Making computer and normative codes converge. A sociotechnical approach to smart cities*

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Abstract. In this paper, we propose that a smart approach to city development must seek a continuous and recursive interplay between two levels of codes. On the one hand, *computer codes*, which rule the development and the functioning of the ubiquitous ICTs infrastructure. On the other hand, *normative codes*, which govern the practices through which social actors perceive ICTs and decide to exploit them in order to improve their lives. We thus take an exploratory standpoint and investigate to what extent key players in the EU smart cities policy domain are framed according to such a sociotechnical perspective. To this purpose, we first map an online issue network on the topic of smart cities in Europe and then explore the frames that circulate within its core. Our results suggest that, although smart cities are framed sociotechnically, EU key players tend to better converge around technological aspects rather than social ones.

Keywords: smart cities, socio-technical systems, frames, online issue networks

1 Introduction

The label "smart city" has rapidly become a passe-partout concept to indicate collaborative projects aimed at virtuously integrating enhanced human and technological possibilities for developing the urban environment and improving the quality of life within it. Above and beyond the semantic richness and, perhaps, even the vagueness that stems from the widespread adoption of this label, smart cities can be broadly defined as "places where IT is combined with infrastructure, architecture, everyday objects and even our bodies to address social, economic and environmental problems" [1]. Thus, smart cities usually present five main characteristics: i) the widespread embedding of ICTs into the urban fabric; ii) business-led urban development and a neoliberal approach to governance; iii) a focus on the social and human dimensions of the city from a creative perspective; iv) the adoption of a smarter community agenda with programmes aimed at social learning, education and

* The research leading to these results was partially funding by the EC Seventh Framework Program under grant agreement n. 600854, Smart Society (http://www.smart-society-project.eu/).

social capital; v) and a focus on social and environmental sustainability (Hollands 2008 quoted in [2]).

To be fair, even in the pre-digital age cities always tried to be as "smart" as possible [3]. In fact, governmental and institutional actors, often in partnership with business entities, have always pushed forward strategies to address and, possibly, solve great social and environmental challenges. As the abovementioned definitions suggest, what truly characterizes current struggles to urban smartness is the role played by information and communication technologies. Few would deny that contemporary technological possibilities do provide an unprecedented ground for improving our endeavors to efficiently and effectively govern and manage urban environments. Contemporary ICTs are indeed characterized by an unprecedented *materiality*, i.e., by a pervasive networked structure as well as by an interactive modus operandi. Such materiality guarantees the continuous production of data streams and preludes to a "real-time understanding" of our cities [2].

This nonetheless, such materiality *on its own* is not conductive of any effect. In order to benefit society, it needs to be "set in motion" by social actors according to their intentions and expectations [4]. Thus, social actors can approach the same materiality with a variety of different aims and thus perceive the same technology as able to afford different functions. Therefore, at the crossroads between human and technological agencies, smart city projects can take many different forms depending on several factors: the "future scenarios" that decision-makers envisage for their cities, the role they assign to ICTs within these scenarios, how the strategies they propose to turn these scenarios into reality are implemented by citizens in their daily lives.

While existing accounts tend to emphasize almost exclusively the great potentialities connected to the pervasive diffusion of ICTs, they seem to overlook the challenges that emerge from grounding the smartness of our cities into these tools and the data they produce. Placing ICTs at the core of smart cities does not mean solely leaning on an unprecedented and innovative infrastructure: it does introduce a twofold dependence on both technological *and* social factors. This dependence requires much more than simply *acknowledging* that there are two sides to any smart city strategy or policy that may be elaborated. In fact, it means rooting any successful smart city project into the *constitutive entanglement* between social and technological elements. As stated by [5]:

> A position of constitutive entanglement does not privilege either humans or technology (in one-way interactions), nor does it link them through a form of mutual reciprocation (in two-way interactions). Instead, the social and the material are considered to be inextricably related — there is no social that is not also material, and no material that is not also social.

Thus, to be "genuinely smart", a project of urban development must not be oriented by any priori assumption on the effects that technology will generate, as materiality is always mediated by social perceptions of available options, i.e., of affordances. In the same way, an excessive emphasis on social variability should also be avoided. Indeed,

a specific materiality does invite users to adopt certain behaviors and, although infinite variations are possible, routines of uses are always likely to emerge.

Ultimately, a smart approach to city management and development must seek a continuous and recursive interplay between two levels of codes. On the one hand, *computer codes*, which rule the development and the functioning of the ubiquitous ICTs infrastructure that permeates our lives and has the potential to revolutionize them. On the other hand, *normative codes*, which govern the practices through which social actors perceive ICTs and decide to exploit them in order to change and, possibly, improve their lives. The more these two levels of coding will converge, the more smart cities will be shaped as consistent and coordinated *sociotechnical systems*, wherein ICTs are actually "embedded" within society and there is a constitutive relationship between technological and social networks [6]. Conversely, the more computing and normative coding activities will diverge, the more ICTs will remain simply "pervasive" without necessarily setting an active contribution in shaping (and thus enhancing) the social interactions and practices that innervate our cities.

2 Investigating the sociotechnicality of smart cities in Europe

Over the last few years, smart cities have actually become one of the most important components of the European Digital Agenda (EUDA) - the EU initiative for the full exploitation and integration of ICTs for enhancing Europe's economy and empowering its citizens. Quite interestingly, the official EUDA website defines smart cities as "a place where the traditional networks and services are made more efficient with the use of digital and telecommunication technologies, for the benefit of its inhabitants and businesses".[1] Moreover, the website specifies that the concept of smart cities "goes beyond the use of ICTs for better resource use and less emissions" and thus encompasses innovation within the procedures for governing and administrating urban environments.

On the overall, the above definition appears to be consistent with the great emphasis put on ICTs as the core element of contemporary smart cities. At the same time, it acknowledges that the employment of these tools must not be self-referential but, rather, geared towards generating social and economic benefits. However, to a closer look, the EUDA definition seems to suggest that efficiency and social benefits *flow directly from* a not-better-specified "use" of technologies whereas EU citizens (but also business entities) are depicted somehow as *passive recipients*. Is this definition a hint of the fact that the EU is adopting a mainly techno-deterministic perspective on smart cities? Or, rather, is it an attempt to provide a general conceptual framework within which computer and normative codes can actually converge? Ultimately, how sociotechnical is the EU approach to smart cities?

In order to begin answering this question, we take an exploratory standpoint and investigate how key players in the smart city domain at the EU level frame this issue in the online public space created by the World Wide Web.

[1] https://ec.europa.eu/digital-agenda/en/smart-cities

Our investigation roots into two main premises. First, we borrow from social movement studies the idea that *frames*, i.e., the cognitive "schemata of interpretation" hold by social actors, are a crucial factor for acting collectively in view of achieving social change (e.g., [7, 8]). It is indeed through frames that actors give a sense and a meaning to what happens around them: the more they share frames, the more they agree on the same interpretations of the world as well as on how it should be transformed. Thus, the more frames are shared, the higher the probability that actors will join forces and act in a coordinated manner to achieve their objectives. As much as it happens in any other policy domain, also when it comes to smart cities the way in which the issue is framed will impact the type of plans and the strategies of action that decision-makers and key players will adopt.

Second, we argue that online digital platforms (and websites in particular) provide a privileged entry point to the investigation of frames. Indeed, although digital platforms do not exhaust the totality of means through which social actors formulate and display their "interpretations" of the world, they nonetheless provide a prominent "public space" to make their visions, missions and commitments accessible to citizens as well as to a variety of other stakeholders [9].

Starting from this background, we first map the online "conversation" that is taking place amongst the websites of organizations, institutions and private sector entities that are stakeholders in the smart city domain at the EU level. Subsequently, we analyze how the issue of smart cities is framed within this online conversation. In a first step, we investigate whether key players adopt a socio-technical frame or if, conversely, they tend to emphasize technological or social aspects. Secondly, we explore the extent to which these key players share the same frames and thus possess the potential to act collectively for translating their common vision into practice.

In doing so, our primary aim is to begin addressing smart city projects from a critical perspective targeting not so much *how they have been implemented* in different contexts but, rather, how actors that are leading their drafting and implementation *understand smart cities*. Thus, while we do not aim at generalizing our results to the whole EU strategy for smart cities, we do seek to provide an innovative analytic framework to push forward research activities in the smart city domain.

2.1 Data and Methods

In order to perform our exploration, we lean on a combined use of two research techniques: digital methods and network analysis. The former is a set of research tools that were developed precisely to analyze digital objects (e.g., hyperlinks, web pages, search engines, etc.) in order to maximize their informative potential about social dynamics [10]. The latter, instead, is a set of research techniques to study the patterns of relations amongst a set of actors, also called *nodes* [11].

In this specific case, digital methods allow us to map an "online issue network", i.e., a network of websites with a common thematic focus an tied together via hyperlinks, which can be considered as a proxy for the online conversation on smart cities that we are interested in. To obtain this network, we start from a list of 10 URLs

associated with the key initiatives an networks identified by the European Innovation Partnership on Smart Cities and Communities (EIP-SCC), the core initiative launched by the European Commission to foster the European smart city project.[2] This list is then processed by a tool called Issue Crawler (IC), one of the first software designed to systematically crawl the Web and trace connections between websites.[3] For each "starting point" in the list, IC fetches all outgoing links. Whenever at least two starting points share outgoing links to a website or a Web resource that is not in the initial list, the software adds a new node to the network. At the end of this process, called co-link analysis, the software traces hyperlinks amongst all nodes in the final list and returns a map of the online issue network (Fig. 1).

Fig. 1. Online issue network on smart cities produced through Issue Crawler (n. of iterations=2; privileged starting points=on; crawl depth=2)

Although the IC suffers (as much as any other crawler available) from important limits – above anything else, the fact that it cannot read and, hence, scrape, JavaScript

[2] https://eu-smartcities.eu/about/useful_links. The list of starting points is available in Appendix.
[3] http://www.issuecrawler.net

(see [12]) – ultimately this online issue network provide us with a good approximation of "who is talking to whom" in the online space about smart cities.

Within this network, we identify those we have called above the "key players", that is, actors that occupy most "powerful" positions as they show higher centrality values. Indeed, following existing approaches (see [9]), we claim that most central actors, by virtue of their peculiar position, are able to "set the tone" of the overall conversation deploying within an online issue networks. Thus, we distinguish between three categories of key players:

- *Programmers*, i.e., nodes with a high indegree value and that, therefore, enjoy a wide recognition from other nodes in the online issue network about smart cities:
- *Mobilizers*, i.e., nodes with a high outdegree and that, therefore, are actively engaged in building the online network of discussion on smart cities;
- *Switchers*, i.e., nodes with a high betweenness and that, therefore, mediate indirect connections amongst other nodes in the online network of discussion.

Subsequently, we investigate how key players in three categories frame smart cities arguing that:

- frames supported by programmers are those which are taken as "points of reference" by other nodes in the online network;
- frames hold by mobilizers are those which motivate the construction of the online network of discussion;
- frames endorsed by switchers are those upon which coordination within the network can be achieved.

In order to track actors' frames, we employ a tool called Googlescraper, which queries websites for sets of keywords and returns the number of pages that contain every keyword.[4] Thus, we query central websites for keywords able to capture different facets of the two broad visions of smart cities we discussed above: on the one hand, a techno-centric vision based on the predominant role of ICTs; on the other, a socio-centric one that emphasizes social and human aspects (table 1).

Table 1. Techno-centric and socio-centric frames on smart cities

Dimension	Frame	Dimension	Frame
Techno-centric	Digital City	Socio-centric	Creative City
	Intelligent City		Learning City
	Ubiquitous City		Humane City
	Wired City		Knowledge City
	Hybrid City		Smart Community
	Information City		

We derived our set of keywords building on a thorough literature review realized by [13], who originally classified a wide range of studies on smart cities based on

[4] https://tools.digitalmethods.net/beta/scrapeGoogle/

their focus: technology, people and communities. Thus, we merged the original dimensions of "People" and "Community" in the study within our dimension "Socio-centric".

Building on the output produced by the Googlescraper, we first assess the extent to which actors adopt a sociotechnical perspective on smart cities by looking at how much they endorse techno-centric *and* socio-centric frames within their websites. We also explore the level of coordination these actors can reach amongst themselves when endorsing specific frames on smart cities. In this respect, we examine through network analysis techniques the extent to which most central actors tend to converge around common frames and compare their levels of coordination when they focus on technological or social aspects of smart cities.

3 Results

Online issue network composition and structure. The online issue network mapped through Issue Crawler (IC) is structured within one sole component, tying together 75 nodes through 550 hyperlinks (table 2). As shown in figure 1, which depicts nodes in the issue network with different colors depending on the top-level domain they carry, the majority of nodes are colored in light green and thus belong to the big family of actors operating at the European level (i.e., URLs end with a .eu domain). Within this large group, we find actors such as the European Commission (*ec.europa.eu*); the European Covenant of Mayors for Climate and Energy (*covenantofmayors.eu*), launched in 2008 and today one of the largest initiatives for the governance of climate change and renewable energies in the world; the European Environment agency (*eea.europa.eu*); Eurocites (*eurocieites.eu*), the network of major European cities.

Table 2. Online issue network on smart cities overall metrics

Measure	Value	Measure	Value
Size	75	Reciprocity	17%
Ties	550	Core members	20
Density	0.10	Indegree Centralization	40,63%
n. components	1	Outdegree Centralization	46,11%

The second large group in the network is formed by .org websites, which gathers several actors and initiatives that are mainly of institutional nature. For example, prominent nodes in this category are *iclei.org* and *iclei-europe.org*, the general and the European websites of the world-leading network of cities and towns committed to implement plans for a sustainable development. Other examples are *klimabuendis.org* and *climatealliance.org*, the general and the English versions of the website of the alliance between European cities and indigenous rainforest people.

Beside these two main groups, the network gathers a plurality of websites representing local actors who, also in this case, are mostly of institutional nature. This

is particularly true for French websites, which are associated mainly to municipalities engaged in the implementation of smart development plans such as Nantes, Lille, Amiens, St. Etienne and Reims; or to the main institutional events linked to the discussion of climate change (the Cop21 conference and the Climate Summit for Local Leaders). Other representatives of local institutions come from Germany (*stadt-koeln.de*, the website of the city of Cologne), Finland (hel.fi, the website of the city of Helsinki), UK (with the city portals *birmingham.gov.uk* and *bristol.gov.it*) and Belgium (*bruxelles.irisnet.be*, the portal of the city of Brussels). Italy does also enter the network, however only by providing national versions of international initiatives, in particular of the Covenant of Mayors (*pattodeisindaci.provincia.roma.it*) and the Climate Alliance (*climatealliance.it*).

The relatively low presence of .com actors, limited to *kic-innoenergy.com* and *cedec.org* – two networked companies active on the EU territory –, should not be misunderstood for the absence of the private sector from the issue network.[5] Indeed, "hidden" under other TLDs, there are several nodes pointing to initiatives concerned with financing and private corporations in the smart city "business". One example is provided by *fi-compass.eu*, a platform for advisory services on financial instruments linked to the European Structural and Investment funds (ESIF) as well as to the Programme for Employment and Social Innovation (EaSI).

On the overall, the online issue network appears to be rather cohesive, as 10% of possible ties are activated (table 2). However, amongst these, though, only 17% are reciprocal and are mainly located within the core of the network, which gathers 20 actors that either belong to the EU context or to the big networked initiatives as the Climate Alliance. Conversely, all local constituencies are located within network periphery (figure 2). Taken together, these elements suggest that, although a structure for discussing smart cities is in place and includes, either directly and indirectly, European and local constituencies, a true and diffused dialogue is not taking place yet.

Key players. Results in table 2 also show that few actors, which seem to catalyze the majority of links from others (see *Indegree Centralization*) but also to be particularly active in building connections (see *Outdegree Centralization*), dominate the online conversation that is taking place amongst websites in the online issue network.

Table 3 identifies these most central nodes and classifies them as *programmers*, *mobilizers* and *switchers*. As it shows, there is a substantial overlap between the three categories, in particular between *programmers* and *switchers* – as these latter are a subgroup of the actors playing a programming function in the network. Not very surprisingly, the main programmer in the network is the European Commission (EC), which receives hyperlinks from half of other nodes. Other programmers, which are all expressions of more specific initiatives, receive links from a more limited number of network members (between 15% and 21%).

Following the EC in the indegree ranking we find *eumayors.eu*, the sister website of the Covenant of Mayors, and *buildup.eu*, the European portal for Energy

[5] The third .com node is Twitter.com. The platform appears as a node on its own although webpages crawled by the Issue Crawler link to a specific account upon it because of the overall incapability of the software to process deep links within social media platforms.

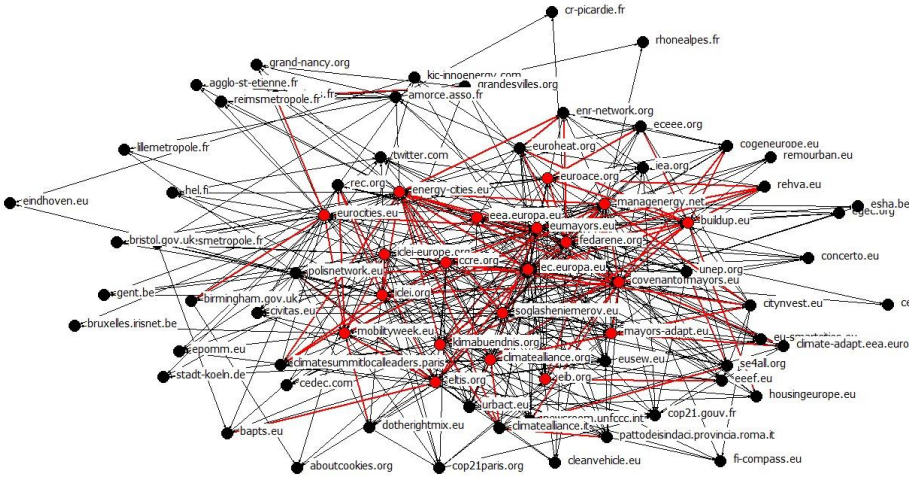


Fig. 2. Core-periphery representation of the online issue network (final fitness= 0.524). Red nodes=core; black nodes=periphery. Red lines=reciprocal ties.

Table 3. Programmers, Mobilizers and Switchers in the online smart cities issue network

Programmers	Indegree	Mobilizers	Outdegree	Switchers	Betweenness
ec.europa.eu	37	covenantofmayors.eu	41	ec.europa.eu	843.24
eumayors.eu	16	eumayors.eu	41	eumayors.eu	509.643
buildup.eu	16	energy-cities.eu	33	energy-cities.eu	388.526
energy-cities.eu	15	managenergy.net	31	eurocities.eu	373.753
covenantofmayors.eu	14	soglasheniemerov.eu	27	covenantofmayors.eu	357.151
fedarene.org	14	klimabuendnis.org	23	managenergy.net	320.493
eurocities.eu	14	polisnetwork.eu	23	iclei.org	216.609
mobilityweek.eu	13	iclei-europe.org	23		
ccre.org	13	fedarene.org	22		
eea.europa.eu	13	climatealliance.org	22		
eusew.eu	13	iclei.org	18		
managenergy.net	12	eurocities.eu	17		
iclei.org	12	eltis.org	17		
eltis.org	12				
birmingham.gov.uk	12				

Note: Mean Indegree=7.33; S.D..=5.2; Mean Outdegree=7.33; S.D.=9.87; Mean Betweenness=62.42; S.D.=137.87

Efficiency in Buildings. These websites well represent the two general subgroups that can be found in the programmers category.

On the one hand, programmers are initiatives aimed at joining different localities and municipalities within networks often in view of fostering coordination in relation to environmental governance. Within this first cluster, we find Energy Cities (*energy-cities.eu*); the European Federation of Agencies and Regions for energy and the Environment (*fedarene.org*); Eurocities, the network of major European cities (*eurocities.eu*); the Council of European Municipalities and Regions (*ccre.org*); ManageEnergy (*managenergy.net*), an initiative of support to public sector actors working in the field of renewable energy; and the abovementioned *iclei.org*. On the other hand, programmers are thematically focused initiatives that are centered on a specific topic. Within this group, we find the European Environment Agency but also the European Sustainability Energy Week (*eusew.eu*), a month-long set of initiatives aimed at sustainable mobility; and Eltis (*eltis.org*), the principal EU observatory on urban mobility.

The category of *mobilizers* is instead made almost entirely from websites representing networks of cities often with a focus on energy and climate-change related interests. The majority of links are sent by the European Covenant of Mayors for Climate and Energy as well as by its sister site *eumayors.eu*. Quite interestingly, one of the main mobilizers is also the Russian version of the European mayors' portal (*soglasheniemeriv.eu*). Other relevant mobilizers are city-network actors functioning also as programmers, such as Energy Cities, ManageEnergy, ICLEI and ICLEI-Europe, the Federation of Agencies and Regions for energy and the Environment and Eurocities. In comparison to the programmers list there are also few but interesting exceptions: first, the general and the English websites of the website of the alliance between European cities and indigenous rainforest people (*klimabuendis.org* and *climatealliance.org*); second, POLIS (*polisnetwork.eu*), the network of European cities committed to the amelioration of local transportation plans. Both are again city-network actors but with specific thematic foci that enrich the mobilizers agenda – respectively, environmental sustainability in indigenous areas and local transportation and mobility.

Finally, a restricted number of websites, besides programming the contents of the online issue network, are also in a favorable position to coordinate its different parts as switchers. Thus, these websites are also representative of the different interests that animate the online discussion: the regional ones, with the European Commission; the local ones, with the Eurocities network of cities; the institutional concern for energy and climate-change issues, with the European Covenant of Mayors for Climate and Energy and ManageEnergy; mobility and local transportation with ICLEI.

Smart city frames. Figure 3 represents the level of endorsement the different smart city frames found in the webpages of the key players' websites. As it shows, all frames are adopted in the online conversation on smart cities thus suggesting that the European discussion is on the overall supported by a sociotechnical approach. However, the figure also reveals that not all frames are endorsed with the same

emphasis. Key players tend indeed to emphasize predominantly techno-centered frames, which are present in a larger amount of pages in all websites functioning as *programmers*, *mobilizers* or *switchers* (respectively, 57%, 58% and 60% of webpages).

Fig. 3. Treemap of techno-centered and socio-centered frames endorsed by programmers (a), mobilizers (b) and switchers (c). Techno-centered frames are depicted in purple, socio-centered frames in gold.

In giving more prominence to techno-centered aspects of smart cities, all key players endorse in particular two frames.[6] On the one hand, they see smart cities as *information cities*, that is, as "digital environments collecting information from local communities and delivering it to the public via Web portals" [13]. On the other hand, smart cities are also *hybrid*, i.e., places in which physical entities and real inhabitants enmesh with their "virtual counterparts" [13] and, therefore, actions and interaction deploy fluidly across the online/offline boundary. In general, then, smart cities are seen mainly as spaces where activities are carried on in context where data and information allow the continuous proliferation of services and social possibilities are augmented by the presence of digital technologies.

A further commonality to all key players is the convergence on a social vision of *smart community*, which emphasizes the element of governance and collaboration between stakeholders and institutions. Differently from the *information* and the *hybrid* city frames, where technology is seen as the engine for the amelioration of the urban environment, the view of a smart city as a *smart community* bends explicitly the potential of ICTs towards the resolution of challenges that emerge at the crossroads

[6] We base this section on the definitions given by [13] in sections §2.3.1 to §2.3.3.

between different neighborhoods and localities. Thus, in comparison to other socio-centered frames, the idea of a smart community calls attention for the *collective* dimension of social life, making of efficient coordination amongst different views and needs a prerequisite to a successful exploitation of ICTs potential.

It should be noticed though that, concerning the type of "social interpretation" provided to smart cities, mobilizers distinguish themselves from other key players as they complement the vision of smart cities as smart communities with the idea of *creative city*. This latter concept points to the "human infrastructure" of intellectual and social capital that is necessary to harness technological potential and thus better specifies the role of citizens and their skills in relation to that played by technologies. This notwithstanding, the main arguments that push the construction of the online discussion are those of the "power of data", intrinsic to the *information city frame*, and that of the "augmented reality", inherently connected to that of hybrid cities.

Other socially or technologically oriented frames seem thus to play a secondary role in the discussion. To a certain extent, all key players see smart cities as *intelligent*, that is, possessing all the latest "infrastructures and the infostructures of information technology" [13]; but also as *knowledge* and *learning* cities, that is, as spaces where innovation links to the growth and the transmission of cognitive resources to make skills and services continuously evolve.

Finally, poorly adopted by all key players are the ideas of a *ubiquitous* and *wired city*, which points to the capillary diffusion of technological infrastructure [13]. Scarcely endorsed is also the general idea of a *digital city*, which depicts the urban environment as innervated by broadband connections, infrastructures and services able to meet the needs of its inhabitants and institutions, yet without addressing where these needs come from. On the side of socio-centered frames, the less adopted one is that of a *humane city*, a concept stressing the "multiple opportunities to exploit its human potential and lead a creative life" [13].

Sharing smart cities frames. Besides putting more emphasis on techno-centered interpretations of smart cities, key players also tend to coordinate more consistently around technological frames rather than around social ones.

Table 4 illustrates some key features of the affiliation networks that key players in their different roles form when sharing technological or social views of smart cities (see figure 4 for an example). As it shows, both programmers and mobilizers tend to converge more cohesively around technological interpretations. Not only networks based on sharing technological frames show a lower number of isolates, i.e., key players not systematically recognizing any specific frames (see values in column ISO).[7] Density values (column Δ), which indicate the proportion of existing ties on the total possible number of ties in the network, also indicate that both programmers and mobilizers form a much cohesive group when it comes to sharing technological interpretations rather than social ones. Finally, average degree values (column Av.

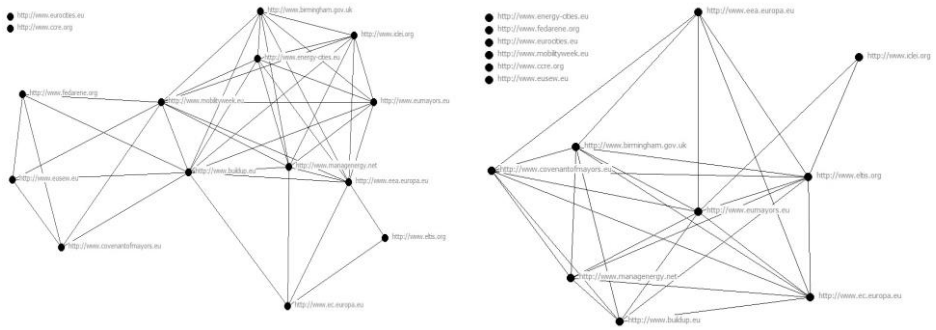
[7] In each affiliation matrix, there is a tie between any couple of key players if they shared a frame in a number of webpages higher than the average number of pages where any socio-centered or techno-centered frames could be found.

Degree), which indicate the average number of connections established by nodes within a network, suggest that both programmers and mobilizers are more "active" in sharing techno-centered frames than social ones.

Interestingly, the coordination of the network provided by switchers seems not to be "structurally sensitive" to the different type of frames. This element may relate to the overall heterogeneity of this specific group in terms of interests represented. Indeed, as we noted above, in spite of its limited size, the group of switchers represents all interests brought in by programmers and mobilizers: the regional ones, the local ones together with the energetic and the mobility and transportation ones.

Table 4. Features of affiliation networks formed by key players based on sharing techno-centered and socio-centered frames

Key Players	Frames	N	T	Δ	ISO	Av. Degree
Programmers	Techno-centered	15	42	0.40	2	40.00
	Socio-centered	15	28	0.27	6	26.67
Mobilizers	Techno-centered	13	35	0.45	2	44.87
	Socio-centered	13	16	0.21	5	20.51
Switchers	Techno-centered	7	7	0.33	2	33.33
	Socio-centered	7	7	0.33	2	33.33



(a) (b)

Fig. 3. Affiliation network between programmers sharing techno-centered frames (a) and socio-centered frames (b)

4 Discussion and future perspectives

In this paper, we claimed that contemporary efforts to make cities thrive through the strategic exploitation of ICTs can be successful to the extent to which they are carried on in a sociotechnical fashion. In fact, grounding innovative approaches into

pervasive ICTs infrastructures necessarily entails depending also on social perceptions of technological affordances and from the scopes and the aims that social actors aims to achieve. In this sense, we claimed that it is necessary to build smart city projects that endorse a sociotechnical approach, i.e., that recognize and give value to technical as much as to social aspects. We thus explored how much the European approach to smart cities is carried on sociotechnically. Our results suggest that, although there is a formal recognition of both technological and social aspects, key players in this policy domain are keener to emphasize the former. More importantly, they are also better coordinated around techno-centered frames rather than around socio-centered ones. In this sense, it is more likely that the EU smart city strategy will be carried on along a technological perspective leaving somehow the social behind.

A number of factors may explain this dominance of technical factors over social frames. Right because ICTs are grounded on specific materialities, it is certainly easier to envisage the role they can play in relation to the process of social innovation. Conversely, social dynamics are much more complex and rather unpredictable – as the current economic crisis has very well showed us. It is therefore rather understandable that key players with such complex agendas do privilege in their policy action those aspects and theses upon which it is easier to find agreement.

However, our results also do suggest that a more challenging mechanism may be in place. Albeit it is non-representative of the current policy discussion in the smart city domain, the online issue network we analyzed points to the total exclusion of citizens' and civil society initiatives from the discussion. On the overall, ICTs specialists, whether they are from the private sector or of governmental nature, seem to have far greater access to resources and opportunities to influence policy processes in the smart city domain by comparison with other types of organizations – e.g., civil society initiatives working to educate citizens to a conscious use of technologies or to defend their freedom of expression and privacy. Thus, not much space seems to be left for the actual inclusion in the discussion of other disciplines, such as social and political sciences, besides engineering.

The overall emphasis that EU key players put on the "smart community" frame testifies a general acknowledgement of the fact that political innovation lays at the core of successful smart city strategies. And yet, the initial exploration we performed seems to suggest that this overall awareness is not accompanied by the adoption of a multi-stakeholder governance approach, where institutional, private sector and civil society actors are *actual partners* in the governance of our cities. A systematic and sustained effort to implement the "smart community" frame seems then to be the road to follow, so that a fertile ground to sociotechnical smart cities can be set through an actual inclusive and democratic collective effort.

Appendix

Online issue networks staring points:

1. http://ec.europa.eu/eip/smartcities/index_en.htm

2. http://smartcities-infosystem.eu/
3. http://www.civitas.eu/index.php?id=69
4. http://www.eumayors.eu/index_en.html
5. http://www.eurocities.eu/
6. http://eit.europa.eu/eit-community/climate-kic
7. http://www.kic-innoenergy.com/
8. http://www.errin.eu/
9. http://www.polisnetwork.eu/about/about-polis
10. http://www.energy-cities.eu/

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