Participatory Democracy and the Governance of Smart Cities

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Abstract

Citizens' participation in urban planning and policy-making develops the traditional top-down governance model via promotion of bottom-up approaches to policy development and decision-making. This evolution drives social innovation in support of planning initiatives and results in more public-oriented policy specification for better governance and sustainable urban environment. Innovative ICT solutions offer significant opportunity to ameliorate the substantial challenges arising from these developments. Smart city defined initiatives promote the use of ICT solutions for better governance in terms of improved communication and information services, as well as offering the potential to provide policy-makers and urban planners with the tools and intelligence needed to actively manage the urban environment. In this paper, we present and discuss smart planning and urban governance in a smart city perspective. Also, we present a case study based on the UrbanAPI project which aims to develop and deploy different ICT solutions for public participation in planning initiatives and policy making at various scales of urban governance.

Keywords: urban democracy, urban governance, smart cities, stakeholder engagement and public participation.

1. Introduction

The effective governance of the cities and city regions of Europe today fundamentally must address urban complexity, whereby the high degree of interconnectedness and multiple interactions between socio-economic and environmental factors in a territorial context create major barriers to the effective specification and implementation of sustainable urban development.

In this context there is a major opportunity for the application of enhanced ICT driven intelligence in urban management to secure the proactive governance of

cities and the delivery of more sustainable compact cities. In particular ICT enabled urban governance can support the production of an effective basis for the assessment of urban complexity, and decision-making support. In a broader perspective ICT enabled urban governance offers a significant new potential to simultaneously achieve effective management of the complexity of the city, as well as engaging citizens in defining their urban futures.

ICT enabled innovations can enhance public engagement and allow a wider audience to simultaneously contribute to the political debate. This is particularly evident as the convergence of broadband with ICT-enabled innovations (e.g. especially user driven applications based on social computing and mobile technologies) is transforming the way people use the Internet to communicate and interact. Most European citizens embrace the "collaborative Internet" and expect to be able to interact with city governments using ICTs (EXPGOV 2009) . ICTs thereby are seen as enablers of more and better participation (e-Participation), and democracy (e-Democracy) and more inclusive societies (inclusive e-Governance and e-Inclusion), extending beyond enhanced service delivery, to facilitate interactions between actors. Overall technological opportunity is prompting a transformation of the relations between citizens and government agencies, and at the same time the driving forces of ICT enabled governance are also responding to the dynamic of transformational governance and changes in regulatory and governance processes.

Despite all of the above, at the city level there is as yet only limited evidence of the direct effects of ICT-enabled innovations on city governance systems, and in many respects the smart cities revolution is still in infancy and clearly more research, particularly the pan-European level, is required to define the most effective tools and methodologies to support ICT enabled governance.

Research directed by the Interactive Analysis, Simulation and Visualisation Tools for Urban Agile Policy Implementation (UrbanAPI) project (2011 - FP7 DG Information Society[1]) aims to fill this gap in understanding and application. UrbanAPI provides ICT enabled innovations for city governance and adapted governance models to support new stakeholder engagement and citizen participation, in order to enhance sustainable urban policy development and delivery.

The enhanced ICT tools developed by UrbanAPI offer new opportunities for the development of both intelligence sources as well as tools for decision-making support at three levels of urban governance from neighbourhood to city region level, thereby addressing the key dimensions of the management of urban complexity. At the same time by providing a simplified language of communication between different stakeholder groups (virtual reality, visualisation and simulation-

[1] The UrbanAPI project is partly funded from the 7th Framework Programme (FP7) of the European Commission, call identifier: FP7-ICT-2011-7, under the grant agreement no: 288577, started in October 2011.

based communication) developed on a common platform of communication between the different levels of governance including local (virtual reality), citywide (GSM) and city region (simulation). UrbanAPI also advances the state of the art in relation to the necessary collectivity of city governance.

The conceptual frame for the project is based upon the understanding that urban managers throughout Europe face common challenges in responding to the desire for a more participatory democracy, in order to define the basis for urban economic vitality, social inclusion and environmental sustainability. The commonality of the drivers of urban change including global economic instability, demographic and migratory change, as well as climate change offers a major opportunity for the development of common solutions grounded in effective citizen and wider stakeholder engagement in the planning process.

UrbanAPI directly addresses these potentials for the development of common models of policy formulation and implementation in respect of both information generation and management, as well as stakeholder engagement, thereby supporting the potential for widespread application in the cities and regions of Europe.

The structure of this paper as follows: in section 2, we discuss in detail smart governance and urban planning using ICT tools. We also briefly indicate need for information integration at local scale across various administrative units for better intelligence and flow of information between different levels of governance. Then in section 3 we briefly present a smart city perspective followed by the UrbanAPI project example in section 4. Finally, we conclude in section 5.

2. Smart Governance and Urban Planning

Cities sustain 80% of the population of Europe (EEA 2006) and naturally form the focus of political initiatives to secure a more sustainable development plan in response to multiple global and local environmental, social and economic challenges. The core principles of sustainable urban management highlight the need for effective stakeholder engagement and public consultation in relation to the complex of the tensions at play within a multiple system of interactions and often conflicting views between the three pillars of sustainable development (economic, social and environmental) (Jacquier, 2008).

Urban management aims to address the key political concerns of European cities in responding to the challenges of climate change, arising as a consequence of excess greenhouse gas emissions, frequently driven by uncontrolled urban sprawl, and impacting adversely on urban health and biodiversity loss etc. However, urban management is far from straightforward, as cities are extremely complex systems, and the various drivers of change, environmental impacts and political responses

are strongly interrelated, support, alter or compete with each other.

The political priority to ensure that climate change adaptation and mitigation is consistent with, and promotes healthy and economically viable urban communities, is in turn a prime driver of initiatives to secure integrated urban management, reflecting the view that effective solutions must be based on better land use policies as part of an integrated policy response.

Failure to integrate policy can be attributed to a variety of factors including notably organizational and procedural barriers between sectoral planning agencies responsible, for example, for land-use, transport and environment, primarily at the local level, on the one hand, and on the other poor communication between agencies responsible for policy development at local, regional, national and EU levels. A further casualty of the lack of connectivity in the policy model, is the fragmentation of the information and intelligence essential to support integrated policy definitions and policy implementation.

These failures of communication and coordination between government agencies that underpin the concerns of the policy-making community for integrated urban management frameworks, are in turn reflected in the demand for new assessment methodologies and decision-making tools to support urban and regional governance. It is clear that ICT enabled urban governance offers major potential to deliver these assessment methodologies and decision-making supports. However, in accordance with Shared Environmental Information System (SEIS 2008) and other related principles, ICT investment in governance tools and methods must be based on new governance models and not the existing failing model. Accordingly, beyond new assessment methodologies an entirely new paradigm of integrated monitoring (policy model) is required in order to provide a consistent framework and context to systematise the information flows from data collection to assessment and policy support.

Furthermore this new policy paradigm and model of urban governance must be fully user defined, and fully cognisant of the opportunities created by the emergence of transformational governance models.

Classical models of urban governance emphasise expert, centralised, hierarchical, top-down perspectives, supported by departmental defined implementation, delivering one-dimensional solutions. Transformational governance critical to the realisation of sustainable development, demands a new synthesis of expert governance fully articulated with bottom-up stakeholder and citizen engagement to inform decision-making. These new models of governance and management in support of sustainable development require greater stakeholder engagement, partnership between stakeholders, and integration of information and analysis

(cross departmental/multiscalar), with a focus on management of urban complexity, including management of the peri-urban (interface urban and rural), where key challenges for urban planning include issues concerning the containment of urban sprawl and the creation of the compact city.

In this framework of transformational governance new assessment methodologies and decision-making tools must be defined and developed by the ICT community in collaboration with end-user communities according to the requirements of the new models of urban governance. In particular requirements arising from integrated urban management, the defining concept of the new governance model, demands transformation towards enhanced connectivity/communication in two respects. First, in relation to both vertical and horizontal dimensions of government agency engagement and communication in urban governance, and second in support of enhanced communication with stakeholder groups according to the principles of sustainable urban development.

From a technology perspective the development of new methodologies for information acquisition and increase of computing capacities to unprecedented levels opens new fields for monitoring and assessment with high information flow and capacity to manipulate it. The end user defined policy paradigm of integrated urban monitoring and management offers the opportunity for the development of a data model to which improved integrated intelligence can be applied and thereby overcome deficiencies in sustainable urban policy formulation and implementation addressing the key urban challenges including urban sprawl.

2.1 Urban sprawl in Europe – exemplar of challenge and opportunity

The specifications of the end user defined policy paradigms for integrated urban monitoring and management are usefully explored in relation to a more detailed assessments of the challenges arising in the management of cities focused on urban sprawl and its associated environmental, economic, and social impacts.

Apart from wealth, health and happiness, the ideals of the good life and quality of life are often equated with maximum person mobility and car ownership facilitating life in the green suburban environments surrounding Europe's cities. These aspirations provide important drivers for the sprawling urban area, which is arguably the antithesis of sustainable urban development.

Indeed the evidence for the unsustainable nature of Europe's sprawling cities abounds. Car based transport growth associated with the sprawling cities of Europe is a key driver of the growth of transport related greenhouse gas emissions. In 2005 transport emissions accounted for almost 20% of greenhouse gas emissions in

EU25. Road transport is responsible for 93% of all transport emissions and urban transport accounts for half of these emissions. The correlation between the expansion of urban land use and the growth of transport related greenhouse gas emissions is very strong, much stronger than for other factors including population growth and GDP.

Furthermore, it is not just the issue of urban sprawl as a driver of greenhouse gas emissions that raises cause for concern, but also the connection between sprawl and a variety of other environmental impacts in the urban area. For example, car based urban transport growth associated with the sprawling cities of Europe is a prime driver of not only greenhouse gas emissions, but also associated pollutants (Green Paper on Urban Mobility (2007)). Urban transport accounts for 70% of pollutants and 40% of GHG emissions, driving climate change and impacting adversely on human health in the urban area. Emphasis in the analysis of urban challenges and their causality, from a sustainable development perspective is therefore given to the interconnected nature of the challenges in the city, which reflects the ecosystems perspective on the city.

Political concerns with climate change, greenhouse gas emissions, poor air quality and biodiversity loss etc are all fundamentally related in the land-use - transport - environment nexus, in which the complex interrelationship between land-use planning, transportation planning and associated environmental impacts are critically related to the nature of urban form, and in particular the extent to which the urban area is more sprawling or more compact.

These complex interactions between the drivers of change in the urban environment, including land-use and transport planning, the resulting sprawling urban form, and the environmental impacts resulting from these interactions are illustrated in Figure 1: Policy Model - Urban Change Drivers and Impacts.

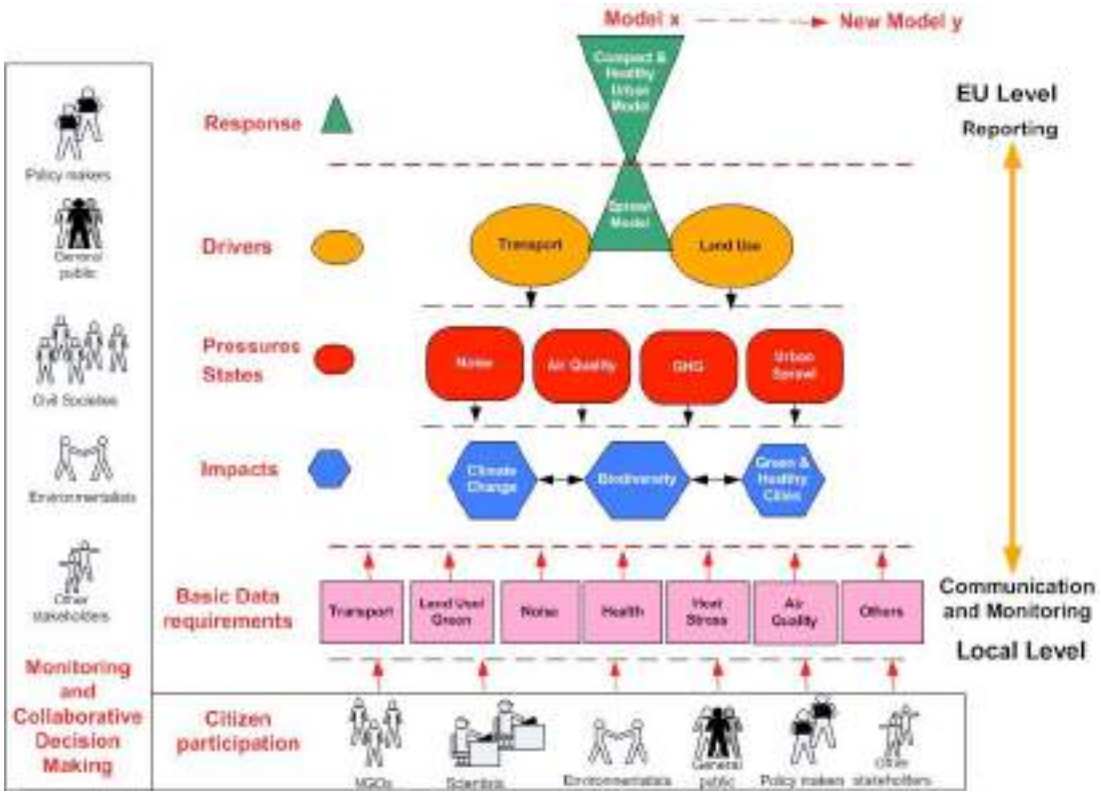

Figure1: Policy Model - Urban Change Drivers and Impacts

2.2 Policy integration – win-win opportunities

Clearly the challenges of urban management are substantial, however set against these challenges the opportunities for sustainable urban development in prising open this complexity are great. Appropriate policies to address the growth of transport related emissions in the context of the land-use - transport - environment nexus can secure the “win-win” possibilities of positive management of climate change, and also effectively address other environmental and social priorities without limiting the economic growth of the city.

This political opportunity to ensure that climate change adaptation and mitigation is consistent with, and promotes healthy and economically viable urban communities, underpins numerous initiatives over the past decade to secure integrated urban management, recognising that more effective solutions must be based on better land use policies according to principles of integrated and holistic policy making.

These principles are well illustrated by the example of urban sprawl impacts. Critical to the formulation of appropriate policies for the management of urban sprawl is the understanding provided by the Green Paper on Urban Transport (Com (2007) 551 final) that the low density environments created by urban sprawl including

dispersed home, work and leisure facilities result in increased transport demand that cannot be effectively satisfied by collective transport solutions. In other words sprawl cannot be fixed by investment in public transport alone, and effective solutions must be based on better land use policies as part of an integrated policy response. Such integrated policy responses inevitably demand collaboration between numerous sectoral agencies at the local level.

Equally, collaboration is required between the levels of government from local to EU levels. This is evident from examination of the widespread failure of local governments to prevent ever greater sprawling of cities. Evidence from the European Environment Agency urban sprawl report indicates that EU infrastructure investments conflict with and thereby undermine local policy initiatives to contain sprawl. Consequently coordination and collaboration is required, and urban planning can no longer be considered just a local or national issue, but that its impact on climate change make it also a matter where EU has clear responsibility to act in cooperation with the local and regional levels of governance. Neglect of this reality furthermore threatens to undermine the achievements of other climate change policies.

Indeed, a principal concern undermining the integrated approach to policy formulation and implementation is the lack of connectivity between levels of governance in both vertical and horizontal policy dimensions, with an accompanying fragmentation of information and intelligence essential to support integrated policy definitions and policy implementation. In For example, at the local level agencies addressing the management of urban regions to contain urban sprawl have a critical need to integrate data across the sectoral domains of land-use and transport. However, given their distinctive departmental identities, the prime sources of information and data, information management and decision support tools developed for land-use and transport policy analysis are typically not interoperable.

Active communication and data integration not only between sectoral agencies at the local level, but also between the levels of governance from local to EU, is clearly critical to the attainment of all policy objectives for urban areas.

These horizontal and vertical dimensions, not surprisingly, also define the prime lines of communication and connectivity between sectoral agencies at the local level, as well as between levels of governance in a vertical perspective, all essential to the development of an integrated policy response. These dimensions for the engagement of agencies in the planning process, thereby provide the structuring principles for policy integration and for the policy implementation model, as identified in Figure 2: Implementation Model - Structuring Principles, below.

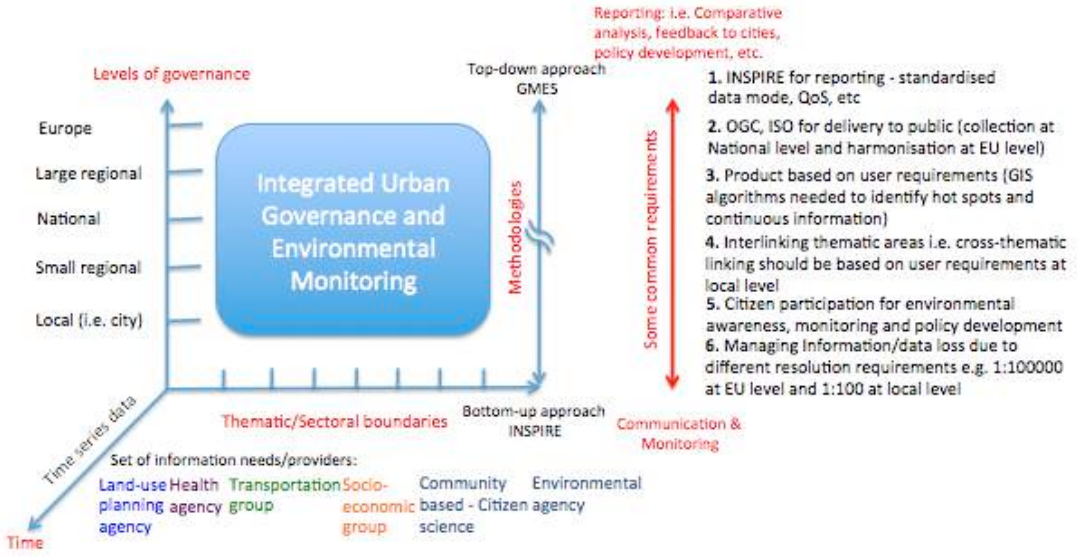

Figure 2: Implementation Model - Structuring Principles (Khan Z, et al. 2011)

2.3 Integrated urban management – new smart governance

Looking forward the structuring principles for the policy and implementation models identified above (Figure 2), offer the basis, according to the necessary interactions between planning agencies, to provide the essential user-defined building blocks for full deployment of ICT applications to secure more effective and transformed integrated urban governance.

This model aims to provide a consistent framework and context to systematise the information flow from data collection to assessment and policy support. The end user defined policy model of integrated urban monitoring and management thereby offers the opportunity for the development of a data model to which enhanced integrated intelligence can be applied and thereby address deficiencies in policy responses. From a technology perspective the development of new methodologies for information acquisition and increase of computing capacities to unprecedented levels opens new fields for monitoring and assessment with high information flow and capacity to manipulate it.

These principles of enhanced communication and technology in support of urban governance are developed primarily in response to classical models of centralised, hierarchical, top-down perspectives mobilising departmental defined solutions and implementation. As we have seen transformational governance critical to the realisation of sustainable development, stimulated by the demands arising from the management of urban sustainability, advocates a new synthesis of expert

governance fully articulated with bottom-up stakeholder as well as citizen engagement to inform decision-making. The emphasis here is upon the need for bottom-up process and effective stakeholder engagement in relation to the conflicting views at the community level (as depicted in Figure 1).

This new governance approach provides additional emphasis on networks of enabling, influencing, mobilisation, coalition and relationship building, between multiple stakeholders at multiple levels, characterised by the following components:

- Linking territories to networks which cross multiple boundaries, with sometimes highly mobile and globalised social-economic groups;
- Multifunctional policy agendas for urban planning relating to energy and carbon, food, leisure, ecology, business park, retail park etc.;
- Multilevel decision making where strategic and local objectives need to be coordinated;
- Multi-sector working, which aims to realise the potential and added value from a wide range of stakeholders and 'communities of interest'.

Accordingly the demands of new governance have challenged existing governance systems, different sectoral agencies speaking different "languages" with different incentives, to respond to agendas which are multi-functional, multi-level, multi-agency, and intergenerational. As a consequence sectoral agencies are able to not only generate more information, but also new intelligence applied through the whole policy cycle from capacity building, to analysis, strategy, implementation and evaluation.

The necessary translation of new governance principles to urban planning processes and structures lies at the heart of the concept of 'strategic policy intelligence' (Plurel 2011). Strategic policy intelligence provides a conceptual framework in response to the new governance model requirements which translates governance priority into urban planning principles and their associated information demands including:

- Exchange of technical information from different sectors;
- Application to the policy cycle, with stages including survey, analysis, strategy, implementation and evaluation;
- Anticipatory governance through foresight and future studies, systems thinking and strategic planning.

Building on these foundations the ICT enabled innovations offer planners, new information and intelligence, new decision-making tools to meet these challenges, and new means of fully engaging stakeholders in the development process. ICT enabled innovations thereby facilitate this process of transformation, and

simultaneously drive further the transformation process, supporting interactions actions between actors, enabling changes in policy-making, and thereby driving change in regulatory and governance processes.

3. Towards Smart cities

The dynamics of ICT enabled urban management identified above in which ICT innovation facilitates the transformation of urban governance, and at the same time is stimulated independently by the dynamics of urban governance, forms one component of wider drives towards Smart cities, in respect of thematic and sectoral responsibilities at the local level. Such an ICT driven urban management can therefore be considered as one step towards smart cities which can be defined as:

"A smart city is a city which invests in ICT enhanced governance and participatory processes to define appropriate public service and transportation investments, that can ensure sustainable socio-economic development, enhanced quality-of-life and intelligent management of natural resources."

ICT innovation brings a significant change in cities' governance, particularly in terms of improved communication and information services, as well as offering the potential to provide urban planners with the tools and intelligence needed to actively manage the urban environment. In addition, it facilitates data acquisition from various sources by using different mechanisms such as remote sensing, sensors, smart phones, census, satellite imagery, etc and performs integration of cross-disciplinary information to obtain knowledge and intelligence for the sustainable governance of cities. The more information intelligence cities possess, the greater the opportunity to realise smarter decision making and governance, and to justify claims for smart city status.

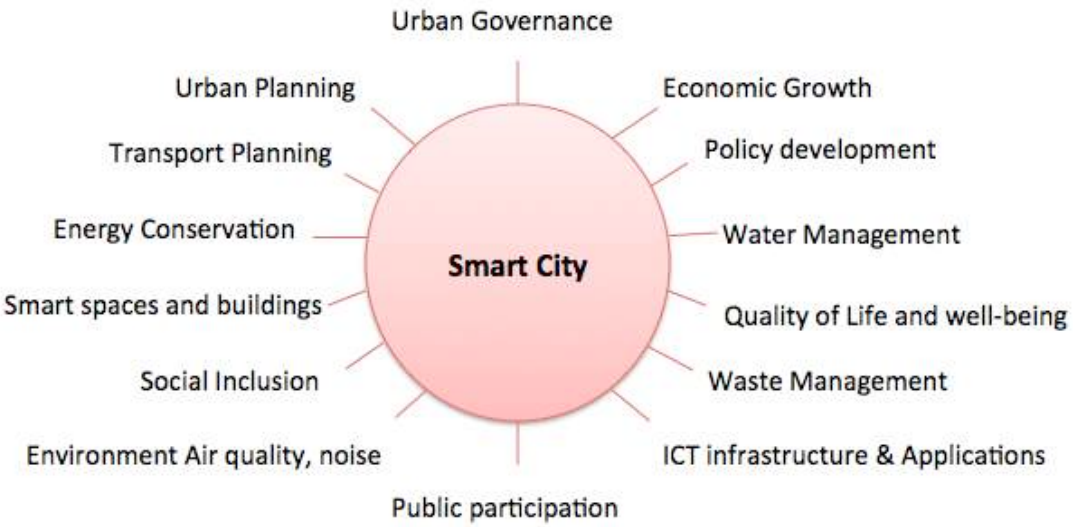

Figure 3: Smart City: Thematic Conceptual Framework

A conceptual framework for the definition of smart cities developed according to a thematic specification is identified in Figure 3, above. These thematic components include: governance, policy development and decision making; efficient use of natural/environmental resources such as water, electricity etc; reduced carbon footprint; efficient energy utilisation; citizens well-being, informed citizens and empowerment; and availability and advancement in ICT such as smart phones with ubiquitous connectivity with internet for context-aware information etc.

ICT as prime enabler for smart cities mainly utilises digital data and transforms it into a useful information, knowledge and intelligence. Cities typical already possess land use, transport, census, environmental monitoring data which is derived from various local sources but rarely is used as integrated source of information for urban governance and planning decisions. The main challenge here is to acquire integrated information from disintegrated data sources at various scales and use this information intelligently to enhance the sustainability of the city. This information can then be effectively utilised to support urban planning and management, citizens engagement, policy development and collaborative decision making.

In the above context, a smart city is primarily defined in relation to the development of ICT solutions for two interrelated issues: i) better governance and management and ii) informed citizens. Former is to get integrated information intelligence about city entities including socio-economic, road networks, structural health of buildings, demographics, environment, transport, utility services, energy consumption, water management, noise, waste management, public health etc for urban planners, policy and decision makers for better governance and sustainable

development of the city. The later is to facilitate general public with access to context aware information such as services, environment, etc. This later perspective can also be used as citizen science i.e. citizens participate in information collection such as environmental sensing data collection, biodiversity and green infrastructures, public/citizen participation for policy development and collaborative decision making. These initiatives empower general public and raise awareness about their environment and health which can result in behavioural changes for green and sustainable healthy city-wide initiatives.

4. UrbanAPI: An example

Evidence from recent surveys of European cities engagement in ICT enabled urban governance, and wider smart city related initiatives demonstrates that with notable exceptions of innovatory progress, there is as yet only limited evidence of the positive impacts of ICT-enabled innovations on city governance systems. It is reasonable to conclude that the smart cities revolution remains in its infancy and that progression towards a more mature status, and wider acceptance by European cities, will benefit from further research to identify a more comprehensive vision of its effective application, particularly where a clear user defined requirement is established. It is precisely this sort of ambition that it is addressed by the UrbanAPI project (2011).

UrbanAPI provides ICT enabled innovations for city governance and adapted governance models to support new stakeholder engagement and citizen participation, in order to enhance sustainable urban policy development and delivery. In this context, the ICT solutions proposed by UrbanAPI offer the potential to provide urban planners with the tools and intelligence needed to actively manage the urban environment. These tools aim to provide planners with precisely the information they need to fully expose the socio-economic and environmental impacts associated with alternative options for territorial development and thereby create conditions in which the political mandate and the basis for more effective management is secured.

UrbanAPI adopts an agile development methodology: cyclic and multiple tasks running in parallel. Furthermore, the UrbanAPI toolset aims to provide advanced ICT-based intelligence in relation to three urban planning contexts as depicted in Figure 4. First, UrbanAPI will directly address the issue of stakeholder engagement and citizen participation in the planning process by the development of enhanced 3D virtual reality (3DVR) visualisation of neighbourhood development proposals. Second, at the city-wide scale, UrbanAPI will develop mobile (GSM) based applications that permit the analysis and visual representation of public movement patterns across the city. Finally, UrbanAPI will develop an ICT simulation application in the city-region context addressing multiple challenges in responding to the

simultaneous demands of both expanding city populations and attractiveness of regions based on settlement and business opportunities.

The key added value offered by UrbanAPI is the extent to which these applications support the development of transformational governance - the shift from a purely top-down planning approach to one which is fully engaged with bottom-up initiatives supported by public intervention. Such applications collectively provide vital decision-making aids for urban planners in the management of the territory, as well as for the associated responsibilities in political negotiation, and wider stakeholder engagement regarding the future development of the territory.

The UrbanAPI ICT toolset and applications are being developed by the case study cities of Vienna, Sofia, Vitoria-Gasteiz, and Bologna. Local initiatives in the four urban regions working in this project are encouraged to participate within the planning process, to contribute to the final solutions and understand and finally accept the expected impacts on environment and habitants. Based on the toolset, adapted urban planning applications will be created, deployed, evaluated and used to support policy makers, planners and stakeholders at different governance and spatial levels (urban quarter level, municipal level, urban region level).

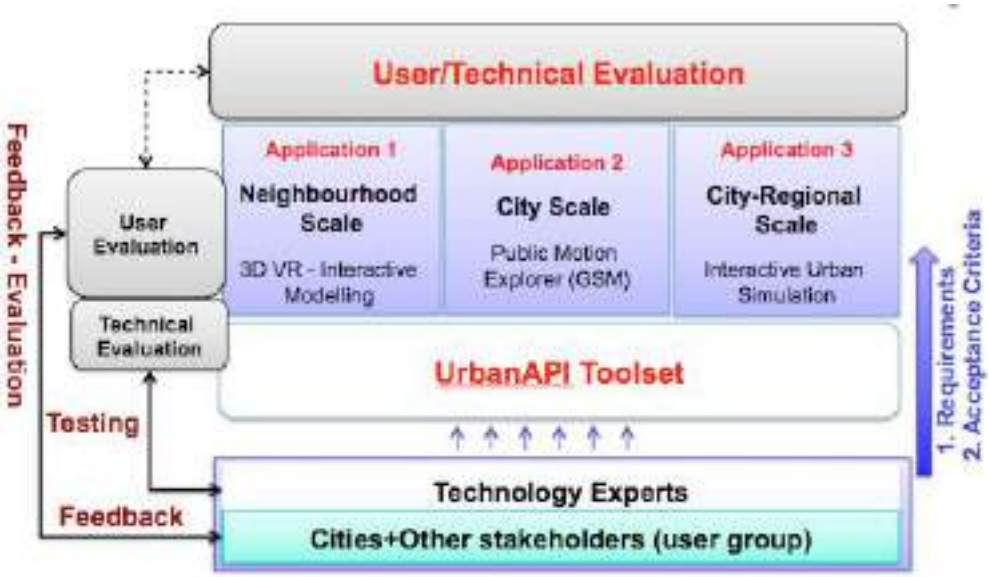

Figure 4: UrbanAPI: requirements, applications and evaluation

Each application developed in one city context is paired with another similar application in another and different city and national context, where context specific socio-economic, environmental and territorial characteristics, as well is governance structures and practices will be evident.

At the same time it is evident that the drivers of change influencing the

development of European cities, including the governance and management of urban areas, have common global and pan-European origin. Therefore lessons will be sought from the comparative assessment of the applications developed in the differing city contexts that will form the basis for the future development of generic ICT tools that can be utilised in the majority of the 500 cities of Europe with populations over 100,000, as well as other smaller cities and towns throughout Europe.

Preliminary analysis derived from the stakeholder engagement and requirement engineering process of UrbanAPI indicates that nearly 50% commonalities exist between two or more city requirements for the 3D VR application. Furthermore, usability aspects including visual aid; data synchronisation and integrity; public participation and ease of interaction with the application; accessibility of the application using different platforms e.g. web, smart phones; change impact assessment; importing new data and exporting results in common formats; and conformance to city administration IT policies form the most common functionalities required by all cities.

In addition, individually specified requirements from cities indicate new potentials which can be developed to improve the overall functionality of the 3D VR application. This suggests that based on commonalities in city requirements, that generic tools and services can be developed which can be adopted and further extended to fulfill the specific needs of new city administrations.

In a similar fashion to 3D VR, there exist about 60% commonalities between two or more city requirements for the public motion explorer (GSM) application. Furthermore, usability aspects including intuitive user interface; visualisation of aggregated population; indicating places attracted by public; extrapolation to reflect the results for overall city population; identifying social biasing; visualising motion traces between city districts/zones; intra-city and extra-city origin-destination matrices and travelling mode; accessibility using different platforms; importing new GSM data and exporting results in common formats; integration of GSM data with data from other sources e.g. GPS, polls; city administration IT standards compliance; and workflow documentation are the most commonly required capabilities for the GSM application. This again suggests that generic tools can be developed to facilitate wider adoptability of the GSM application where more specific requirements from cities add value to these common capabilities.

5. Conclusions

A smart city driven ICT enabled urban governance offers huge potential to secure effective management of the complexity of the city, incorporating new potentials for engaging citizens in defining their urban futures. ICT enabled innovations are

driving the opening up of governance models enhancing public engagement and allowing a wider audience to simultaneously contribute to the political debate and improve the quality of public service delivery. A smart city managed by contemporary ICT solutions not only facilitates enhanced intra and inter-city communication and information exchange but also enables flow of information between various levels of governance at city, regional, national and EU scale.

UrbanAPI project provides a huge potential for participatory planning and policy development by using interactive ICT applications at different urban governance scales. Furthermore, preliminary analysis of the requirements specification of four different European cities indicate that there are commonalities in policy development and decision making processes and hence demand for generic capabilities in the participatory applications can be useful and applicable in other European cities.

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