

Creating a Roadmap for Smart City Development based on Regional Strategy Work

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Keywords: Roadmap, Strategy, Smart City.

Abstract: This paper focuses on introducing a strategy linked roadmap supporting coordinated and collaborative smart city development between various stakeholders. The primary focus on the roadmapping work is to identify those actions required to make smart city ambitions a reality in a region. In a case study, a roadmapping approach is linked to regional strategy work in Southern Finland. The introduced roadmap is generic by nature and it could be applied also to other cities and regions willing to steer their smart city initiatives further.

1 INTRODUCTION

Urban areas and cities are complex social ecosystems and the coordinated development of them is a challenging endeavor. This article is about how to steer a coordinated co-development between various stakeholders to make a smart city to become a reality. On broad sense, smart cities can be categorized into two major groups: 1) high technology and infrastructure intensive approach (e.g. Seoul, Santander, Rio de Janeiro, Barcelona), and 2) citizen-centric approach (e.g. Montreal, Amsterdam, Copenhagen, Helsinki, Manchester) (d. Bergh & Viaene, 2015).

Anthopoulos & Fitsilis (2014) define a smart city as an ICT-based infrastructure and services environment that enhance a city's intelligence, quality of life and other attributes (i.e. environment, entrepreneurship, education, culture, transportation etc.) One interesting addition to the concept of the smart city is the concept of smart community. Giffinger & Gudrun (2010) define smart community in a following way: "A smart community is a community that has made a conscious effort to use information technology to transform life and work within its region in significant and fundamental rather than incremental ways." The concept of the smart community could better serve the actual focus of this particular paper while the main focus is on regional development expanding the formal city limits.

Den Bergh & Viaene (2015) argue that smart cities are typical phenomenon to talk about within

local governmental institutions and associations of cities. However, the challenge remains on what it actually requires to become a smart city. Chourabi et al. (2012) state that the success of smart city initiatives relies heavily on managerial factors. According to them, there is a lack of academic studies focusing on the managerial aspects of a smart city ambition. More and more cities are taking a strategic approach to become smart. However, most of them have the challenge to figure out the entity of becoming smart. How to connect smaller projects with each other and steer the progress from end-to-end.

The research problem of this paper is: How to make smart city ambitions a reality in a region?

This paper intends to build on existing strategy work of a region to support smart city development by providing detailed contents of a roadmap. This roadmap could then be applied to clarify the actual steps it requires to become a smart city.

Innovation in a smart city environment requires an ecosystem approach where local authorities do not act in isolation but in collaboration with other stakeholders in the ecosystem (Chourabi et al. 2012). Komninos et al. (2012) argue that smart cities are part of an open innovation ecosystem, which also supports smart city's development. In order to support the innovation ecosystem for smart city development, various public-private partnerships should be created and fostered (Lee & Hancock 2012). Den Bergh & Viaene (2015) emphasize the need for experimentation in order to support the adaptation of facilitating/permitting technology. According to Hielkema & Hongisto (2013), living labs are one

relevant approach to incubate innovation and knowledge. Typically living labs have diverse functions and their activities are aligned with user-driven innovation principles.

From management perspective a smart city is more complex compared to traditional urban planning while it implies interaction among various stakeholders that are involved with different subsystems (transportation, health, and environment among others) (Komninos et al. 2012). Cities intending to become smart cities should prepare strategic plans and follow them (Nam & Pardo 2011). Glasmeier & Christopherson (2015) argue that in the vast majority of smart city related cases the actual implementation is more about renovation rather than about building completely new urban environments. This is the reason why smart city development should be managed as a transition rather than a project focusing on developing something completely new. As part of future strategy work, the cities ought to focus on identifying their strengths and build on those (Lazaroiu & Roscia, 2012). A roadmap approach focuses on the transition, not on building up a new smart city from the scratch.

Komninos et al. (2011) have studied how the creation of a common roadmap for urban innovation and economic development makes it easier to find consensus between stakeholders on shared longer-term objectives and their priorities. According to Lee & Hancock (2012), roadmapping is a viable methodology for seeking a shared understanding of future development. Garcia & Bray (1997) imply that according to the roadmapping literature the roadmapping process consists of three subsequent phases: these phases are 1) preliminary activity, 2) actual development of the roadmap, and 3) follow-up activity. In order to make a strategy implementation really happen is to prepare a concrete roadmap guiding future actions required.

2 CASE STUDY - SMART HÄME

The applied case study in this paper is linked to the Growth Corridor Finland and especially one sub-region on that geographical corridor. The Growth Corridor is located in southern Finland between the cities of Helsinki, Hämeenlinna, and Tampere, thus binding three sub-regions together. On both ends of the Growth Corridor, there are two smart cities that are identified and documented as smart cities in literature. Helsinki, the capital of Finland, is covered among others by (Hielkema & Hongisto 2013). The smart city development of Tampere is documented

among others by Caragliu et al. (2013) and Anthopoulos & Fitsilis (2014). Almost 40 percent of all jobs in the country are within the region and nearly half of the turnover of Finnish companies is generated in the growth corridor. This paper is focused on the Hämeenlinna sub-region (Proper Häme region). The case name Smart Häme is applied in this paper to remind about the historical name of the region. The vision of the corridor is to gain a recognized position as a growth platform of Finnish competence, as Finland's largest pool of skilled labor and as a basis of national competitiveness. In the long run, the corridor ensures sustainable growth, energy efficiency and new export-led business.

The Growth Corridor itself has a roadmap including among others following steps or activities: National level steering of regional development, becoming an experimentation platform as means of combining people, organizations, and projects. The development is intended to be implemented through managing a portfolio consisting of several projects. In order to meet the needs of both private businesses as well as public sector organizations, active networking is required. However, it seems that the roadmap is not as detailed as the one proposed in this paper.

The strategic plan is based on foresight work covering future trends. The regional strategic plan is a long-term vision and strategy. Province plan assigned to pursue the development of the province and the general guidelines for the development until the year 2040. Regional strategic plan objectives will be specified in the annual provincial program, as well as the regional strategic program implementation plan and regional plan.

Regional strategic plan's strategic priorities are: 1) growth corridors and accessibility, 2) diverse housing and welfare, 3) bio-based economy and sustainable use of natural resources, 4) the possibilities for the manufacturing industry, 5) internationalization and 6) attraction of the region.

The importance of regional development is to create synergies and concentration of investment cooperation between public and private actors. Increasing the development of a critical mass of resources facilitates the creation and development of successful businesses through innovation successful business. One challenge in Proper Häme is to improve the awareness and visibility among international investors and operators in the region, and the internal and external connections. The implementation of the smart city is supported by a smart specialization strategy.

In a smart specialization is also important to be able to react quickly to meet the needs of emerging

industries. Also, promoting new entrepreneurship is important. In addition potential new startups, companies operating in traditional industries must invest in active experimentation culture, rapid and agile development projects, digitalization new opportunities provided by digitization and co-operation between stakeholders. Smart specialization it is expected to strengthen the already strong and emerging industries, enhance entrepreneurship and promote international competitiveness. Proper Häme's smart specialization priorities for the period 2018-2021 has been prepared in cooperation with the province's analysis of the strengths and utilizing statistical data.

Neirotti et al. (2014) classify different Smart City initiatives to various domains and even sub-domains. These domains are linked to the smart specializations in the roadmap. Giffinger & Gudrun (2010) propose that a smart city can be observed from six main dimensions (a smart economy, smart mobility, a smart environment, smart people, smart living, and smart governance). This paper takes another perspective and covers these smart city-related domains from four areas of specialization: Smart City, Smart Agriculture, Smart Factory, and Smart Health. In the following, these four areas of smart specialization are introduced.

Smart City

In future city structure will be more mixed with each other, overlapping the housing, logistics, work and other activities. Digital services enable features such as location-independent work, which may occur, for example, the automatic guided vehicle in connection with work or leisure-related trips. This may involve an assembly for automatic vehicles very close to each other in a sequence of passing vehicles or for one driver to control the car why many combinations.

The main objective of Proper Häme's transport system related development is to support sustainable growth in the province, to improve the functionality and safety of everyday life, as well as to ensure good accessibility of the province. Transport automation is evolving rapidly. In 2040, an autonomous robotic vehicle is likely to be a fairly conventional mover on our roads. These autonomous cars have become more common in 25 to 30-year time span. This is done while the vehicle fleet is renewed. However, the prerequisite is the development of enabling legislation supporting automatic door openers, communicating with the vehicles and the use of the infrastructure. Adapting Mobility as a Service (MaaS) is about to be a combination of smart transport systems with a door-to-door emphasis.

Smart Agriculture

Sustainable use, bio-economy and circular economy of natural resources, play a very important role in the EU and Finland's innovation strategies and development programs. Proper Häme has strong expertise in these areas. Energy efficiency and effective use of resources are becoming increasingly important targets. While resources are scarce and recycling of resources becomes an important competitive factor. The circular economy is related to the use of resources and materials improved in such a way that both the raw materials and their value will remain in circulation. In practice, this may mean, for example, that the product is designed so that the materials are separated and recycled.

Low-carbon and green economy is driven by international agreements, such as emissions trading and a commitment to complying with international climate agreement greenhouse gas emission reduction targets are increasingly influenced by the business community and individual consumers. Resources

The food industry needs domestic agriculture. Finnish conditions in the food industry largely depend on access to domestic raw materials. Agriculture and forestry production changes and changes in the demand for a new kind of breeding solutions. Also, the Finns ore and mineral resources are the subjects of increasing international interest.

Smart Factory

The manufacturing industry is one of the traditional strong industries in Proper Häme region. Digitization is expected to change the manufacturing industry significantly. Future challenges include increasing industry's competitiveness and productivity. Changes in global demand for products and raw materials, production pressures to move to lower-cost countries and the change in the age structure of Finland's population greatly affect the future of Finland's industrial structure. One objective is to increase smartness to the industry by adapting the Industry 4.0 framework.

Smart Health

Health and well-being are areas that increased utilization of technology (applications, data, genetic engineering) provides lots of opportunities. People have access to more and better ways to manage and promote their own health advances in technology. On the other hand, the growth related to the health and well-being associated with prosperity that is, those

who can afford to invest in their health. Thus, the health and well-being can also be formed more strongly in different parts of the population as a distinctive factor. From social equality and inclusion perspective, these issues should be taken into account as well.

In Finland, as well as in most European countries, the population is aging and the need for services is

growing. While the aging is also declining the share of working-age people the current way of taking care of healthcare as well as social care especially among elderly people has to be changed. One route to increase productivity and availability of health and social care services is the adaptation of technology.

Table 1: A phased roadmap for linking regional strategy work towards smart city development (adapted from Lee et al. 2013).

Preliminary activity	Phase 1: Planning	Step 1. Smart city mid- to long-term vision and goals identified	
		Step 2. Definition of roadmap	Activity 1. Individual objectives of the roadmap Activity 2. Setting roadmap boundaries and scopes Activity 3. Defining an individual timetable
		Step 3. Critical success factors for the roadmap considered	
		Step 4. Organization of the project team	Activity 1. Identify the party responsible for the development of the roadmap Activity 2. Form a working group
Development activity of integrated roadmap	Phase 2. Demand identification	Step 1. Identify urban problems Step 2. Infer demands and solutions	
	Phase 3. Service identification	Step 1. Smart city services classification	
		Step 2. Analysis of service trends (Delphi)	
	Phase 4. Technology identification	Step 1. Smart city technologies identification	Activity 1. Set classification standards for technologies Activity 2. List technologies Activity 3. Establishment and verification of classification system
		Step 2. Analysis of technical trends (Delphi)	
	Phase 5. Roadmap drafting	Step 1. Develop roadmap formats Step 2. Analyze interdependencies between service/device/technology Step 3. Develop integrated roadmap	
	Phase 6. Roadmap adjustment	Step 1. Roadmap adjustment Step 2. Roadmap verification	
Follow-up activity	Phase 7. Follow-up stage	Step 1. Development of execution plan Step 2. Execution of plan	

Active retirement age is increasing consumption of services. Demand for leisure and cultural services is increasing, and this will benefit in particular those regions that are able to provide these services and to take into account the needs of older citizens.

3 GUIDANCE ON PREPARING A MORE DETAILED ROADMAP TO SUPPORT SMART CITY-RELATED STRATEGY IMPLEMENTATION

This paper drafts guidelines on how to support transitioning towards a smart city by adapting a modified roadmapping approach developed in South Korea originally by Lee et al. (2013). They have introduced an integrated service-device-technology roadmap for smart city development. Our paper adapts a modified approach of some parts of their work to structure a roadmap for smart city development. However, since the emphasis of this paper is not directly linked to enabling technologies we have cut of some phases or steps from their framework.

The approach is such that a suggested roadmapping approach is presented in Table 1. By introducing this generic roadmap for strategy linked smart city development the intention is to support also other cities and communities with smart city ambitions to be able to proceed more systematically. The roadmap to be developed could serve as an important strategic documentation supporting communicating and directing various smart city-related initiatives.

Adapting various timeframes could be applied to provide a more detailed guidance on where to focus on various moments of time. These timeframes could be near future, mid-future and far future. It is suggested that the far future timeframe would be set in the case study's example until the year 2040 and thus link it to regional strategy work.

In order to create the contents of the roadmap, a series of workshops, several surveys, and in-depth interviews would be required. These activities belong to the next action items if there is further interest to apply smart city roadmap and link it to existing regional strategy work.

4 CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

This paper has described a regional strategy linked roadmap to support co-ordinated and collaborative smart city development. A roadmap is expected to support co-ordination between various interest groups involved as well as between the projects related to the smart city initiative. The intention is such that the developed roadmap would serve as an important strategic resource and communication tool to support smart city development. Through the introduced case study, the following lessons have been identified, which may be relevant to similar projects in the future.

To be better able to coordinate and allocate resources for development work that is expected to last over twenty years it is important to have a strategy linked roadmap for smart city development. A developed detailed roadmap would provide a comprehensive and unified view of current and future trends and actions required for smart city development. A detailed roadmap is important while it is expected that there is limited guidance on how to proceed in phases to make smart city ambitions a reality. A national, as well as regional, co-ordination would be beneficial to align various smart city-related initiatives and projects. Also, communication and real collaboration between various stakeholders is important. Too often, each city is individually developing their own services and enabling infrastructure supporting the smart city.

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