Adaptive learning in smart cities – The cases of Catania and Helsinki

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Abstract

Our research is a comparative qualitative study. The material has been gathered from the cities of Helsinki and Catania. The target cities showcase varied successes and models of smart cities. In the cities, key people involved in the smart city concept – with different kinds of professional backgrounds – were interviewed, both individually and in teams. All interviewees had at least a basic knowledge of information technology and of organizational learning processes. On the basis of these interviews it has been possible to create an overall picture of learning processes occurring in the organizations involved (universities and local government) and within the smart city programmes produced or still to be developed. We explore how the expertise has been challenged: how the key players of the smart city uphold the concept and promote it.

Keywords

Smart city, smart learning cities, innovation capacity, adult learning, expertise, regional learning

Introduction

The developing of smart cities (SCs) is a hot topic right now. At the moment, the U.S., Europe and Japan are, for instance, funding initiatives and implementing SC technologies to address current urban problems such as energy shortages, traffic

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congestion, inadequate and poor urban infrastructure, health and education. The European Union is supporting the implementation of SC strategies for metropolitan city regions, e.g. Amsterdam, Barcelona, Bath, Berlin, Edinburgh and Manchester (Lee, Phaal, & Lee, 2013).

The SC concept is especially used to identify a large spectrum of heterogeneous solutions and city programmes, involving different types of technologies and aiming to reach a very large set of different and not well-defined goals (Dameri & Cocchia, 2013). Among some of the critical success factors for the creation of 'smart/intelligent communities' (Komninos, 2009, 2014; Stratigea, 2012, p. 379), effective education and training of the labour force and high rates of adoption/use of information and communication technology (ICT) infrastructure are both considered as key factors to increase the capacity of the workforce to perform knowledge-intensive activities and to enhance the potential of participation in the knowledge creation processes (Bell et al., 2008).

Our study concentrates on the issue of challenges to the learning environment within the concept of SC, characterised by multiple focus areas. The learning dimension is becoming more central within SC discussions.

Our starting point is that the evolution patterns of a SC highly depend on its local context factors (Neirotti, De Marco, Cagliano, Mangano, & Scorrano, 2014). In this context, SCs are not possible outside the development of smart communities; communities that have learned to learn, adapt and innovate (Coe, Paquet, & Roy, 2001; Schuller, Baron, & Field, 2000), according to the lifelong learning paradigm (Delors, 1996; OECD, 1996). We must not forget, in fact, that learning is a process of acquisition and transformation of knowledge that enables continual adaptation to the environment to take place. The key role played by learning processes, both individual and social within the community at different levels (from the individual to the company, to groups of enterprises connected to each other and to government bodies) in the production of constant change is paramount so that an economic organization based on awareness and learning is able to flourish (Florida, 1995).

The purpose of our research is focused on highlighting and understanding learning processes that managers, workers, researchers and organisations operate in their daily working activities to meet the challenges that the cognitive development of SC requires. The role played by ICT in organizations has been largely described in Information Systems literature and organization studies, especially as regards the revision of the working procedures and service delivery to citizens. However, the goal of our research is to reveal the learning processes that people involved in the development of SC implement in tackling complexity – a factor featuring in cities – as well as complex situations and cases, where there is no pre-known outcome.

The importance of this analysis lies in the awareness that various learning approaches and levels characterise the diffusion processes of SC initiatives. Indeed, so far such initiatives have been studied considering different needs and

contextual conditions around the world, or the characteristics and future trends of SC, or the obstacles that slow down ICT diffusion (Neirotti et al., 2014). The novelty of the research lies in the analysis of the learning factors that can support the SC's initiative and applications, moving from the perspectives of the workers involved in the processes. To analyse the learning processes implemented, the researchers referred to the model of professional expertise offered by Dreyfus and Dreyfus (1980, 1986), which outlines an individual's progression of skills acquisition in the everyday experiences of learning.

In this study, we consider the key change to involve a transition from closed systems to open ones. Open systems refer to novel processes where end-users become service designers, service co-producers and assessors. That is supported by open data and information flow. From this perspective, services are constantly developing interactive processes, where reformation and learning are based on information, experience, and, in process, learning. Technological solutions are a part of open systems. The use of technology enables, for instance, the transfer of information, the involvement of customers into services and the production of interactive information (Laitinen, Harisalo, & Stenvall, 2013). In closed systems, the logic supported thinking in which novices used the learning strategies of following and asking experts. In open system models, this dichotomy of experts and novices is questioned and challenging; even experts fundamentally act towards a difficultly predictable future.

Theoretical basis

SC

SC has been in discussions and became fashionable especially after 2010, but is still somewhat fuzzy or not clearly defined. SC has been used even to refer to cities that do not have clear strategies or processes supporting that (Dameri & Cocchia, 2013). The SC concept originated from that of the 'information city', but now has a much broader and deeper scope.

The SC concept is based typically on six focus areas: a smart economy, smart mobility, a smart environment, smart people, smart living and smart governance (Lee et al., 2013). The following characteristics may be seen as common to many SC definitions. SCs (1) utilise networked infrastructure to improve their development, efficiency or competitiveness; (2) have emphasis on business-led urban development, (3) aim to achieve the social inclusion; (4) have high-tech and creative industries in a crucial role; (5) pay attention to social capital and (6) are sustainable (Caragliu, Del Bo, & Nijkamp, 2011). It is clear that the 'smartness' of a city lies not only in infrastructures, but also in the enormous wealth of human resources and in the social capital that a region is able to generate to promote social innovation and regional development. This means that the smartness of cities is not determined exclusively by strategies related to energy saving and to traffic management.

The SC definitions highlight also the importance of identifying possible challenges and wicked problems related to future technologies. Those are deeply linked to future city demands and also imply most likely that the SC industry will grow.

The ways of building SCs are based more on bottom-up approaches in which cities provide access to data and allow citizens to make their own decisions (Ratti & Townsend, 2011). In this vision, efforts made to improve the quality of life of the citizens play a central role more than investments in ICT, considered as a way to solve the emerging problems of urban living. Some city governments are able to generate innovation in the way services and communications are delivered to the local population, involving citizens over time (see Boyle & Harris, 2009; Lee, Hancock, & Hu, 2014; Smart Cities, 2011; Von Hippel, 2005). While during the last decade bottom-up approaches to innovation and urban development have emerged and become dominant within the SC paradigm, on the other hand many European cities are still struggling with the limited diffusion of Internet access and the scarce use of internet-based services among the local population (Neirotti et al., 2014; Schaffers et al., 2012).

Clearly, the superficial use of the SC concept in the policy arena and the underestimation of the possible negative effects of the development of the new technological and networked infrastructures needed for a city to be smart (Graham & Marvin, 2001) can be interpreted as a lack of interest on citizens and communities and lack of awareness of those involved in 'smart city' development (Giovannella, 2016). As outlined by various scholars (Chourabi et al., 2012), some of the challenges of using technologies in SCs lie in the shortage of IT skills and, concerning the e-government services, in a lack of skilled staff who are familiar with major IT skills (Ebrahim & Irani, 2005, p. 604; Moon, 2002).

It is now acknowledged that SCs involve consideration of 'soft factors' that have to be holistically accounted for. Hence learning dimension has not been mentioned very often as such within SC discussions. Some researchers have noted, though, that SC initiatives 'can also include human capital investments' in order to foster a city's learning and innovation capacity (Neirotti et al., 2014, pp. 6–7). Practically, this means that professionals working in 'smart' cities and regions should be supported to integrate informal and non-formal learning with formal paths, to systematise what has been learned on the field, and to recognize their competences.

The nature of expertise

Stuart and Hubert Dreyfus presented in 1980 an influential five-stage model of adult skill acquisition. Those stages are novice, advanced beginner, competence, proficiency and expertise. The novice professionals tend to be rule oriented and try to function like a computer following a program, which in turn produces poor performance in the real world (Dreyfus, 2004; Dreyfus & Dreyfus, 1980).

The expert has intuitively wider and broader understanding of the situation and its requirements. The expert sees what must be achieved and also how that goal can be achieved, while novices have a tendency to follow the rules when solving

problems without deeper understanding of the context in which those rules operate. Experts, on the other hand, seek the solution based on intuition, experience and knowledge so that they use those problem-solving strategies that apply and bring results without putting too much weight on rule obedience. Experts have thus an intuitive grasp of the situation, and this intuition can be defined in terms of implicit knowledge (Peña, 2010): 'when we speak of intuition or know-how, we are referring to the understanding that effortlessly occurs upon seeing similarities with previous experiences. We shall use intuition and know-how as synonyms' (Dreyfus & Dreyfus, 1986, p. 28). In addition, they have the ability to focus on the accurate details related to possible solutions without wasting time with a large range of irrelevant details and unfruitful options. Experts have an ability to recognise patterns (Daley, 1999; Dreyfus, 2004; Dreyfus & Dreyfus, 1980; Loh & Sheng, 2013).

According to Dreyfus 'the expert has learned to distinguish those situations requiring one reaction from those demanding another'. Because of the vast experience in diverse situations, the expert's cognition decomposes situations into subclasses, each of which with a specific response. This pattern recognition allows experts to intuitively create meaningful responses (Daley, 1999; Dreyfus, 2004). Novices and expert learning strategies are different. Novices tend to ask experts and take formal courses and they wait to be told what to learn. Novices need 'scaffolded, iterative, and recursive experiences to acquire the perceptual background they need to develop an intuitive feel for the information behaviours proper to a domain of practice' (Farrell, 2013). Expert learning has been recognised to be constructivist learning (Daley, 1999).

In leading the analysis, two cities characterised by different levels of implementation of SC, Helsinki (Fi) and Catania (It), have been considered. The differences between the levels of development recognised by the international rankings, tied with the most effective implementation of development policies, are functional to understand if and how learning processes achieved by workers involved in the improvement of SC reflect different levels of professional expertise and different approaches in addressing adaptive challenges.

Methodology

Our research is a comparative qualitative study. The material has been gathered from the cities of Helsinki and Catania. The target cities showcase varied successes and models of SCs. One strategy in doing a comparative study is to avoid similar cases. According to Flyvbjerg (2006), the typical or average case is often not the richest in information and extreme cases may reveal more information. Thus, in this study, we followed the comparative strategy, which is the variation-finding comparison. In these kinds of studies, e.g. *the most different approach can be used to compare two or more cases of a particular process to understand why difference or similarity persists* (Ward, 2008, p. 18).

Two case studies were carried out to support the theoretical discussion to clarify the learning processes on SC implementation. Qualitative research techniques were

used, because the researchers' interest was mainly focused on ideas, notions, experiences and perceptions about the learning processes involved in the SC development. The research techniques included document analysis, face-to-face interviews and focus groups. The first insights about SC concept were gained in 2015, when an in-depth interview and two focus groups were conducted in the City of Helsinki (12 people). In 2016, in-depth interviews and a focus group were conducted with 11 experts in the city of Catania.

Each interview and focus group lasted from 45 min to 1 h 15 min. All the interviews and focus groups were conducted with IT professionals (or at least with a basic knowledge of IT) and/or of organisational learning processes. Both in Helsinki and in Catania people interviewed represented different kind of specialists (Table 1). Some of them have, for instance, professional backgrounds in technological or ICT sectors. There were specialists from the social and health care sector (Helsinki), from cultural heritage, urban planning and entrepreneurship fields (Catania) and from research- and innovation-oriented units. What should also be noted is that in the focus groups there were no specialists in learning processes (although some of those interviewed come from the university) and this might have affected the contents of the interviews. All interviewees from Helsinki worked for the municipality; the interviewees from Catania worked for the University of Catania and research centres; one of them was a consultant for the Municipality of Catania's SC project. They were all involved, at different levels, in the SC programme. In general, interviewees gave a quite reliable and valid picture of what has happened in Helsinki and Catania's SC programme.

Table 1. Specialists of Helsinki and Catania.

Helsinki	Catania
Twelve interviewees	Eleven interviewees
Specialists in ICT	Specialists in ICT (3)
Specialists in R&D	Consultant for Municipality SC project management programme
	Researchers on cultural heritage (4)
	Manager of IBAM (Cultural heritage research centre)[a]
	Director of CAPITT (University Centre for transfer of innovation)
	Researcher on urban planning
Involved in the smart city programme	Involved in the smart city programme
Municipality	University and research centres

ICT: information and communication technology; SC: smart city.
[a]IBAM is a multidisciplinary research institute with high expertise and specialised skills in the fields of knowledge, documentation, diagnosis, preservation, enhancement, fruition and communication of archaeological and monumental heritage. These skills are expressed through the multidisciplinary personnel of IBAM, composed of archaeologists, architects, geologists, engineers, chemists, physicists, computer scientists in addition to technical staff which supports actively all research lines (chttp://www.ibam.cnr.it/en/).

The interviewers played an active role, encouraging diversity by active intervention, informal information exchange and encouraging personal comments, suggestions and reflections. The interview questions were generally the same for all interviewees. They were aimed at obtaining information about the SC concept and development and their perception of the learning processes needed to support and to face new changing working environments in relation to the organisations they represented and their experiences. The questions were arranged in four thematic sections: the first one was concerned with the SC concept and the technological changes needed, the second part with the learning processes that SC development requires, the third one with SC and the adaptive capacity, and the last one with adaptive leadership.

The interviews and focus groups were recorded, transcribed in full or part and coded. Then a qualitative content analysis was carried out to find common theme ideas and key differences, considering the cultural context of the interviewees and the different implementation levels of the SC model. To assess the inter-coder reliability in a qualitative content analysis, we used the participants of the research only.

Results and discussion

The counterparts of SC comparison: Helsinki and Catania

Helsinki is the capital and largest city of Finland in the region of Uusimaa, southern Finland. Helsinki has approximately 621,000 residents. The City of Helsinki organization is comprised of 30 departments and six public utilities. The City maintains approximately 4000 facilities around the city area and approximately 20 outside the city borders. The City employs a total of around 39,000 people, around 33,000 of whom were permanent employees. Helsinki scores high on the European digital city index, being fourth in 2015 (EDCI, 2015). The CITIE 2015 index, City initiatives for technology, innovation and entrepreneurship, notes that Helsinki, which was third on that index, has the most consistent profile of any of the top five. CITIE describes Helsinki as having a highly collaborative approach to working with local entrepreneurs (CITIE 2015 Index, 2015).

Catania, a metropolitan city in Italy, includes 58 municipalities and has 1,078,766 inhabitants (2011); its 10-year population growth rate is 2.3%. The education level is slightly lower than the national standard (0.12 is the graduation rate for the inhabitants of Catania, compared to the average rate of 0.16 in the Italian capital cities). Catania shows a high unemployment rate far exceeding the Italian average, with a high concentration of unemployed people in the capital municipality itself. The unemployment rate is, in fact, 27.31% compared to an average value of 14.42% in the other Italian capitals. The overall rate in the 58 municipalities making up the whole metropolitan city of Catania is 23.93% versus a 13.73% average value of the metropolitan cities. Although the employment levels are critical, there is an increase in the business sector (5.7% for companies and 8% for workers between 2001 and 2011).

As for the smartness of the city, the 2014 SC Index, the national ranking of the smartness level achieved by the 116 Italian province capitals, shows Catania in 43rd position (whereas Bologna is the smartest city in Italy, with a score of 100 and 11 top thematic areas out of 12). Despite the improved overall ranking (in 2011 Catania was only in 72nd position), the index still identifies three deficit thematic areas (education, government, energy) and two totally inadequate ones (health and natural resources). Catania is the only smart Sicilian city in the field of smart culture and travel (where it is among the first 39 Italian municipalities). Although the index sees it as an improvement, the process of innovation and digitalization to make Catania a SC seems to be slow and still based on a silo approach rather than being grounded on interoperability, the only model than can really favour the economic sustainability.

In Catania, the PRISMA project, launched in 2012 and funded by the National Operational Programme for 'Research and Competitiveness' 2007–2013, aimed at testing the eGovernment for open and dynamic digitising, systematization and consultation of the data related to the themes of urban decoration, mobility and social services. The aim of the project, which has recently created the SC portal of the city (December 2015), is to create an organizational structure exclusively dedicated to the SC, to help achieve the 'profound change' as stated in the portal: 'A change that affects daily life, administration, technologies and infrastructures'.

The project also addressed IT professionals by offering them 'a standard, strong and reliable platform always updated and maintained by professionals', considers citizens and the public administration as privileged users. Citizens are encouraged to communicate disruptions in town (City Reporter), or are offered app solutions to optimise movements (City Mover), or are provided with information about charities and their services (City Welfare). For the government there is a platform including all the typical components for local public administration solutions (Open Data Hub, e-Government Process Management System, Portal Services, Geo-Portal, etc.) provided in Cloud mode.

Beyond such technical experiments, what is really needed is to frame, in a unique setting, the various 'smart' initiatives carried out in Catania on environment, energy, and promotion of cultural heritage. The governance issue is important, because if these experiences are not properly placed deep in the system, they are likely to remain episodic, so wasting energy, resources and human capital in fragmented interventions. Moreover, together with the executive ability of the city's political leadership, we must deal with the issue of overcoming the resistance to the implementation of SC systems – often rooted in the administration itself – and the dissemination of a culture of participation among the citizens. In general, culture is a critical element on a national basis, and it is true that 'the population is not involved in innovation projects in a smart key: only 1 Italian out of 5 knows the meaning of smart city' (The European House-Ambrosetti, 2012).

The index findings contribute to clarifying the importance of defining effective development policies, not down to a single contributor, but involving communities of individuals to design and install the improvements to the city, starting from

the history and culture that has shaped it. This lack of dialogue and collaboration – partially linked to the absence of a customary participation – decreases the possibilities to communicate and does not allow the good practices generated by the different stakeholders in the territory to become policies for the cities and to find opportunities that may make them sustainable.

SC concept and technological changes

The contents of the SC programme are very comprehensive in the City of Helsinki. The idea is that not only city employees are integrated in the programme but also, for instance, service users and stakeholders, such as private companies. The ideology of the programme is based on open-system thinking. The programme covers various activities of the city, such as social and health care services, traffic and environmental issues. The SC programme especially brought together two activities: smart technology development and participation. Some interviewees also take into consideration that if people are well educated they typically have a capacity for reflexive learning.

> The question in learning is who is teaching, and whom
> Who knows information handling best and who is the quickest to learn

> A part of learning is that even if you tried to make more analytic solutions, so that you don't get any misconceptions, that the entity is not necessarily predictable.

The culture of developing new things is also important in SCs. Hence, we found in the focus groups that the processes and working methods are not necessarily suitable for learning and adaptive technological development. Especially structural rigidity is a big challenge. For this reason, many interviewees expected that the SC programme would cause radical changes in the city. One of the interviewees summed up his viewpoint by saying that those actors are successful who 'have the agility' to learn.

In Helsinki during the interviews, some individuals spoke a great deal about competence management, learning and a learning organization as characteristics of SC. Quite many of the interviewees referred also to some key thinkers in the field (e.g. Boyd Cohen was mentioned numerous times).

> What you would need in an intelligent city are city sensors. For example, parking and street lighting could have some intelligence attached to it to suitably direct people's activities

> If the starting point is technology and with it the possibilities to participate would become a part of, for example, city planning, the result must be that the process will also change

In Helsinki, the majority of the interviewees shared a 'big picture' of a SC, that is they referred to networking, social capital, sustainable city and eco-systemic collaboration with ICT companies and start-ups. Organizations do not necessarily have a deep conception or meta-theory of the true purpose of their operations.

From the 'smartness' perspective, therefore, neither do they have a picture of what they should know and what kind of knowledge they should possess, or information on this, but in the case of Helsinki the SC concept seemed to be quite clear. Their comments also well addressed information technology and the City's ICT strategy; these were deemed to support development towards the goals of SC.

In Catania, all the interviewees agree that SCs are multidimensional systems, and even those of them more focused on a particular dimension do not fail to acknowledge the importance of some other dimensions as well.

The reference to the use of ICT for functions related to the Public Administration (PA) ('*becoming leaner*') and that may facilitate citizens' access to services ('*to do this, you will need the data digitization*') is prevalent. Thanks to ICT, the city is connected, which makes information available to everybody, facilitates interaction and allows citizens to '*live their city in a better way*'. ICT is a tool used by 'Smart' cities to support joint planning and provision of services for the benefit of the urban communities.

From such a viewpoint, the role played by the PA is essential, whereas also the cultural heritage – an area of great interest for Catania and that many respondents felt strongly characterises the city – is its expression. The surveyed people are well aware that a city that today starts its route to become 'smart' needs to both respect its unique history and culture, and to experiment with innovative solutions.

> *A "smart" city is a city able to invest in the regeneration, especially if linked to the sphere of public and cultural interest (squares, gardens, cultural spaces). Regeneration has repercussions both on the wellbeing of the population that on the attractiveness from a touristic point of view.*

For Catania, a city with many critical issues that does not know its history, smartness is the chance to enjoy its artistic and cultural heritage and to generate '*a spread (diffused) knowledge*'. The SC suggests innovative approaches in doing research and making it available to the beneficiaries (either citizen or tourist); in this way it operates aiming at '*social inclusion*', which is its final target. In addition, the social dimension of the SC is recognised in its focusing on resources, respect for the environment, waste management and its tourist vocation.

> *Investing in the renewal means to consider Smart City not as a product but as an on-going process. In this process searching for solutions to the various problems can be seen as the outcome of inclusive governance, collaboration with industry, co-design processes with users: all this will decreed success. Smart cities are using ICTs as a tool for assisting in the co-design and co-delivery of services to the benefit of urban communities.*

A SC is, then, a city able to invest in renewal, especially if linked to the public–cultural sphere (spaces, squares, gardens, cultural containers), because it has implications both for the welfare of the population and on its attractiveness from a touristic viewpoint. However, as pointed out by some respondents, the smartness

cannot be limited only to the dissemination of new technologies, however important in facilitating connections. Technological changes are necessary but not enough. SCs must '*start with people*' rather than believing that ICT alone can automatically transform and improve cities (Hollands, 2008, p. 315). '*Changes must relate to the systems but also citizens who have to learn how to participate*'.

Among the technological innovations it would indeed be desirable – as suggested by one respondent – to create a portal that makes available in real time

> *data that describe the weather conditions, pollution level, critical events in environmental and social terms, and which can also raise awareness and spread opportunities for citizens in relation to public transport, job opportunities, assisting disadvantaged, local markets, aggregation and cultural exchange opportunities.*

However, the idea of such a portal needs to be supported by a system of real activities coordination and therefore by an appropriate governance system. In fact, it is quite clear to respondents that the sore point of Catania is the lack of coordination of initiatives and the absence of a shared construction of the SC vision (someone mentioned an '*inclusive governance*'). In an ideal model of SC, people ('*companies and users*') are crucial to its success or failure, by adopting and using services and by participating in the governance and the management of the city (Castelnovo, Misuraca, & Savoldelli, 2015). Smart means '*learning ability*' that is not concerned with intelligent systems only. '*It is the mental attitude of those who govern and of those who live*' in such cities.

From the citizen's viewpoint, one of the respondents believes that learning and adjusting to changes might be easier than you think, especially when citizens understand that innovations are assets belonging to them. And this is the case of the LivingLab, created for the promotion of the city's cultural heritage. It has allowed the transformation of the traditional services into technologically advanced ones. At the same time, the creation of a multimedia laboratory accessible to all, thanks to the presence of informative and interactive instruments, has returned a new vision of cultural heritage to a heterogeneous public – mainly consisting of citizens and tourists – who have rediscovered elements of their historical, artistic and cultural tradition.

To achieve the change it seems necessary that educated and informed people must engage in the SC initiatives, and the paradigm of the past 50 years about the relationship between PA and citizens radically changes. The SC represents a chance to '*overcome the antagonism*' between PA and citizens and to learn together. Managing data implies '*confidence*' and if there is no trust between the citizens and the public offices, dialogue is a difficult target to achieve.

When discussing the technological changes necessary to make the SC functional, not all respondents have a clear view of the ongoing processes. Only one researcher seems to be aware that the development lines are already traced, and they are essentially related to the interoperability of services and applications and the possibility of an easy connection and dialogue between PA services and applications.

'*The Public Administration and University should open up to researchers so that they can get information without asking for those*'.

It was observed that the problem is not the digitization itself, although '*not all administrations have in fact scanned all the data*', but the availability of such data for those who need them. The main problem is always transparency and access to services.

Although the input to such a city should mainly start from the PA that, according to one respondent, in Catania doesn't seem to wish to take full charge of the process, we must say a word about the role of the university. The changes towards SC should also cover the University of Catania, in order to make the workers (administrative and faculty members) aware of the study and research opportunities that open up. What you notice is that the university is still a traditional structure, lacking the referents that should lead this change: there is a strong '*disconnection*' between the academic staff and the administration workers. This leads the territory to assess the university as '*useless*' for the development and smart innovation purposes.

The learning processes for the SC

Data, information and knowledge are the key issues of SC. In Helsinki, one interviewee noted that that the departments and the field have been divided into two distinct worlds – those who plan and those who do, 'the brains' and 'the hands'. But that is now in flux and changing because of the digitalisation of services. As for concrete measures, this means engaging citizens and employees such that they participate more in the planning and increasing the amount of interaction. This will increase flexibility.

During the interviews in Helsinki, it was noted that the key factors to enhance a SC's service innovativeness, knowledge sharing and cooperation are the mix of knowledge and competencies of all members. That means how well an organization is led, how fast it is learning, how it interacts and changes. Some interviewees noted that employees who are focused on demonstrating competence are less likely interested in learning new skills, but repeat doing tasks where failure is unlikely and in which they have succeeded before. On the other hand, the organisation rigidity was related also to data overflow and data analysis challenges. '*There is so much data that their causes and effects remain unrecognized*'.

It seems that the challenge of learning is people's capacity to analyse information in SCs. This challenge concerns, for instance, city employees, service users and decision makers. According to this viewpoint, if people cannot analyse information they cannot learn and adapt their behaviour.

> *Information is not just flowing from administration to citizens but also with user orientation . . . when citizens are made involved, so how can this information be utilized and harnessed . . . how to autonomically utilize and verify the validity. If this is based just on citizens' own activity, it is not a completely representative sample . . .*

> *How to involve citizens in the development of their own city. This requires outlining localism in a different way, because people are interested in where they are living . . . how*

they want to influence, where they spend their lives . . . How could you motivate modern
citizens with something decades ahead.

In Catania, questions about learning as a tool to make people and organizations adjust to both SC external and internal demands and daily challenges and to increase technical know-how created some hesitation. Respondents stated that they had never paid attention to the topic of learning in smart contexts, although almost everyone said that they had to adapt to the change, modifying already consolidated mindsets and operating procedures. The biggest difficulty was to think over the process that each of them implemented; almost everyone preferred to speak about training activities rather than learning ones. Only one researcher had some knowledge of the organizational learning processes, given his previous experience in a company. In Catania, all agreed that a solid basic training with a specialization relevant to the technological dimension, supported by the presence of IT experts, is fundamental for people working in a 'smart' context. City workers should learn how to cooperate and use the potential of ICT for a continuous and constructive dialogue with the citizens '*in facing and trying to solve the most crucial issues*'. Technicians and experts should learn how to make their expertise available so that '*even the less experienced people may benefit from ICT*'.

'*Digitization requires training*' and the '*training supported*', thanks to the presence of an expert, according to the novice level of Dreyfus and Dreyfus model (1980, 1986), seems to be the preferred way to enhance learning.

A solution could be a 'supported' training
Guidance is necessary. Even if I learn by-doing I need to know if I'm doing well
In PA some experts in ITC used to coach employees to learn new routines
A training course for managers of the PA could help them understand what are the
difficulties that the user encountered when data are not correctly transcribed

Respondents recognise that learning in the workplace has an essentially experiential nature and the learning process of the SC technologies requires '*continual experimentation*'. However, the support of a '*guide*' – a '*reviewer*' of the involved processes – is deemed necessary to support workers in strengthening the knowledge and skills they had acquired informally. Among the tasks of this guide or tutor, an employee of the company or an external consultant, there are also those of leading the workers in their reflective path and in the consolidation of their acquired knowledge.

Despite respondents assigning importance to the figure of the expert, what emerges from the interviews and focus groups is that, in dealing with the innovations of the SC, they had to find autonomous paths to respond to the requests for change, albeit as a reactive response to a problem caused by the introduction of new applications. Interaction with information technology systems seems to make some of these people accidental users,

a person who is forced to use a specific system or artefact to achieve an end, but who would prefer to do it in a different way if alternatives existed. From the point of view of the accidental user, the system is therefore a barrier that is blocking access to the goal – or which at least makes it more difficult to reach the goal. (Marsden & Hollnagel, 1996, pp. 346–347)

None of the respondents explicitly refer to group learning activities or to community practice experiences (Wenger, 1998).

To the researchers engaged in the enhancement of cultural heritage, learning meant '*to revise one's own mission as a pure archaeologist*' and '*roll up one's sleeves*', substantially changing '*the way people think with regard to and with technologies*', thanks to a change of '*attitude*'.

And this is what also happened to some PA officials. When the central administration started the service of inefficiency reports by the citizens, the offices had not been computerised quickly enough. Officials, thus, had to handle the data coming from the citizens using outdated methods and technologies. In the individual offices, employees organised themselves, often in an empirical way, to solve the problems, especially given the amount of work that has increased considerably.

What can sensitise the learning of those who are not familiar with technologies? Much depends on the person (someone speaks of '*character*' or '*goodwill*') and from his/her willingness to open up to novelties. Working in smart contexts implies the distortion of mentality and '*a different interoperability*'. Nevertheless, we cannot fail to notice how the introduction of new technologies has often caused a refusal in learning, especially because neither citizens nor workers have immediately perceived the real improvement in their life experience or in the working practices. '*Novelties always frighten people. Some practitioners thought that new technologies would create more difficulties in the relationship with citizens*'.

While adults decide 'to be ready to learn something when they experience a need to learn it to cope more satisfyingly with real life tasks or problems' (Knowles, 1980, p. 44), what is lacking is the motivation to learn and the sharing of objectives. Although the role of a leader in promoting change and communicate with 'novices' is very important, 'being told by someone (like the boss) that it would be good for them' is seldom a convincing topic for adults (Knowles, 1987, p. 170).

Also, due to the absence of '*measurement of the learning objectives achieved by the operators*' (for lack of political will) and, consequently, any form of recognition of the achievements, according to some this will further reduce the motivation to learn. Poor motivation and lack of sharing of the strategic objectives also concerns the university, where we see '*island-like*' and '*compartmental*' processes of change. The '*full sharing of information*' is totally missing and information systems do not communicate with each other. The logic is still that of separation and absence of dialogue (e.g. a respondent complains that teachers have not been informed about the process of change). On the other hand, tools that could facilitate the sharing of information may be found, but because academic staff don't know their full potential, they remain largely unused.

In Catania, the interviewees put relatively more emphasis on details and how the SC could technically be copied and implemented in a 'right' manner. In Dreyfus' model this was considered more as novice or beginners learning while experts primarily were considered to learn through a process of dialogue and sharing (Daley, 1999; Dreyfus & Dreyfus, 1980, 1986). In Helsinki, the interviewees mentioned numerous times that the challenge is to keep the process as a learning process and to convey the ideas and lessons of a learning organisation to the operation well enough to produce genuine readiness for change.

In the citizens' training process, the associations, which can inform/train, might play a role and for them '*mediate*' with respect to the innovations introduced by the PA. The SC needs to involve not only engineers or systems scientists but also civic organizations, local associations and community groups that can support the creation of a 'smart civic space' (Sadoway& Shekhar, 2014). Less incisive seems to be the role of universities in learning pathways, as it takes up little to involve citizens also in the dissemination of the results of the research on the SC. It proves a lack of that civic intelligence which represents 'the ability of humankind to use information and communication in order to engage in collective problem solving' (Schuler, 2001, p. 166).

Conclusions

There are some clear distinctions between Helsinki and Catania. First, it seems that the dominant SC discursion in Catania is more characterised by a history push than in Helsinki, whereas the dominant discursion is more based on future pull. In Catania, interviewees referred to history and cultural heritage clearly and notably more often than in Helsinki. The history-dominant discursion leads to view development through an incremental process rather than a system-wide change.

Second, interviewees in Catania referred to digitalization and technology more often as a supportive system. In Helsinki, SC was more often referred as a holistic system and as a paradigm shift. In Helsinki, the interviewees also referred to SC theories and theorists, to open innovation and the wisdom of crowds aligned with the SC process.

These distinctions echo the three classical observations of organisational learning. The first is based on routines, the second is that organizational actions are history dependent and more on the past than the future and the third is that organizations are oriented to targets (Levitt & March, 1988). Hence, organizations typically improve their competency within a quite narrow set of routines until they are somehow forced to explore and co-create new routines. In Catania's case there seems to be very little real need to change patterns of behaviour and routines, whereas in Helsinki a very vital and core part of the dominant discourse is to reinvent itself and interviewees commonly shared the understanding of the need to renew and change the system. The historically dominant system in turn typically adapts incrementally to past experience, which drives into repetition of choices that support the past choices (Levinthal & March, 1993). As the interviewees in Catania

referred to skills gap that history dominance seem to link competency traps especially when the existing routines are not seriously challenged.

In the interconnected SC, experts are the key players in creating platforms to collaborate with a variety of participants in an open learning community. The history dominance is controversial to the characteristics of experts, who are assumed to have varying levels of flexibility in their approach to new situations. Thus, the expertise of the history dominant case was more focused on the challenges and barriers of the technology than on the acceptance of the concept and the smartness of the city. That, in turn, creates a challenge to knowledge transfer between experts and novices and organizational outcomes. Thus, in Catania's case the interviewees' answers illustrate the challenges of the SC concept showing that the expertise is not a fixed role, but in obtaining and sharing knowledge even experts are both experts and novices or advanced beginners at the same time.

In Helsinki, experts have a key role in the SC exploration and through the ongoing development programme also in exploitation. In Helsinki, the experts referred to the others' readiness to change as a challenge. In both cities, the experts defined the SC as a novel way to create and share information so that interaction and innovative, educational learning are brought alongside technological issues. At the same time, in neither city did the experts systemically see themselves as learners, yet in a SC the knowledge transfer is comparable to the communication, interactive process including all the aspects of obtaining and sharing knowledge, co-creating and interpreting the information. The real challenge for experts is that instead of making a routine of repeating what is already known, the goal is to understand, through patterns of interaction between people, the unfamiliar and the unknown.

Information, its accessibility and interpretation and the organisation's ability to use it have been internal drivers for change within organisations. The lower the predictability of organisational activities and the greater the uncertainty about everything continuing unchanged in a linear fashion, the more important it becomes to be able to add value to information through networks, create interpretations for it and enable its application.

Technology alone is not enough for SCs, because changes in the operation environment give organisations impetus for constantly refreshing their competence and better utilising the information at their disposal. The growth in demands has been seen to apply, in particular, to expert competence and the availability of information in organisations that process, interpret and distribute information. And at the same time, a SC's open system logic challenges the linear closed system thinking. In an open system, experts may not rely on their roles or positions; both experts and novices, learners at the same time in front of the difficultly predictable.

The concept of a SC is developing and maturing and means more than the use of ICT technology. However, most municipal departments have quite little experience of how to collaborate around shared data, more agile and modular development methodologies and insufficient holistic understanding of the SC concept to devote to this effort. As technology and data analysis are becoming more central to

municipalities and delivering public services, new or updated skills are required of civil servants. This study shows that there is a real need to constantly assess smartness of the SC from the learning perspective: how people obtain and share information, and co-create and interpret the information.

References

Bell, R., Jung, J., & Zacharilla, L. (2008). *Broadband economies. In Creating the community of the 21st century* (pp. 22–32). New York: Intelligent Community Forum.

Boyle, D., & Harris, M. (2009). *The Challenges of Co-production: How Equal Partnerships Between Professionals and the Public are Crucial to Improving Public Services*. London: Nesta.

Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart cities in Europe. *Journal of Urban Technology*, *18*(2), 65–82.

Castelnovo, W., Misuraca, G., & Savoldelli, A. (2015). Citizen's engagement and value co-production in smart and sustainable cities. In *International conference on public policy* (pp. 1–16). Milan.

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., & Scholl, H. J. (2012, January). Understanding smart cities: An integrative framework. In *System Science (HICSS), 45th Hawaii International Conference IEEE* (pp. 2289–2297).

CITIE 2015 Index. (2015). *City initiatives for technology, innovation and entrepreneurship*. Retrieved from http://citie.org/2015-results/

Coe, A., Paquet, G., & Roy, J. (2001). E-governance and smart communities: A social learning challenge. *Social Science Computer Review*, *19*(1), 80–93.

Daley, B. J. (1999). Novice to expert: An exploration of how professionals learn. *Adult Education Quarterly*, *49*(4), 133–147.

Dameri, R. P., & Cocchia, A. (2013). Smart city and digital city: Twenty years of terminology evolution. In *X conference of the Italian Chapter of AIS* (pp. 1–8). Milan, Italy: Università Commerciale Luigi Bocconi, ITAIS.

Delors, J. (1996). Education for tomorrow. *UNESCO COURIER*, *49*, 6–11.

Dreyfus, H. L., & Dreyfus, S. E. (1986). *Mind over machine: The power of human intuition and expertise in the era of the computer*. New York, NY: Free Press.

Dreyfus, S. E. (2004). The five-stage model of adult skill acquisition. *Bulletin of Science, Technology and Society*, *24*(3), 177–181.

Dreyfus, S. E., & Dreyfus, H. L. (1980). *A five-stage model of the mental activities involved in directed skill acquisition* (No. ORC-80-2). California Univ Berkeley Operations Research Center.

Ebrahim, Z., & Irani, Z. (2005). E-government adoption: Architecture and barriers. *Business Process Management Journal*, *11*(5), 589–611.

EDCI, The European Digital City Index. (2015). Retrieved from https://digitalcityindex.eu/

Farrell, R. (2013). Reconsidering the relationship between generic and situated IL approaches: The Dreyfus model of skill acquisition in formal information literacy learning environments, part II. *Library Philosophy and Practice (e-journal)*. Paper 1049. Lincoln: University of Nebraska.

Florida, R. (1995). Toward the learning region. *Futures*, *27*(5), 527–536.

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, *12*(2), 219–245.

Giovannella, C. (2016) Mettere persone e comunità al centro delle smart city: Un'arte che si impara. *Forum PA.IT*. Retrieved from http://www.forumpa.it/smart-city/mettere-persone-e-comunita-al-centro-delle-smart-city-unarte-che-si-impara

Graham, S., & Marvin, S. (2001). *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. Psychology Press.

Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City*, *12*(3), 303–320.

Knowles, M. S. (1980). *The modern practice of adult education*. Chicago, IL: Follett Publishing.

Knowles, M. S. (1987). Adult learning. In R. L. Craig (Ed.), *Training and development handbook* (3rd ed., pp. 168–179). New York, NY: McGraw Hill.

Komninos, N. (2009). Intelligent cities: Towards interactive and global innovation environments. *International Journal of Innovation and Regional Development*, *1*(4), 337–355.

Komninos, N. (2014). *The age of intelligent cities: Smart environments and innovation-for-all strategies*. London, UK and New York, NY: Routledge.

Laitinen, I., Harisalo, R., & Stenvall, J. (2013). *Palvelutiede julkisten palveluiden uudistajana – Kansainvälinen vertailu*. Tampere, Finland: Tampere University Press.

Lee, J. H., Hancock, M. G., & Hu, M. C. (2014). Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. *Technological Forecasting and Social Change*, *89*, 80–99.

Lee, J. H., Phaal, R., & Lee, S. H. (2013). An integrated service-device-technology roadmap for smart city development. *Technological Forecasting and Social Change*, *80*, 286–306.

Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic Management Journal*, *14*(S2), 95–112.

Levitt, B., & March, J. G. (1988). Organizational learning. *Annual Review of Sociology*, *14*(1), 319–338.

Loh, C. S., & Sheng, Y. (2013). Measuring the (dis-) similarity between expert and novice behaviors as serious games analytics. *Education and Information Technologies*, *20*(1), 5–19.

Marsden, P., & Hollnagel, E. (1996). Human interaction with technology: The accidental user. *Acta Psychologica*, *91*, 345–358.

Moon, M. J. (2002). The evolution of e-government among municipalities: Rhetoric or reality? *Public Administration Review*, *62*(4), 424–433.

Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). Current trends in smart city initiatives: some stylised facts. *Cities*, *38*, 25–36.

OECD. (1996). *Lifelong learning for all*. Paris, France: OECD.

Peña, A. (2010). The Dreyfus model of clinical problem-solving skills acquisition: a critical perspective. *Medical Education Online*, 15, 4846.

Ratti, C., & Townsend, A. (2011). The social nexus. *Scientific American*, *305*(3), 42–48.

Sadoway, D., & Shekhar, S. (2014). (Re)Prioritizing Citizens in Smart Cities Governance: Examples of Smart Citizenship from Urban India. *The Journal of Community Informatics*, *10*(3). Retrieved from http://www.ci-journal.net/index.php/ciej/article/view/1179.

Schaffers, H., Komninos, N., Pallot, M., Aguas, M., Almirall, E., Bakici, T., & Hielkema, H. (2012). Smart cities as innovation ecosystems sustained by the future internet (p. 65). Technical report.

Schuler, D. (2001). Cultivating society's civic intelligence: Patterns for a new 'world brain'. *Information, Communication and Society*, *4*(2), 157–181.

Schuller, T., Baron, S., & Field, J. (2000). Social capital: A review and critique. In S. Baron, J. Field, & T. Schuller (Eds.), *Social capital: Critical perspectives* (pp. 1–38). Oxford, UK: Oxford University Press.

Smart cities: Co-design in smart cities. A guide for municipalities from smart cities (2011). Retrieved from http://www.smartcities.info/files/Co-Design%20in%20Smart%20Cities.pdf.

Stratigea, A. (2012). The concept of 'smart cities'. Towards community development?. *Netcom. Réseaux, Communication et Territoires*, *26*(3/4), 375–388.

The European House-Ambrosetti. (2012). *Smart cities in Italia: Un'opportunità nello spirito del Rinascimento per una nuova qualità della vita.* Retrieved from http://www.smartcityitalia.net//wp-content/uploads/2014/10/REPORT_ABBAmbrosetti_Completo.pdf.

Von Hippel, E. (2005). *Democratizing innovation*. Cambridge: The MIT Press.

Ward, K. (2008). *Comparative urbanisms: Past work and future agendas. Imagining urban futures.* Working Paper 5. Manchester: University of Manchester.

Wenger, E. (1998). Communities of practice: Learning as a social system. *Systems Thinker*, *9*(5), 2–3.