Exploring the Relationship Between Smart City Policy and Implementation

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Abstract— The implementation of smart technologies gives rise to concerns about how imposed technologies create genuine value to a city. City leaders are facing increasing pressure to meet ambitious targets with limited resources. Much of the private sector heralds 'smart city' solutions as the way forward for meeting these targets, but city leaders often find it difficult to align the technology solutions with the intended policy outcomes. This paper investigates the core themes within the field of smart cities and future city policy, in order to derive an interpretive conceptual model of the relationships between them. We find that devising appropriate solutions should be framed not only by policy goals but a wider understanding of local challenges and opportunities, as well as an interpretation of public value.

Keywords- Future cities; policy implementation

I. INTRODUCTION

The 'information age' has driven a significant shift in nearly all aspects of modern life. In the past decade, we have seen a fundamental change in the way we work (networking through social media, distance working etc.), how we shop (online, price comparison), interact with family and friends (skype, social media), and our expectations of government (FixMyStreet, opendata). It has also heralded a new era of activism and community unity. "In the Arab Spring, social media facilitated action in the Middle East and North Africa (MENA) region, providing a free and accessible method of organising and coordinating demonstrations"[1]. This was echoed in the London riots and the subsequent cleanup operation [2].

"The networked information environment has dramatically transformed the marketplace, creating new modes and opportunities for how we produce and consume information" [3]. Companies like Facebook, Amazon and Google have capitalized on this opportunity by using information to provide value to their customers. These companies utilize information as a core asset, and leverage it to create products and services that respond to user desires and expectations. The current 'information marketplace' in cities already creates value for citizens as highlighted in recent reports such as "Information Marketplaces: The New Economics of Cities" [4]. Innovative products and services create jobs and support citizens in navigating and using the city in effective, educational and enjoyable ways. However the true value has not yet been quantified or captured by city leaders. Governments are struggling to realize the opportunities offered by ubiquitous information, 'smart' technologies, social media, and anytime, anywhere access. They are unable to articulate the value of the market within their own city, let alone the 'value chain' [5] in term of inputs, outputs and outcomes for citizens. In an interview, Emer Coleman (Deputy Director Digital Engagement Government Digital Services at the Cabinet Office) explained, "this requires new leadership from the public sector. Data surfaces political decisions."

This paper investigates the core themes within the field of smart cities and future city policy, in order to derive an interpretive conceptual model of the relationships between them. Section two sets out a methodology for investigation, sections three to six investigate the core themes through analysis of second-hand evidence. Finally, we introduce our model in section seven and set a further research agenda in section eight.

II. METHODOLOGY

Investigating local government decision making around 'smart cities' requires an understanding beyond the business case analysis for a given solution or investment. While a rigorous financial justification is important for smart city investments, it is also useful to consider the wider context of decision-making; the motivations for change, the value systems, and the political paradigm within which both long and short term decisions are made. Furthermore, "a city is an enormously complex and open-ended system, with many intertwining force fields influencing its form simultaneously" [6]. An investigation into single technology-solutions is largely obsolete if the wider context and relationships are not understood. In this light, we have undertaken a multi-disciplinary literature review of the way in which decisions are made in the public sector. Taking a grounded approach we extracted core themes and explored the relationship and flows between them to create an interpretive conceptual model. We then explored, validated and developed this model through consultation with a series of 'smart city' experts.

We intend to use this model to compliment our research into how cities should invest in the 'information economy' and 'smart cities.' Setting this research in its wider context of public sector decision making helps to ensure that research findings are directed towards recommendations that are politically acceptable, actionable and that are a genuine contribution to the creation of public value.

III.   CHALLENGES AND OPPORTUNITIES

All city leaders operate within a unique context. The challenges and opportunities that the city faces are derived from the socio-economic conditions, demographics, population size, accessibility, infrastructure, local business types etc. These form the baseline, or 'building blocks'[7] that the city leaders have to work from. These baselines are continually moving, and forecasting is used to assess future challenges. For example, a report on 'Demographic Challenges for European Regions' cites that "demographic change might lead to further increases in social polarization in Europe"[8] in the next 10 years.

According to the report "All Our Futures" (a forecasting report from the UK Office of the Deputy Prime Minister, based on a literature review, trends analysis, a Delphi survey and futures events) "in 2015 many of the pressures of government will manifest most dramatically at a local level. More flexibility and responsiveness at a local level would significantly enhance governments' capability to meet the challenges successfully" [7]. It is becoming important then, that city leaders actively engage in seeking out and responding to the opportunities and challenges faced by their particular locality.

Static snapshots of understanding are of limited value. This is because of the dynamic nature of the problem; the solution itself will change the operating context. For example the 'information economy', which has been driven by technological advances, is itself a driver of change for a city's challenges and opportunities. In turn, the way a city chooses to respond (perhaps through investing in start-ups or providing free public wifi) will affect the operating context yet further. Here, there is a reinforcing loop between the 'challenges and opportunities' and the solutions that might be implemented. The implication of this is that, if cities are to stay effective and responsive to citizen needs, they must continually evaluate the operating context through analysis of its challenges and opportunities. This can be achieved through local, national or international schemes such as the Covenant of Mayors [9].

IV.   POLICY GOALS

The quantified challenges and opportunities are the basic facts about a city's context although 'opportunities' may be more subjective. "Once facts are accepted the ethics discussion begins as to how facts can be used or the appropriateness of facts in any specific case" [10]. Political leaders must translate these facts into goals or aspirations of where they would like to be; they must translate the "is" and "is-nots" into "ought" and "ought-nots" [11]. So, the 'challenges and opportunities' from part III, influence the development of policy goals. This process is heavily value-laden and requires the facts to be filtered through a political and cultural value system.

There is, however, an ongoing debate about the role of ICT in challenging the political and cultural paradigms of city leadership. The opportunities created by the 'smart city' "may lead us to a more fundamental choice between a privatized government (in which most issues are dealt with according to commercial relationships and principles, with services paid for by clients) and traditional, public government (in which many services considered to be of public interest are provided to citizens and businesses according to a variety of criteria not necessarily linked to commercial considerations)" [12]. The political context will fundamentally change how presented facts are interpreted into policy goals. City leaders must take care to ensure that the ability of ICT to outsource city services does not dictate the political direction, but that instead, investment in ICT is derived from a sound articulation of political, social and cultural values.

The policy goals are created to address the challenges and opportunities in a given context, and can directly affect citizen quality of life, environmental impact and civic engagement. In their research, Oxendine et al. found that "policy approaches regarding information technology interact with civic activity to predict both general internet use among citizens, as well as citizens' likelihood to use the Internet to seek out information about local government and community activities" [13]. There is therefore a tangible role for local and national governments to create policy goals that can genuinely respond to local challenges and capitalize on opportunities.

V.   PUBLIC VALUE

The concept of public value management has become increasingly important for city leaders in recent years. O'Flynn explains that "public managers have multiple goals which in addition to the achievement of performance targets, are more broadly concerned with aspects such as steering networks of providers in the quest for public value creation, creating and maintaining trust, and responding to collective preferences of the citizenry" [14]. The creation of public value is described by Baptista as the "raison-d'etre of government," [12] and is distinct from simple cost cutting. "Public value argues that public services are distinctive because they are characterised by claims of rights by citizens to services that have been authorized and funded through some democratic process" [13]. It is delivered when solutions implemented adequately respond to a city's challenges and opportunities, and contribute the achievement of policy goals. It covers a host of outcomes from the tangible examples such as 'reduced crime on busses' to the more intangible delivery of 'feeling of safety' or 'level of happiness' [15].   Kelly and Muers [16] claim that public value can be achieved through the:

- Delivery of high quality services
- Achievement of outcomes that are seen as desirable by the public (will depend on opportunities and challenges as well as culture and values)
- Trust in public institutions

Kearns argues that "(public value) can be used both as an aid to judgment by governments when deciding what activities to undertake and as a yardstick against which to assess government performance" [17]. In this way, the delivery of public value determines the types of solutions that are implemented as well as delivering on policy goals.

VI. SOLUTIONS

In order to address the challenges and opportunities of the city and deliver public value, city leaders invest in solutions. These solutions are actionable long or short term projects or programmes that can take many forms including regulation, facilitation or procurement. These are exemplified by smart grid implementation projects, e-ticketing or facilitation programmes such as the iShed in Bristol, the Bristol Council initiative "to produce creative technology collaborations" [18].

ICT or 'smart' solutions that the governments invest in can have direct and indirect implications for the creation of 'public value'. Cresswell et al. identify three core mechanisms in the creation of public value through ICT [19]:

1. Direct service impacts (which "occur when IT is embedded directly in a service delivery process, generating service changes that enhance value to the citizen")
2. Indirect service impacts (which "occur when back office or infrastructure investments produces changes in a government business process")
3. Mixed service and environmental value impact (where "the new IT is also linked to changes in the environment and relationships between the direct beneficiaries and other entities in the public area")

VII. MODEL

The core themes derived from the literature review include: Opportunities and challenges, policy goals, public value, and solutions. These themes are distinct but related, and the conceptual model in Figure 1 interprets the relationships between them. The model highlights that a city's challenges and opportunities influence city leaders' policy goals as well as the types of solution they might employ. These solutions are intended to resolve the challenges and opportunities of the city, but also deliver a wider contribution to public value, which in turn also supports the delivery of policy goals.
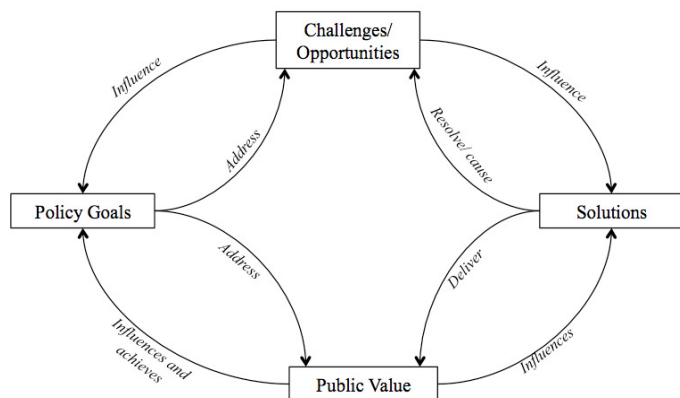

Figure 1. Grounded model of smart city policy and implementation concepts.

This model is not hierarchical. It is not the case that governments always set policy goals to directly address challenges and opportunities within their cities, for which appropriate solutions are derived. Often there is a 'solutions push,' i.e. a solution that is put in place because it seems to make sense and creates 'public value,' even if it does not directly come from a policy goal or a specifically quantified challenge. This model can be applied to interpreting the Greater London Authority's action around open data [20], which shows a city making an investment driven from a bottom-up understanding of creating public value. Emer Coleman saw that for a relatively small investment of £15,000 she could set up an Open Datastore for London. The decision to invest was driven by an inherent understanding of value to Londoners in terms of economic and social development, as well the delivery of better services and the transparency of government. It also responded to the city's 'challenges and opportunities' around private sector innovation and supporting start-up companies. Here, an investment in a solution was made as a contribution to public value rather than being instigated from a particular policy goal.

VIII. CONCLUSION AND FURTHER WORK

The model in figure 1 shows two core influencing features which are; the "challenges and opportunities" and the concept of "public value". These two factors form the context for any government action, and should be specifically articulated and continually explored. To respond to these two factors, governments act in two ways. Firstly they create policy goals which are intended to set investment priorities. These policy goals are explicitly or implicitly responding to local challenges and opportunities, as well as attempting to create public value. Secondly, city leaders intervene with solutions. Likewise, these respond to the core influencers in the system, and, through the tackling of these influencers, are intended to achieve policy goals.

Achieving policy goals through implementing solutions is often oversimplified, with public sector investment being directly informed by policy goals without consideration of the wider context. This is exemplified by the multiple failures of bike hire schemes across the UK (e.g., in Reading, Cardiff and Bristol). Often these schemes are developed directly from a local government policy to increase healthy lifestyles and reduce carbon emissions, but fail to understand where the true public value lies. This might include, for example, the failure to understand primary user groups and usage patterns. The ultimate goal should be to align policy goals with appropriate solutions. However, this is not achieved through directly jumping between them, but instead requires a consideration of the wider view offered by this model.

Achieving this in the complex city environment where long and short term local goals must be balanced with national and international-interest policies is especially demanding. For city leaders, this complexity is further compounded by the huge advancements in the ICT industry, which has fundamentally shifted the citizen behavior, expectations, and the economy. Devising solution programmes that will work effectively within this system, as well as respond to global calls for emissions reductions will

be the defining feature in local governance in the next ten years.

This simple model in its current state is unable to offer the level of insight that a strategic decision maker requires in order to justify investment. To develop this model further we plan to explore each of the core components in turn and create a more detailed, dynamic model. This could include causal mapping and system dynamics modeling. For example, to investigate how cities might leverage policy goals and solutions to maximize public value from the information economy, we first need to gain a comprehension of the value that is already provided by information (or perhaps 'information products' [4]) within the city. Undertaking this research goes some way to quantifying the 'challenges and opportunities' that exist within a certain city. This research will be undertaken using case studies, for which a 'value chain' approach will be adopted to map the source of, and quantify the value. This builds upon work by Mulligan in her book "The Communications Industries in the Era of Convergence" [5]. This understanding will be combined with an investigation into what is considered of 'public value' to that city. Combining these two will support the development of appropriate policy goals and, a solution roadmap. The intention is to support cities in maximizing the value created from the 'information economy', or 'smart city', and ensuring that they have a robust understanding of both the direction of their policy goals, and the appropriate solutions.

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