an affordable level of investment cost and risk. This approach enables sharing of the burden among all participants and delivers and industrial-strength method for fast innovation. The 31 cities already signed-up for the Open and Agile Cities Initiative (OASC) are basing their developments on FIWARE specifications, so there is now critical mass and real momentum behind this concept. In its way, this is a signpost to an increasingly accessible future of multi-sided innovation. By the end of 2015 over 100 cities will have signed to join the OASC.

Towards a smarter future

We need to build a collaborative approach to Smart Cities that meets the essential criteria for developing and launching successful, sustainable innovation projects. We believe there are four factors that must be combined to create an effective multi-sided market, working in the best interests of all concerned:

City governments are painfully aware of the need to improve quality of life for their citizens and businesses in order to compete with other cities in a globalising market. They do not need to be persuaded that the Smart City approach makes sense. The problem lies in paying for what are still sometimes seen as high cost, high risk initiatives.

Atos has no doubt that the only practical way to do this lies in collaboration or cooperative working in a multi-sided market environment. This approach ensures that participants of every kind: local entrepreneurs, small businesses, citizens and citizen groups, large corporations, not for profit bodies, the city government itself, all benefit from each initiative. The aim is to build a shared environment where creativity and innovation can flourish, based on a business model in which everyone contributes and everyone profits.

In this vision, the city has one priceless asset to trade: the massive amounts of increasingly granular data that it gathers from its everyday operations and from delivery of its services. Sensitive, careful use of this data will attract investment, drive economic activity and transform quality of services. This is surely the future of sustainable Smart City initiatives.

"Atos has no doubt that the only practical way to do this lies in collaboration or cooperative working in a multi-sided market environment."

About Atos

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With its deep technology expertise and industry knowledge, the Group works with clients across different business sectors: Defense, Financial Services, Health, Manufacturing, Media & Utilities, Public Sector, Retail, Telecommunications and Transportation.

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