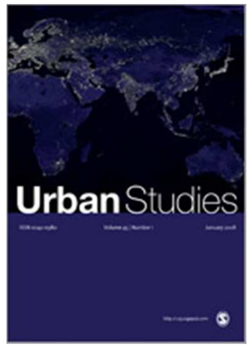

Roadmaps to Utopia: Tales of the Smart City

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Roadmaps to utopia: tales of the smart city

Abstract: Notions of the Smart City are pervasive in urban development discourses. Various frameworks for the development of smart cities, often conceptualized as roadmaps, make a number of implicit claims about how smart city projects proceed but the legitimacy of those claims is unclear. This paper begins to address this gap in knowledge. We explore the development of a smart transport application, MotionMap, in the context of a £16M smart city programme taking place in Milton Keynes, UK. We examine how the idealized smart city narrative was locally inflected, and discuss the differences between the narrative and the processes and outcomes observed in Milton Keynes. The research shows that the vision of data-driven efficiency outlined in the roadmaps is not universally compelling, and that different approaches to the sensing and optimization of urban flows have potential for empowering or disempowering different actors. Roadmaps tend to emphasize the importance of delivering quick practical results. However, the benefits observed in Milton Keynes did not come from quick technical fixes but from a smart city narrative that reinforced existing city branding, mobilizing a growing network of actors towards the development of a smart region. Further research is needed to investigate this and other smart city developments, the significance of different smart city narratives, and how power relationships are reinforced and constructed through them.

Keywords: Governance, Transport, Technology/Smart cities, smart transport

1-Introduction

2008 marked the year when more than 50% of all people lived in urban areas, and the figure is expected to rise to 70% by 2050 (UN, 2014). The rapid growth of urban population is placing increasing pressure on infrastructures as city managers struggle to cope with growing demands for energy, water and transport. Increasing demands cannot be met with a proportional increase in the provision of urban infrastructures, as cities are constrained by physical, environmental and financial limits to growth. Development of so called 'smart cities' has been initiated to address these concerns. By deploying sensing and data management infrastructures, smart cities make vast volumes of urban information available, potentially improving the efficiency of physical infrastructure and enabling sustainable urban development (Hollands, 2008; Aoun, 2013; Kitchin, 2014; Albino et al., 2015). Many self-designated smart cities make business-led urban development central to their brand. As they provide the foundations for data-driven entrepreneurship, smart cities foster a narrative about new products and services that will improve the quality of life in the city while making it more competitive in the global market (Shapiro, 2006; BIS, 2013; Neirotti et al., 2014).

There is growing critical interest in how the smart city concept is grounded in particular places (Shelton et al., 2014; Wiig, 2015). One criticism of the smart city concept is that it is largely advocated by coalitions of experts such as marketing specialists, consultants and city officials who make optimistic but vague claims about its benefits (Greenfield, 2013; Wiig, 2015). Policy and industry actors engage in a collaborative storytelling through the publication of advertising materials, technical prospects, frameworks and policy documents, often conceptualized as roadmaps. This smart city narrative provides direction to the practices of actors concretely building cities through particular projects (Söderström et al, 2014; Bakıcı et al., 2013; Lee et al., 2014). However, tensions may arise during the practical realisation of the smart city because the actors, ideologies and infrastructures of existing cities are not as malleable as those in the generic, ahistoric space of the marketing and policy documents (Shelton et al., 2014; Taylor Buck and While, 2015).

Smart city initiatives may be similar to other high-profile, government-supported initiatives aimed at improving efficiencies in the delivery of public services through increased use of ICTs (Cordella and Tempini, 2015) and market-oriented solutions (Petersen and Houlberg, 2016). However, smart cities are distinctive on account of the imaginaries and roadmaps through which they mobilize and capture the attention of technology developers, academics, urban thinkers and policymakers (Kitchin, 2014; Söderström et al., 2014). Rather than taking the power of the smart city imaginaries for granted, we propose there is a need for further research on the tension between roadmaps and deployments for smart cities, exploring how their capability to address urban problems may relate (or not) to their contribution to a self-reinforcing global imaginary and to the symbolic capital of the locales where such projects are deployed. This paper therefore will explore the tensions arising as the idealized smart city narratives are locally inflected and used to frame smart city projects. The case study follows the development of MotionMap, a smart transport application developed in Milton Keynes (a city located 60 miles north of London) as part of MK:Smart, a broader smart city programme. Academic and policy literatures are reviewed to identify a series of claims which form the basis of the idealized smart city narrative, e.g. about urban problems, the processes through which a city can be made smarter, and the outcomes that can be expected as smartness takes hold. Case study research is presented which shows how these were locally inflected, and tensions between the vision and the enactment of the smart city are revealed and discussed. While the smart transport application did not develop sufficiently to be of practical value in the short term, it nonetheless shaped the long-term transport strategy for the city, reinforced the narrative about a smart, experimental Milton Keynes, and potentially contributed to the development of a smart region. Thus, case of MotionMap suggests that the socio-technical and the symbolic dimensions of the smart city 'roadmap' may develop almost independently of each other.

This research contributes to a developing body of smart city case studies based on 'actually existing smart cities' (e.g., Joss et al., 2016; TSB and Arup, 2013). Of course, further research is needed to assess the degree to which similar tensions may be present in other cities following similar roadmaps. Cases of Glasgow and Peterborough smart city developments may be of particular interest, as the roadmaps they follow are similar to the one discussed in this research (see Taylor Buck and While, 2015). Peterborough would also provide an interesting comparison to MK because of similarities such as the scale of the city, their shared new town status, and the similitude of their transport challenges (Better Transport, 2014).

2- Socio-technical imaginaries and roadmaps to the smart city

Scientific and technological change depends on expectations and visions that play a central role in mobilizing resources (Borup et al., 2006; Berkhout, 2006; Jasanoff, 2015). Various institutions use imaginaries to elevate some imagined futures above others, according them a dominant position for policy purposes and drawing attention away from alternatives (Van Hulst, 2012; Jasanoff, 2015). In this way, the smart city narrative is somewhat predominant in contemporary urban development discourses (Greenfield, 2013; Söderström et al., 2014). Indeed, future city narratives are almost completely dominated by a single story centred on the deployment of networked informatics, with somewhat hyperbolic narratives about the future of urban life framing the smart city as a rational, depoliticized and even unavoidable passage, inherently transformational and socially beneficial (Vanolo, 2014; Söderström et al., 2014; Shelton et al., 2014; Luque-Ayala and Marvin, 2015).

While imaginaries describe imagined futures, roadmaps provide a mechanism for comparing the future vision with the current state of affairs and strategic options to bridge the gap (Carvalho et al., 2013; Phaal et al., 2004). There is not a unique methodology for developing such roadmaps. However, what various formal and informal approaches have in common is use of a time-based structured framework to develop, represent and communicate strategic plans, in terms of the coevolution and development of technology, products and markets. Such roadmaps frequently have a multi-organizational scope, as they seek to capture the environmental landscape, threats and opportunities for various groups of stakeholders in a technology or application area (Phaal et al., 2004).

Here, we critically review the smart city roadmap, extracting a normative position from the roadmaps themselves, then playing on the differential between the official and the unofficial so we can explore how the resulting order conforms to the values it assigns itself in principle (Boltanski, 2011: p11). The following section will describe the approach used for identifying salient claims in the imaginaries and roadmaps to the smart city in general, and for following their implementation in one concrete case study.

3- Method

Data collection and analysis proceeded in two stages. The first one drew on documentary analysis to identify salient claims implied by the smart city roadmaps. The second stage drew on multiple primary and secondary sources to follow a concrete case study, as seen through the lens of the roadmap claims.

The documentary analysis performed in the first stage of this research drew on secondary data from a series of frameworks and guidance documents for the development of smart cities issued by public and private bodies: Arup, 2011; Cisco, 2012; EC, 2013; Epic, 2013; BIS, 2013; BSI, 2014; European Parliament, 2014; Frost and Sullivan, 2015; ITU, 2015. Data were analysed using a coding and clustering method to identify major themes in the corpus (cf. Miles and Huberman, 1994; Braun and Clarke, 2006), leading to the identification of five claims about the smart city outlined in the Analysis section.

A second stage of analysis explored how the various claims implicit in the roadmaps were enacted (or not) through the development of MK:Smart and the MotionMap project. We built a case study to explore the smart city project in its context, drawing on data from primary and secondary sources which were also collated and analysed qualitatively following a clustering and coding method. A template based on the salient claims identified in the roadmaps was applied to primary data collected during a series of MK:Smart citizen engagement workshops and to secondary data produced by members of the coalition responsible for the smart city programme in Milton Keynes. The coded segments were clustered and themes sought to assess the degree to which the developments taking place on the ground reflected the roadmaps.

Participants in the citizen engagement workshops came from a variety of backgrounds and were selected through a purposive sampling strategy targeting potential lead users (Von Hippel, 1986; Hienerth et al., 2007). Thus, we did not seek a representative sample of the MK population, engaging instead with participants with strong needs, direct experiences of the transport problems being addressed, and hopefully a higher interest in adopting and championing MotionMap.

Four of the workshops were open to the general public but targeted citizen groups interested in specific transport issues, who were contacted through community coordinators (Community Action MK); the remaining two workshops were closed and the participation of specific project partners was sought (MK:Smart partners and prospective entrepreneurs interested in developing data-driven business models). Community Action MK has extensive links to the voluntary and community sectors, which allowed us to recruit participants from transport-related interest groups (e.g., the MK bus users group, the cyclists touring group). Given the low levels of bus use, walking and cycling by commuters in MK (4%, 7% and 3%), this was necessary so we could reach the populations of interest.

12-40 participants attended each workshop and were separated into smaller groups to facilitate discussion. Workshop guides were developed and used to stimulate group discussions. Data were collected via notes taken by facilitators working with each group, from feedback forms provided to participants, and from incidental outputs of the group exercises (for example, sticky notes and flipboard sheets with notes from brainstorming sessions). Digital ethnographies (Pink et al., 2015) of transport user forums centred on discussions of similar 'smart' transport applications were performed to verify that attitudes and concerns observed at the workshops were consistent with those of transport users elsewhere.

Secondary data produced by project partners and other insider sources provided insights on the official narrative about the development of the smart city in Milton Keynes. Sources included a smart city perspective study by MK Council (MKC, 2012a); a feasibility study assessing MK's potential participation in the future cities demonstrator programme (TSB, 2013); a comparative analysis of the feasibility studies performed by a transnational consultancy firm (TSB & ARUP, 2013); a long-term vision for the city (MKFC2050, 2016) and articles produced by researchers working in MK:Smart (d'Aquin et al., 2014; d'Aquin et al., 2015; Potter et al., 2015; Wolff et al., 2015a; Wolff et al., 2015b; Montaner et al., 2015; Gooch et al., 2015; Okada et al., 2015; Gaved and Peasgood, 2015; Williamson, 2015; Valdez et al., 2015; Caird et al., 2016).

4 - Analysis

4.1 – Roadmaps to the smart city

There is not a unique roadmap to the smart city. Rather, there are many smart city frameworks and guidance documents built around common themes, issued by both public and private bodies. Collectively the roadmaps exhibit some distinctly modernist features (Greenfield, 2013; Söderström et al., 2014). Metrics are established, resources are marshalled, and progress is assessed as the smart city project progresses through predefined stages. Urban questions are essentially framed as engineering problems to be analysed and resolved using empirical, preferably quantitative methods (Bell, 2011). A core claim shared by the various versions of the roadmap is that by making vast amounts of urban information available in real time, city leaders can improve the efficiency of public service delivery, the sustainability of the urban environment, and the quality of life of citizens (Cisco, 2012; BIS, 2013).

Given the scale of the investment required and the complexity of the networks involved, it is extremely difficult for any one organisation to harness the resources and single-handedly co-ordinate a smart city project. Thus, smart cities are generally initiated by city authorities and supported by coalitions of actors from industry, local government and academia (BIS, 2013; Osborne-Clarke, 2015). Delivery of the smart city vision calls for real-time city management by local authorities, knowledge creation by technical and academic partners, and economic development by business actors (Wolfram, 2012; Deakin, 2015).

The deployment of sensing and data management infrastructures is central to the smart city roadmap. Smart cities draw data from a wide range of sources and systems, collected through pervasive and ubiquitous computing and digitally instrumented devices built into the fabric of urban environments. In addition to the pervasive sensing network, big data infrastructures are needed for storing and analysing the generated information, which is eventually offered to third parties through standardized interfaces in an open data fashion. This infrastructure is expected to provide historical datasets as well as real-time access to urban data (Kitchin, 2014; BIS, 2013; Vilajosana et al., 2013).

The deployment of the initial set of applications demonstrating the capabilities of the new data infrastructures (e.g. city dashboards, real-time transport information systems, energy monitors) marks one of the major milestones in the smart city roadmap. Such applications may offer benefits such as improved building management, more efficient traffic flow, water or waste management, policing, and “clever ways to provision basic services” managed and consumed to reflect changing patterns of need and demand (Cisco, 2013: p4). Applications deployed at this stage are expected to serve a dual strategic role: they should be useful in the sense that they must deliver benefits and make urban living smarter, but they should also offer clear returns on investment, obtaining quick results with minimal expenditure to enhance the confidence of stakeholders (Vilajosana et al., 2013; BSI, 2014; Huawei, 2014). Once the benefits of new infrastructures are demonstrated, it is anticipated that smart city projects will develop momentum, attract further investment and initiate a self-sustaining process of co-creation (BSI, 2014; Vilajosana et al., 2013).

Because city authorities and planners may not always be able to predict which smart urban services are needed, the beneficial economic and societal outcomes of smart city programmes are expected to emerge through a mix of formal planning, market forces and citizen involvement (PAS, 2014; Osborne-Clarke, 2015). The role of citizens as prosumers (producer/consumers) of city services, as entrepreneurs, and as skilled employees of smart businesses is emphasised in the later stages of the roadmaps (Greenfield, 2013; Vilajosana et al., 2013; Hollands, 2015). Citizen participation is somewhat limited in the initial stages: The foundations to the smart city are developed by industry, government and academia. Citizens are relatively passive and consulted on their vision of “what good looks like” for the city (Cisco, 2012: pp 9,10; BSI, 2014: p 6). Keywords such as “bottom-up” and “open innovation” become more prominent once data infrastructures, open platforms and spaces for collaborative innovation become available (ibid). As smart citizens contribute to the co-creation of smart solutions, they are expected to act as “smart entrepreneurs” or “civic hackers” (Townsend, 2013), developing skills that will allow them to contribute to the digital economy and increasing the competitiveness of their city (Vanolo, 2014; Williamson, 2015).

In summary, the smart city narrative provides an idealized account of a process in which urban problems are identified, actor coalitions are formed, and sensing and data management infrastructures are deployed, initiating a virtuous cycle through which citizens and businesses become smarter and create new products and services so their cities can become more efficient and competitive. The success of projects built according to this roadmap may depend on the veracity of the following claims:

1. Smart city processes are initiated by champions in city management, industry and academia, with the expectation that a wider network will develop over time. Once a smart city project is set in motion it will receive support from an expanding range of city actors including citizens, community groups, entrepreneurs and civic hackers, because efficient management of city resources will lead to economic, social and environmental gains (BIS, 2013; Osborne-Clarke, 2015).
2. The smart city can enable an increasingly efficient use of city resources through the provision of real time information on urban flows, which is used to

coordinate collective action. Such information is made readily available through the deployment of infrastructures for sensing, collecting and analysing large volumes of data (Cisco, 2012; BIS, 2013).

3. Deployment of the full potential of smart city solutions requires long term funding and commitment from many actors. This commitment is achieved by identifying strategic opportunities and pressing problems that are specific to the city and delivering attractive benefits in the short term. The initial set of applications of a smart city project play a dual strategic role: they should improve quality of life, but also offer clear returns on investment (BSI, 2014; Huawei, 2014).

4. The most valuable applications for the new streams of urban data cannot be known in advance. Smart city projects must be flexible, developing through a mix of formal planning, market forces and citizen involvement. Experts, entrepreneurs and citizens (civic hackers) can create demand for the data and co-design applications that experts cannot identify by themselves (PAS, 2014; Osborne-Clarke, 2015).

5. As citizens, academics, technology developers, digital entrepreneurs and corporate actors participate in an enduring process of co-creation they become increasingly skilled in the development of smart products and services. Through the development of increasingly sophisticated smart citizenship and smart

entrepreneurship skills, smart cities will be in a strong position to compete for a share of the knowledge economy (InnovateUK, 2012; Deloitte, 2015).

4.2- Case Study: Milton Keynes, MK:Smart and MotionMap

4.2.1-Milton Keynes

Milton Keynes (MK) was founded in 1967 and its development has been shaped by a master plan prepared by the Milton Keynes Development Corporation (MKDC) in 1969-71. The stated goals of the master plan were strikingly similar to those of the smart city roadmaps that would develop 50 years later: Planners aspired to make MK an attractive city with balance, variety, opportunity, freedom of choice, public awareness, participation, easy movement, good communications, and an efficient and imaginative use of resources (Finnegan, 1998: pp 25-29)

From the outset, the city has positioned itself as a test bed for sustainable living initiatives: a place where business and governmental actors can test new ideas and set standards for future adoption around the UK (PRP Architects, 2010). The sustainable innovation narrative is also visible in the economic development strategy of the city council (MKC, 2011; MKC, 2012a). Local government, universities and industrial actors found in the new town a suitable venue to explore sustainable technologies and to develop new business models for them. Examples include the demonstration of the world's first solar-powered house in 1972, pioneering energy standards for buildings in 1979, and the UK's first kerbside recycling collection in 1992 (PRP Architects, 2010).

The “test bed MK” strategy contributed to the economic development of the city, creating an environment where bids for sustainable innovation projects attract considerable investment. Recent examples include an £8 million grant for the deployment of charging infrastructure for electric vehicles (MKC, 2013), a £13 million OFGEM-supported smart grids trial (WPD, 2013; Cook et al., 2015) and £150 million for the operation of a transport innovation centre (TSC, 2013).

4.2.2- MK:Smart

In 2013 a bid to develop a smart city programme in Milton Keynes was submitted to the Catalyst Fund, a Higher Education Funding Council for England (HEFCE) programme. The bid was led by The Open University and supported by partners from local government (Milton Keynes Council), academia (University of Cambridge, University of Bedfordshire), utility companies (HR Wallingford, e.on) and ICT providers (BT, Samsung, Huawei, Tech Mahindra). The consortium was awarded £8 million, and match funding commitments resulted in an overall programme value of £16.7 million.

The smart city programme, MK:Smart, ran from 2014 until 2017. The main deliverable for the programme was the MK Data Hub, a data management platform for the collection, integration and use of large amounts of urban data. The Data Hub can collect urban data from satellites, sensor networks, social media and other sources, providing interfaces to make it accessible to the developers of smart applications (BT, 2013; D'Aquin et al., 2014). Availability of real-time urban data is expected to benefit MK through various mechanisms: Experts, service providers and city managers can use it to implement new solutions for managing limited city resources. Entrepreneurs can develop new products and services by using and adding value to the data. Smart applications can provide personalized advice to citizens so they can make smarter choices (MK:Smart, 2014a).

Smart applications were developed by university and industry partners with expertise in key areas of urban infrastructure, particularly transport, energy and water. Additionally, smart entrepreneurship was supported by a team focused on business development, while teams specializing in education and citizen innovation sought to educate and empower citizens of MK. The formation of smart citizens was crucial to the project. One of the claims made by MK:Smart is that once citizens are educated on the issues and given access to data they will optimize their behaviours and engage in voluntary demand management, overcoming limits to city growth imposed by financial, infrastructural and environmental constraints (MK:Smart, 2014a; HR Wallingford, 2014). The development of one such application for voluntary data-driven demand management, MotionMap, is discussed in the following section.

4.2.3- MotionMap

The "transport" team of MK:Smart was tasked with the design of a smart application addressing the transport problems associated to the rapid growth of the city. Despite its relatively small population (250,000 people), the automobility problem in MK is eminently suburban. The city has been built to a distinct design dating from 1969-71 that sought to facilitate the use of the private car for all journey purposes (Llewelyn-Davies, 1968): a one kilometre grid of high capacity, high speed roads and extensive car parking in all areas, coupled with low density development. While there is an extensive network of cycling and pedestrian paths (colloquially known as 'redways'), they were designed for leisure (Clapson, 2013: p 15,16,64) and their circuitous routes are widely considered unsuitable for commuting (Edwards, 2001; Franklin, 1999). This design that elongates journey distances is systematically hostile to most forms of travel other than the private car. In consequence, MK is consistently ranked last or near-last in car dependency scorecards (Better Transport, 2014). Because of the combination of high car dependence and rapid population growth, traffic growth of some 60% is expected in MK by 2026 (MKC, 2012b), but local authorities will only be able to provide an extra 25% capacity through junction improvements and other measures. The transport team in MK:Smart explored the potential for addressing the gap between capacity and demand using a smart transport application based on voluntary demand management. The intention is that the high availability of personalised information on travel choices could have a similar, if not greater, impact to that of Personalised Travel Plans which have been used to provide enhanced travel information for households. Traffic reductions of up to 11% have been achieved through the adoption of such plans (Cairns et al., 2008).

Design and development of the application was led by the University of Cambridge, in collaboration with the Open University and various start-up companies with the technical skills required for deploying sensors and developing visualizations, analytics and interfaces. The proposed solution, MotionMap, was conceived as an application accessible through mobile phones that would allow users to make spontaneous transport decisions. The real-time visualization of transport flows made possible by MotionMap would facilitate "spontaneous real-time choices about transport which spring from the exercise of personal preference rather than from bureaucratic coercion" which were expected to lead to substantial (and beneficial) changes to the nature and pattern of movements within the city (MK:Smart, 2014b). While the application itself was not expected to deliver the number of features or the sleek look-and-feel of commercial applications receiving billions of dollars in funding, other competitive advantages were sought. The project leadership pursued a strategy based on the inexpensive provision of rich local-level information in real time and with a high level of granularity, to a degree usually not available outside of 'first-tier' cities such as London. Such information would be made available mainly through smart phones, raising concerns about a potential 'digital divide' (Velaga et al., 2012). Given the focus on addressing congestion issues, however, the team did not consider this as a major concern. Even if the application seemed to be mainly beneficial to smartphone users, it would create positive externalities: if users were empowered to behave more efficiently, they would contribute to reducing the levels of congestion experienced not just by themselves, but by all transport users in the city.

Long term plans contemplated a rich variety of data sources: Partnerships with public transport companies would provide real time data about the location and availability of taxis, minicabs and buses. Smart cards would have made possible to track the origins, exchanges and destinations of public transport users. Sensors installed in public and commercial spaces would monitor the speed of vehicular flows on the road and foot traffic in areas like shopping centres, parks, and in the extensive but underused network of footpath/cycle paths crisscrossing the city. Additionally, automated monitoring and analysis of social media would provide some insights on the 'emotional dimension' of transport in the city.

In practice, only a fraction of the desired data sources were included in the proof of concept. Feeds included interactive maps, routing information provided by public transport operators; occupancy information from managers of selected parking areas in the city centre; and road traffic information purchased through "data as a service" agreements with corporate providers.

To complement these pre-existing data sources a variety of sensing devices were designed by the team. MotionMap largely relies on automated image analysis for monitoring "busyness", measured in terms of the number of pedestrians, cyclists or vehicles occupying a given space (a stretch of the road, an intersection, a parking lot). Deployment of the sensors and development of visualizations proceeded gradually through the duration of the programme, and were demonstrated through a series of prototypes as described in the following section.

4.2.4- Citizen engagement with MotionMap

The prototype version of MotionMap facilitated an exploration of possible futures for smart transport in the city. The limited sensor networks available in early stages were sufficient to demonstrate potential and generate interest in citizen co-design and engagement activities, such as the workshops described in the Methods section. Using mock-ups and prototypes, participants were asked to discuss the features of MotionMap that they would value (Fig 1). Citizen preferences identified through those exercises, however, do not completely match the original vision of data-driven efficiency implied by the original design of MotionMap.

Figure 1. here.

Early MotionMap prototypes were developed under the assumption that users would value transport information if they could use it to travel more efficiently, avoiding congestion by changing the route or time of their journeys (voluntary demand management). However, workshop participants did not think that the system as designed would lead to significant changes in their driving patterns. Habitual drivers were already familiar with the patterns of congestion in the city:

"We have been having this conversation since 30 years ago. Gridlock happens 2 hours out of 24, and everyone knows it but everyone has to get to work at peak hour anyway."

Additionally, workshop participants were not convinced that the benefits of more efficient driving would be significant. They estimated that improved information would save a few seconds off their commuting time and a few pence off their fuel consumption. The expected benefits were not sufficient to compensate for trade-offs like loss of privacy.

"*My two sons have basically signed away their privacy, because they like the benefits they get as a trade-off. I try to give away as little info as I can. If I am going to get inundated with advertisements for McDonalds I do not want it, getting a 5p discount is not worth it.*"

In contrast to the scepticism of drivers, workshop participants that relied on public transport, walking and cycling were optimistic about the impact that real time information would have on their travel experiences. However, they did not discuss the expected benefits in terms of increased efficiency. Participants generally considered that all alternatives to the car involved a loss of control and reliability. Non-drivers saw the potential to use smart technologies to have a more reliable experience, to increase their control over their travel, and to increase the accountability of public transport providers.

For example, many bus stops in Milton Keynes have real time information boards, but users found the information unreliable and stated that sometimes buses would seem to just disappear from the application. The issue was particularly problematic for frequent bus users and those planning multi-leg, multi-modal journeys. Workshop participants considered that 'official' information could be usefully complemented through crowdsourced, real-time reports about transport services. Cyclists and pedestrians were also interested in crowdsourced information that would let them know about hazards like flooded underpasses, footpaths with insufficient night-time lighting, or cycle paths made dangerous because of broken glass. While the specific information required by bus users, cyclists and pedestrians was different, the intended use for information was similar in all cases: Users wanted to have the information available in real time so they could re-route around broken links, and they also wanted that information to be user-controlled, verifiable and kept on record so city managers and service providers could be held accountable.

In the efficiency-driven strategy that shaped the design of early prototypes, the sensing infrastructure of the smart city would be used to make citizen activities visible so that users could voluntarily manage their demand of transport services. The alternative approach suggested by workshop participants focused on reliability and accountability, providing citizens with a toolkit for sharing crowdsourced data about transport services and city services.

4.2.5 – Epilogue and future directions

At the time of this writing the MK:Smart programme has come to its conclusion, but funds and support to continue the development of MotionMap have been made available by local authorities at MK and Cambridge. Despite not yet reaching a stage when it can be used generally by citizens (to be expected by 2018), MotionMap has already achieved an impact in that it has reinforced the narrative about innovation in MK. The narrative positioning MK as a leader in smart mobility is being used to mobilize actors and potentially marshal resources locally and nationally. In January 2016 MotionMap was made part of the medium and long-term transport strategy advocated by the MK Futures 2050 Commission, an independent body launched by local government to address potential longer term futures for Milton Keynes.

MotionMap is envisioned as an enabler of new forms of mobility to ensure that everyone who lives, works, studies or does business in the city is able to “move freely and on-demand” (Transport Innovation Task and Finish Group, 2016; MKFC2050, 2016).

Various components of MotionMap are being adopted in other applications and locales (UKAuthority, 2017; Osborne-Clarke, 2017). There is potential for the smart transport innovation to break out beyond the experimental space, leading to a transition towards smart region, even as the meaning of smart transport in MK is still being explored and contested. In July 2016 Iain Stewart, MP for MK South, made a case to the National Infrastructure Commission in support of a regional strategy for development of a Cambridge–Milton Keynes–Oxford corridor. Here, parallel deployments of data and transport infrastructures were seen as enablers to "maximise the potential of the corridor as a single knowledge intensive cluster that competes on a global stage" (House of Commons, 2016).

Development of the Oxford-MK-Cambridge corridor, if funded, is expected to take decades. The MK2050 plan has a similar time horizon. Like so many other smart projects, smart mobility in MK is described “using language that stages their proposals in a future indefinitely postponed… where we are continually about to enter a new age, when we are continually anticipating what happens next” (Greenfield, 2013, p27).

5 - Discussion and conclusions:

This paper set out to investigate the claims underpinning idealized smart city narratives, and how those claims were interpreted and shaped the development process of a smart city project. Through the observation of the development process of a smart transport application, MotionMap, we explored how claims from the idealized smart city roadmap were enacted. Through this exploration, we also noted where outcomes from the smart city project in Milton Keynes seem to differ from the outcomes described in policy documents and marketing literature. In this section, the claims identified in the Analysis section are re-examined in light of the case study data:

1. MK:Smart sought to use smart technologies to facilitate voluntary demand management for water, energy and transport, based on the claim that users and providers of those resources had a shared interest in using them more efficiently. According to the roadmap, this would have resulted in compelling benefits for all the stakeholders through economic savings and increased quality of life. In the case of MotionMap, efficient use of transport infrastructure is valued by the city managers and by transport service providers but our workshops and other citizen engagement activities suggest that efficiency is not as highly valued by prospective users. They considered that other factors would have a stronger impact on the quality of their transport experiences. Particularly, they would value the possibility of using real time data to improve the

reliability and accountability of transport service providers. Such openness may create tensions with service providers that traditionally have been owners and gatekeepers of information about their own performance, but it has potential to increase use and satisfaction levels.

2. MK:Smart provided infrastructures for capturing, curating and making available large volumes of real-time data. According to the roadmap, urban information would facilitate collective action. In the case of MotionMap unlocking the value of information was not just a matter of making sufficient data available in real time. Choosing which data to collect was not trivial as the choice had implications about the sort of solutions that could be developed and about the nature of the smart city itself. While it is often assumed that sensing infrastructures will be used to make the activities of citizens visible, different sensing approaches can be used to make the activities of different actors more visible (for example, those of city managers, transport service providers), empowering different coalitions. In consequence, identifying and negotiating access to transport data required deliberation, ingenuity and negotiating skills, as the interests of transport users and those of current owners of data were not always aligned.

3. Three work-packages were created to design and deliver solutions to specific problems in the city, namely, expected levels of demand for water, energy and transport. According to the roadmap, this would demonstrate the value of the smart city approach, ensuring funding and continued support**.** In practice, the schedule of the project did not give time for delivering commercially viable, financially self-sustaining solutions. However, even if practical value could not be provided the technologies were successfully demonstrated and MotionMap succeeded in becoming part of the long-term transport strategy for the city and may contribute to the development of a smart region**.** MotionMap became valuable not because of its immediate usefulness or commercial success, but because it reinforced the narrative about Milton Keynes as a smart city.
4. Citizen participation in the co-design of smart solutions was supported through citizen labs and other citizen innovation activities, with mixed success. Workshops provided useful inputs for the design of smart applications as citizens challenged the original efficiency-driven approach. Development of the smart city remained a predominantly expert-led activity, but 'smart citizen workshops' are increasingly becoming part of the innovation culture in MK. One notable example of

this is the 'MK Futures Connectors Group' led by Community Action MK to engage MK residents with the 'Six Big Projects' outlined in the 2050 vision for the city (with one key project being 'Smart, Shared and Sustainable Mobility').

5. Development of smart businesses and smart citizens in Milton Keynes was supported through the activities of three work packages: Enterprise, citizens and education, complementing citizen engagement and business activities of the water, energy and transport work packages. According to the roadmap, this would initiate a virtuous cycle: having demonstrated the value of smart city applications the project would attract private investment, leading to the development of a whole ecosystem of smart citizens, entrepreneurs and civic hackers**.** In the case of MotionMap, only the business and academic actors belonging to the official development team developed significant expertise, capabilities and plans for the continuation of the smart city project. This still proved sufficient to initiate a virtuous cycle, in the sense that they were able to attract further investment and contribute to further smart city projects in Milton Keynes and elsewhere.

The processes that took place in MK through the actions of MK:Smart in general and the MotionMap team in particular followed the idealized roadmap. However, there are differences between the outcomes envisioned in the roadmaps and those observed in Milton Keynes.

One major concern came from a question that tends to be glossed over in the roadmaps: "who are the winners and losers of the smart city?" Roadmaps optimistically assume that smart city projects are universally beneficial. What we observed, however, is that different applications and different combinations of sensors and feeds have potential to empower or disempower different coalitions. When the potential downsides of smart cities are acknowledged, it is generally assumed that the sensing networks associated with the smart city may become disempowering to citizens by making them too visible, eroding their privacy (Kitchin, 2014; Martinez-Balleste et al., 2013; Ball et al., 2016). However, this is only one of the possible outcomes. In the case of MotionMap, citizens saw potential to use sensor networks and crowdsourcing to make the actions of city managers and transport service providers more visible. This approach would potentially empower citizens, but may be resisted by other actors.

Despite the lack of immediate practical benefits, MK:Smart and MotionMap are proving beneficial to the city, in that the city has gained access to sensor networks, data feeds and sociotechnical know-how, furthering a narrative that sees Milton Keynes as a testbed for sustainable innovation. As the smart city narrative develops into a smart region narrative, the coalition being mobilized keeps growing, even if the practical benefits are time and again postponed to a vaguely defined near-future. In the short term, Milton Keynes is unlikely to become a smart city like the ones envisioned in the roadmaps. Over time, and given sustained investment, it may become part of a smart region or a smart corridor. This is still a positive narrative, but it differs from the stories about quick technological fixes that are often found in the idealized literature about smart cities.

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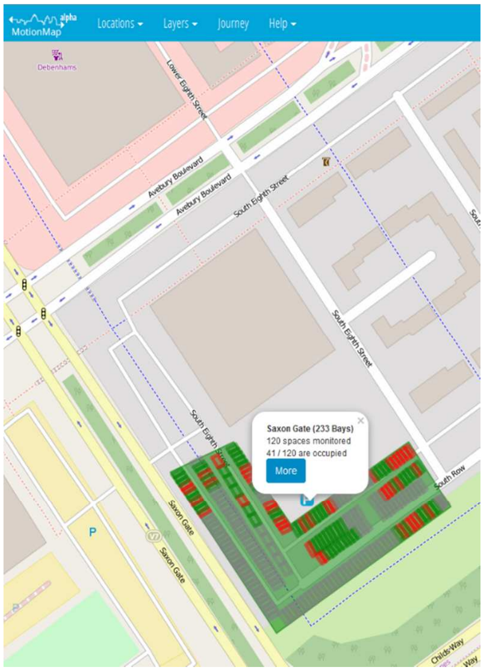

Figure 1. Screen capture of functional MotionMap prototype.