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# In Search of ICT in Smart Cities – Policy Documents as Idea Carriers in Urban Development

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**Abstract.** This paper explores how policy documents carry and institutionalize smart city ideas from high policy level to concrete policy level in an urban development context. We analyze the national urban development vision for Sweden and documents in a local urban development project in a Swedish city, in order to explore what kind of roles and expectations ICT is given in these documents. We contrast this with views of how social and environmental aspects are discussed in the studied documents. In order to understand and analyze the result we apply the concept of institutional carriers from institutional theory to our findings. Our analysis shows that as carriers of how ICT can contribute to increased sustainability in urban development, the policy documents do not function very well. ICT aspects are not put forth by any policy-making actor, neither on national nor on local level. The notion of institutional carriers helped us understand that without a responsible actor focusing on ICT's role in smart cities, it is easy to forget or lose sight of technology.

**Keywords:** smart city, urban development, policy, institutional theory, institutional carriers.

## 1 Introduction

The smart city concept is often used to emphasize how modern urban planning initiatives use information and communication technology (ICT) to fulfil the goals in sustainable development [1, 2, 10]. Strategic policy documents and visionary programs are formulated both on international (e.g. in EU), national and local levels. Previous research shows that these kind of smart city policies seem to both black-box ICT and, at the same time, take it for granted [9]. This may result in a situation where a city misses to develop and use innovative ICT solutions and, thus, becomes less smart. It might not be explicitly mentioned what kind of ICT that is envisioned in plans for a future smart city, but it is concurrently spoken of in a way as if the ICT solution already was in place and ready to use. In reality the situation often is the opposite. Visionary programs do not go into detail about specific ICT solutions, but express positive notions of technology in general terms [e.g. 6]. When the visions are realized in urban development projects other issues which impact sustainability are focused and ICT is reduced to e.g. smart electricity meters or smart alarms. The

innovative potential of ICT in urban development is, thus, not fully taken advantage of. In general information systems (IS) literature this problem has been discussed for a long time; “The IT artifact itself tends to disappear from view, be taken for granted, or is presumed to be unproblematic once it is built and installed.” [14, p. 121]. As a response to this there is a call to highlight and investigate ICT as an artefact more thoroughly in development and use (ibid.). The smart city context is no exception in this case; a main challenge here is to thoroughly understand ICT in order to find out how humans can utilize it in innovative ways that support participation, interaction, and empowerment in the city [7, 10, 12]. Only then we can claim that the city is “smart” in this context.

In this paper we aim to analyze and compare policy documents on two levels; the national urban development vision for Sweden and documents in a local urban development project in a Swedish city. We do this in order to explore what kind of roles and expectations ICT is given in these documents. We contrast this with views of how social and environmental aspects are expressed in the studied documents. The purpose of the paper is to explore how policy documents carry and institutionalize smart city ideas from high policy level to concrete policy level in an urban development project. In order to understand and analyze this we apply the concept of institutional carriers from institutional theory to our findings.

After this introduction, the paper is organized in the following way: In Section Two we discuss previous research on this paper’s two theoretical foundations; smart city initiatives and institutional theory. The research approach is reported in Section Three. The findings from our analysis of policy documents are presented in Section Four. In Section Five the findings are discussed in the light of institutional theory. The paper is concluded in Section Six, in which we also make some suggestions about the need for further research efforts in this area.

## **2 Theoretical Foundations**

This paper focuses on how policy documents carry and institutionalize smart city ideas from national visions to concrete plans in a local urban development project. In this section we discuss previous research on smart city initiatives in order to show societal challenges such urban development projects intend to address. We then give a brief overview of institutional theory, especially focusing on institutional carriers.

### **2.1 Smart City Initiatives**

We are experiencing a time with several intertwined mega-trends that impact our lives [6]. Climate changes and emission of greenhouse gases are important reasons for taking the climate threats seriously and striving for environmental-friendly solutions in urban development [cf. 18]. The globalization has been on-going for a long time and includes an intense interchange of information, goods and trade, tight links between different parts of the world and interdependent economies [6]. Increasing urbanization is another trend; in 2030 the prognosis says that more than half of the world’s population will live in cities [23]. Many cities thus grow rapidly which make

construction activities and good planning important ways to deal with the increasingly dense cities. The fourth trend, which impacts on smart city development, is digitization [3, 26]. Digitization is discussed in terms of an intensive information flow, communication speed, integration, and digital meetings as complement to, or alternative to physical meetings. The need for a robust and accessible communication infrastructure as a precondition for creating smart cities is highlighted [12].

Facing all challenges that these mega-trends comprise, the city has been assigned an important role in achieving sustainability [11]. The concept of smart cities has been defined as an inclusive framework to “mitigate and remedy current urban problems” [1, p. 40], by focusing on several dimensions of city development such as economy, governance, people, natural environment, and infrastructure [13]. Caragliu et al. [5, p. 70] argue that a city is smart “when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance”. It is obvious in both research and policy-making that hope is put on smart cities to solve the above-mentioned problems [6].

Several researchers have discussed what constitutes a smart city. Hollands [10] argues that in order to be successful a smart city must focus on humans and understand how they interact, instead of just hoping that ICT by itself will transform and improve cities. A similar argument is found in Nam and Pardo [12] who emphasize the need of a socio-technical view of the smart city. They pinpoint a smart city’s main components as technology factors, human factors, and institutional factors. In order to understand smart city development we need to understand the relation between technology, people and policy, and how these interact with outer factors such as governance, economy, built infrastructure, and natural environment [1]. Building on this notion of several interacting aspects that together define a smart city, we will focus on social, environmental and ICT aspects when analyzing policy documents in urban development, below.

## **2.2 Institutional Theory and Institutional Carriers**

Institutional theory, or new institutionalism [17], in institutions and organizations [e.g. 20] is powerful when studying the complex nature of ICT, institutional forms, its embeddedness in contexts and understanding change [19]. The smart city is an example of a context where we find this kind of complexity [12]. Institutions are structural arrangements that guide and restrict actors’ behaviour [4]. Important dimensions in institutionalism can be expressed as three pillars both representing and supporting institutions; regulative, normative, and cultural-cognitive [20, 22].

Studying ICT within an institutional framework can be motivated by the fact that ICT have a directive power within institutions and institutionalization that can be traced back to the cognitive and normative elements embedded in ICT artefacts [8]. The three pillars above can be summarized as follows. The regulative pillar contains the constraints and regulation of behaviour; setting and formulating rules, monitoring and sanctioning such activities (e.g. to arrange rules, to follow or monitor rule compliance, rewards or even punishments). The normative pillar contains values and

norms. This includes what is preferred or desirable and the assessment of such aspects. Norms express how things should be done and is the core of legitimacy and the means to reach certain objectives [22]. The cultural-cognitive element as the third pillar rests heavily on sociology and organizational studies. Symbols are important and expressed in terms of signs, gestures, and words shaping collective and individual understanding in institutions (ibid.).

The pillars and elements above are carried in institutions by different vehicles [21]. Carriers are tightly linked to every aspect of the pillars and can be understood and analyzed for example in terms of symbolic systems carrying: regulative elements (e.g. rules in smart city development regarding buildings and infrastructures), normative elements (e.g. values and expectations of ICT in a smart city on a conceptual level), and cultural-cognitive elements (e.g. categories and typifications of ICT or smartness in policy documents). Relational systems can also carry regulative elements (e.g. governance structures and power systems), normative elements, and cultural-cognitive ditto. Activities as a third type of carrier are also a vehicle for regulative, normative, and cultural-cognitive elements. Last but not least, artefacts (like ICT) can have a role as vehicles for all three types of elements. All carriers are non-neutral and carry the values, preferences, and social constructions given to or implemented in them.

### **3 Research Approach**

We have followed and studied a Swedish local urban development project in a qualitative and interpretative case study [25] for almost two years and have, thus, gained detailed understanding of the early phases of the project (from its launch to the municipality's local plan decision). In this paper we focus on the qualitative and discursive analysis [15, 16, 27] of policy documents on different levels; a national vision of sustainable urban development as well as several policy documents that are important in the studied development project. By analyzing how social, environmental, and ICT aspects are expressed and formulated in the documents we illustrate how smart city ideas and ideals are transferred and "flow" between documents representing different phases in a development project – from a strategic and overall level to a more operative and local level. At the same time we acknowledge the deliberate and network-oriented perspective on policy-making and policy processes as being more "messy" and less linear than they usually appear on a strategic level, and also carried by human actors. As information systems and e-government researchers we focus extra on how ICT is described because of the identified risk that ICT is taken for granted and not problematized, as discussed above, in previous studies.

The studied urban development project was launched in late 2011. We have studied the project during the phases of architect competition, exhibition, planning, exploitation, procurement, and local plan decision (see Figure 1 below). The project aims to build a new district and organize a home and urban construction expo in parallel. Social and ecologic sustainability are two dimensions that are much emphasized in the project. The project shows typical characteristics of the aim of a smart city which makes it suitable to use as an empirical case in this paper.

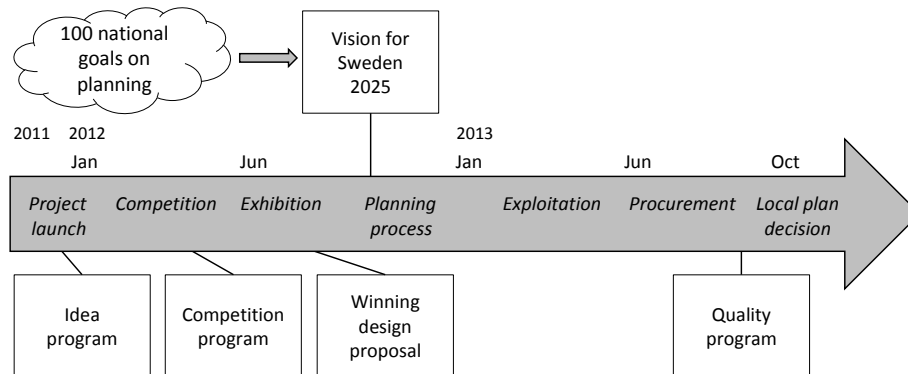


Figure 1: Project development process and related policy documents

We have collected data about the project through several methods; we have attended internal project meetings and external stakeholder workshops, interviewed stakeholders, and studied documents, such as policy documents, project information material, and project web information. Altogether we have gained rich empirical data about the early phases of the project through different kinds of sources and interventions. In this paper we have a certain focus on policy analysis and other data collected in the project serves, thus, as background information. Here the qualitative data analysis of the policy documents is guided by institutional theory, as we use the concept of institutional carrier as a theoretical lens [24]. However, our data analysis is also inductive in terms of being sensitive towards the empirical material when identifying and acknowledging interpretations of the overall view from the policy documents and the urban development project.

## 4 Analyzing Policy Documents

Five policy documents on different abstraction levels are analyzed below, in order to illustrate how social, environmental and ICT aspects are expressed on different policy levels and possibly transferred between levels (Table 1). The documents are: 1) Vision for Sweden 2025, 2) the idea program of the studied local urban development project, 3) the competition program, 4) the winning design proposal, and 5) the quality program including the local plans.

### 4.1 Studied Policy Documents

In 2012, Sweden's National Board of Housing, Building and Planning conducted a strategic analysis, based on existing global analyses, which is reported in "*Vision for Sweden 2025*" (translated to English in 2014). The purpose of the vision is to present holistic objectives for Sweden's future based on 100 national goals that relate to physical and social planning in different ways. The document has a long term planning perspective and puts physical planning in the foreground; other related

issues like social sustainability are in the background and included only if related to the physical social structure. A sustainable society is the major long term objective; i.e. building for environmental care. The document is: “Intended to be used as a conceptual foundation when preparing strategies for sustainable development at different levels.” (p. 51) and should be used as inspiration for: “[...] promoting sustainable social development at all levels from national to local” (p. 51). The target group for the vision is politicians and public officials at all levels: from national to local, from central to local agencies and different organizations and private stakeholders.

The *idea program* describes the purpose of the project in order to guide the future work. It rests on three pillars; knowledge, social sustainability, and creativity which should permeate the future local district. The idea program is written by municipality officers and is targeted to anyone interested in the project. The program states the project’s visions of future front edge urban development based on citizen dialogue.

The *competition program* is based on the idea program and communicates the visions of the future district in order to inspire architects to come up with design proposals for how to realize the project. The view that is conveyed to the architects is the one of a varied district where nature, culture and social activities are in focus. The competition program is written by officers from the municipality in collaboration with representatives from a university, a local energy company, and a housing company.

The *winning design proposal* was chosen by a jury examining the 27 proposals sent in to the competition. The design proposal explains the architect firm’s idea of how to realize the visions of the local district, both in text and illustrations.

The *quality program* contains the local plans which are developed based on the winning proposal. The program is written to support coordination and design of the district. By expressing the desired character of the district a holistic approach is aimed for. The quality program also stipulates demands, recommendations, and responsibilities concerning sustainability that must be met by the building companies that take part in the project. The document is written by the Environment and Planning Administration in the municipality and it is directed to the building companies as a base for their participation in the land allocation process.

## **4.2 Expressions of Social, Environmental, and ICT aspects**

*Social aspects* could of course include many different issues, but in the vision for physical and social planning in Sweden the main emphasis is put on social development and how to achieve a good life. The expression “places fit for people” is used to describe a future where urban districts include everything needed to work and live there. Such urban districts are described as hubs for development. Extensive public transportation networks and green areas for recreation are two examples of how human needs are focused. Everything should be close by and easy to access, no cars are needed and people should be able to choose a resource-saving lifestyle. Opportunities for social integration and distance-learning are included in this vision. In the idea program these ideas are transferred into “a place for everyone to meet, work, live, and learn”. Parks and gardens are also highlighted as places for recreation. The importance of citizen involvement in the planning process is highlighted as a

consequence of a main emphasis on achieving social sustainability through this urban development project. In the competition program social aspects are found in the objective to develop a district that is resource efficient, beautiful and human-friendly. In the winning design proposal it is suggested that neighbours share winter gardens. Another design proposal relating to social aspects is that community houses, where people can meet and interact, should be built. In the quality program these design ideas are realized in form of a community house and a green house in every block. We also find demands for the building companies regarding outdoor lightening, easy access to nature, and the use of health-friendly materials.

Many of the above-mentioned examples of social aspects also have a connection to *environmental aspects*. In the vision for physical and social planning in Sweden we see the call for efficient public transport infrastructure and decreased motor traffic in the urban district as examples of ways to encourage and support an overall resource-saving lifestyle. A strive for increased energy efficiency and a fossil-free electrical energy system are other highlighted goals. In the idea program this is translated to innovations in energy effective buildings, locally produced electricity, and sustainable construction material. Environmental aspects are thus discussed in rather general terms. However, in the competition program it is stated that the district should make it easy for the individual to act climate smart. In order to emphasize the environmental aspects bikes and public transportation should be prioritized instead of cars. The goal is to build a dynamic and robust environment that should be sustainable and easy to adjust to new demands. In the winning design proposal this is converted into a car pool and electric car charging stations together with good public transportation. Another idea is that the residents should grow vegetables locally and, thus, decrease the need for transportation. By building for densified, close living energy efficiency will increase and a CO<sub>2</sub> neutral district is aimed to be a reality in 2025. In the quality program we see how these ideas are formulated in a planning that supports walking, biking and public transportation. Car pools are suggested and parking by houses is not allowed. Smart meters are installed in all houses and electricity surplus should be possible to deliver to the power grid.

*ICT aspects* are treated in rather general terms in the vision for physical and social planning in Sweden. It is stated that communication infrastructure is a robust precondition for services and information flows, and that e-services are important tools to connect citizens and public sector agencies. Mobile devices are also mentioned as important in order to communicate both in cities and in rural areas. In the idea program this is described as smart and innovative ICT solutions which should be used in order to decrease consumption of natural resources. Another effect of using ICT should be increased availability, service and social presence. In the competition program this is concretized to mobile solutions that will enable people to work at home, in cafés and public places. It is also mentioned that smart grid technology should be implemented. The winning design proposal suggests that smart grid technology should be used in the district in order to enable both energy production and consumption. In the quality program ICT aspects are not explicitly mentioned at all. The concept “climate smart” is mentioned, but it is not stated what constitutes smartness in this case.



Table 1: Policy documents' expressions of social, environmental, and ICT aspects

	Vision for Sweden	Idea program	Competition program	Winning design proposal	Quality program incl. local plans
Social aspects	Social development and a good life are promoted	A place for everyone to meet, work, live and learn	A resource efficient, beautiful and human-friendly district	Neighbours share winter gardens  Community houses where people can meet and interact	A community house and a green house in every block  Demands for outdoor lightening, access to nature, and health-friendly materials
	Physical spaces that fit people  Social integration	Citizen involvement in planning process  Parks for recreation			
Environmental aspects	A sustainable environment with "places fit for people", decreased motor traffic in cities and an overall resource-saving lifestyle	Innovations in energy effective buildings, locally produced electricity, and sustainable construction material	Easy for the individual to act climate smart  Bicycle and public transportation instead of cars  A dynamic and robust environment, sustainable and easy to adjust to new demands	Densified, close living increases energy efficiency  Public transportation  Car pool and charging stations  Locally grown vegetables decreases transportation  CO <sub>2</sub> neutral district 2025	Walking, biking and public transportation  Car pools, no parking by the houses  Smart meters installed in all houses  Electricity surplus possible to deliver to the power grid
	Efficient transport infrastructures				
	ICT aspects	Communication infrastructure, a precondition for services and information flows  E-services – connecting e.g. citizens and public sector agencies  Mobile devices for communication in cities	Smart and innovative ICT solutions to decrease consumption of natural resources and increase availability, service and social presence	Mobile solutions to enable people to work at home, in cafés and public places  Smart grid technology	Smart grid technology enables both energy production and consumption

When comparing the main view of ICT in the analyzed documents a picture arises where the high level policy starts with discussing ICT in broad terms. We see traces of digitization in the intelligent home where smart energy use is in focus. When turning to the concrete policy level and the idea program, which is the most visionary

document among the project documents, we find an explicit ambition to build a climate smart district. However, neither in the idea program nor in the competition program ICT solutions are explicitly mentioned. The winning design proposal states that smart electricity meters will be implemented in the buildings. Finally in the quality program (local plans) ICT is not mentioned at all. This is a clear example of the situation we described in the beginning of this paper; that ICT aspects are neglected, taken for granted or seen as so unproblematic that they do not need to be commented on. In Table 1 above, the found expressions of social, environmental, and ICT aspects in the studied documents are summarized.

## 5 Discussion

From this analysis of policy documents we find that rather few ICT solutions and innovations are expressed in high level policies and even fewer seem to survive during the transfer to concrete policy level. Instead, sustainability solutions are dominating when we come closer to the concrete urban development project. The ICT dimension of smartness does not reach out the entire way, and instead smart resource use, without ICT, ends up being in focus. The policy documents do not offer any new visions or ideas when it comes to ICT innovation. Of course we should not regard ICT as an end in itself, but it is definitely an important means to create and realize the visions of the smart city [1, 10, 12]. There might be many reasons for this situation to arise. In the studied policy documents there seem to exist several, partly competing, values such as social sustainability, inclusion, integration and ecological sustainability. ICT is not put forth by any policy-making actor or framework of rules, etc. Furthermore, it seems as the building industry has a rather conservative view of ICT (because of rules and regulations, but also organizational and professional culture), thus, the ICT aspects of smartness seem to be neglected or reduced to existing technologies (e.g. smart grid and smart meters) in the local plans.

From an institutional theory perspective [22] we identify that important pillars and elements are carried in different ways and by different expressions and actors in the studied policy documents. There are several *rules* regarding how to plan and build that are present in different stages of the policy process, and the plans that are expressed in the studied documents. Rules are *regulative* and constraints what is possible to do in a formal plan and building process (regarding e.g. compulsory and necessary steps to be taken as a part of an institutional process). *Normative* elements are also present affecting what is to be considered as legitimate and desirable. It is also expressed in terms of values of sustainability (e.g. environmental aspects in Table 1 above) in all types of documents analyzed above. Environmental aspects are part of the core of legitimizing the smart city and the means to reach certain objectives [cf. 22]. These elements travel all the way through the policy documents, as stated above, and are an evident part of the policy-making from national strategies to the local project. *Cultural-cognitive* elements in the form of symbols are evident here, since words carry different ideals, such as sustainability in ecological or social terms. These elements are also carried by several strong actors, who make them “survive” throughout the process together with activities in the same line. Social

aspects, in Table 1 above, are also carried throughout the process and expressed as what is preferred and/or desirable. Normative elements are clear regarding e.g. the community ideal, interaction and integration. Those ideals are also carried by symbols (words) and significant actors in the studied project.

When analyzing the policy documents also from an institutional point of view, we identify that values and norms regarding ICT artefacts are not that evident. ICT is not a significant part of the prefix smart at any level or setting in the studied documents. There are ideals and meaning of ICT being part of a communication infrastructure, a carrier of services, and a precondition for mobile solution on a general and national policy level, but these ideals and ideas are not that evident in documents throughout the process, and not carried further in a clear and convincing way. The visionary ideas, or to put it in other words, the ICT edge is lost. There are signs of ICT being a part of grids and mobile applications, but more as one means among others, to achieve e.g. sustainability. ICT is not an objective or significant artefact that constitutes the smart concept. The analysis reveals that the local policy documents are dominated by values and norms connected to the building process and strong actors in this field carrying those ideal, rather than ICT related relational system structures (e.g. strong governance structures or power systems supporting ICT as an important aspects in a smart city project). This goes in line with the underpinning from the institutional perspective and the perspective in this study, that all carriers are non-neutral and carry the values, preferences, and social constructions given to or implemented in them [21, 22].

Activities, as another carrier, do not support ICT as a key component of the smart city concept in the development process. In that sense ICT is overruled by other values and norms as a part of a policy process dominated by environmental and social aspects (Table 1), not ICT aspects. The ICT related values and norms are not effectively carried throughout the different documents representing the policy process from a strategic level to a local level. Maybe this is not surprising since building processes are highly regulated and institutionalized. The innovative dimension of the smart city concept, however, can be threatened when not using ICT as an active and symbolic element in policy-making processes.

## 6 Conclusions

In this paper we have analyzed how five policy documents on different abstraction levels express social, environmental, and ICT aspects connected to the urban development process. The purpose of this study has been to explore how policy documents function to carry and institutionalize smart city ideas from high policy level to concrete policy level in this kind of projects. By applying the theoretical concept of institutional carriers [21, 22] to our findings, we have discussed possible explanations to the fact that social and environmental aspects dominate in the policy documents while ICT aspects are almost non-existing. It is interesting to notice that even though ICT is perceived as an important smart city component in literature [1, 10, 12] it does not have the same prominence neither on high policy level nor on concrete policy level. In this paper we have shown that policy documents carry and

institutionalize social and environmental ideas and ideals. However, as carriers of how ICT can contribute to increased sustainability in urban development, the policy documents do not seem to function very well. We have searched for expressions of how ICT is envisioned to support the smart city, but found very little evidence of this. One could expect a leak of ideas during the transfer between policy levels and documents, but if the ICT aspects are not there from the beginning they will not emerge during the process.

An important finding in this study is that the ICT aspects are not put forth by any policy-making actor, neither on national nor on local level. The notion of institutional carriers helped us to see that if no one is responsible for focusing on ICT it is easy to forget or lose sight of technology. Thus, ICT disappears from the view, is taken for granted or underestimated as uncomplicated [14]. A theoretical contribution is, thus, that researchers need to theorize about the role of ICT artefacts in order to achieve “smartness” in urban development. A practical implication of this is that in order for future urban development projects to reach the high expectations of smart cities solving grand challenges of urbanization, globalization, and climate changes, ICT must be focused. ICT can be used to combine social and environmental aspects in innovative ways and, thus, realize the ideas and ideals of the smart city, but ICT can also be the carrier of such ideas in the smart city context. ICT is not an end in itself, but an important means for realizing the smart city.

Applying institutional theory to empirical data from an urban development project has helped us to discuss policy documents as carriers of smart city ideas in a promising way. In future studies a more thorough analysis of findings from both policy and practice levels would be interesting to conduct in order to further understand the meaning of ICT in smart cities. These studies can also include other regional and national contexts in order to challenge and handle the limitations of studying only one context above.

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