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Technology for Democracy in Smart City Planning

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ABSTRACT

In recent history the relationship between technology and urban planning has been variously taken into account (and possibly also undervalued), but lately it has come into focus with the maturation of the concept of the Smart City.
Building on an analysis of documents dealing with the issue and current experiences, this paper tries to determine which opportunity factors the new technologies are offering for the improvement of urban planning. In particular it considers how these technologies are being integrated into the processes of participatory planning thus supporting the development of direct democracy.
The resulting complex framework suggests four main fields of application where the new technologies can contribute to addressing contents and governance of the plan for an urban organisation that enhances virtuous behaviours and steers the town's residents towards adopting them.

1. The evolution of technology support in participative urban planning

Within the present general framework of advanced technologies supporting social participation in urban planning, two main fields or macro-areas of application stand out, characterised by the different factors and timeframes taken into consideration for changing the urban organisation.
The first one covers the instrumentation aiming to help participation in the decisional process and implementation of the urban plan. It is a field of relatively old origin rich in elaborations and applications. Though articulated in various ways internally, it essentially includes the software tools (Planning Support System, PSS; Decision Support System, DSS; Simulation Model, SM; Public Participation Geographical Information System, PPGIS; etc.) for following formalised procedures to implement wide community-based decision paths as well as the diverse more or less complex systems of participation via the Web (weblogs, thematic fora, webGIS, Web meetings, e-learning, etc.) including the latest social networking systems[1].
From the study of this macro-area another field deserving attention and investigation has emerged. Linked to and derived from the former, it concerns the advancement of technology applications toward the growth of participatory democracy in urban planning through a further widening of the functions described above as pertaining to the first field. Obviously this step forward appears dialectically connected to the changes intervening in the physical and social context of the urban model.
Thus the first field includes tools to assist decision-making processes and to widen stakeholder participation. Certainly what this instrumentation now needs is to be translated into widespread and, in particular, effective use. However it appears by this time as a set of established methodologies having high potential for application but narrow space for evolution. The second field covers instead a matter at present far less structured in terms of technologies and application systems and refers to physical and

1 Structuring further what is shown in the OCDE study "Citizens as Partners, Information, Consultation and Public Participation", OCDE Publishing 2001, the technologic tools in support of participatory urban planning can be classified into five categories: tools for information, education/training, dialogue, consultation (voting), and decision making support.

socioeconomic forms of urban organisation notably different from the current ones. The reference for the first field is the urban environment as things stand now, considered from the perspective of transition towns by plans basically dealing with more or less complete phases and processes of change from the town of today to one that is eco-efficient in terms of governance and resource use. Here further research is helpful in order to compare and evaluate the different procedures and tools and to direct pervasive applications. The second field open to research looks instead further ahead toward visions of future towns grouped under the still not very explanatory label "Smart City", which is of late increasingly drawing the attention of public institutions, private organisations, and individuals.

The idea of the Smart City was born from the powerful push of advanced technology manufacturers and installers who saw in the proposal of a future town an efficient marketing tool for business development[2]. It is only recently that, beside the early strictly technological characterisation of such an idea (given by computers, networks, power plants, energy distribution nets and consumption applications, and so on and their management, regulation, and control systems), more comprehensive patterns are emerging, foreshadowing new socioeconomic and physically functional models of the town linked, first and foremost, to new cultural and behavioural models of a general nature embodying the use of said advanced technologies within a systemic and synergic set. The relational dynamics within this complex system include and promote the pursuit of new settlement models acting in turn as a process-pushing factor.

On the basis of these systemic aspects we can individuate a few attributes characterising specific technologies or groups of technologies capable of providing support in directing the urban plan towards specific settlement models. These technologies are featuring as:

- *pervasive*, that is, most widely diffused ("distributed") and employed also at the individual level;
- *embedded*, being built into components of current use and thus, with regards to fruition of the town by its inhabitants, embodied in

2 The idea of the Smart City first came from the information and telecommunication technology (ICT) sectors, soon joined by those of energy technology concerning in particular the efficient use and renewable sources of energy.

the residents' lives;

- *inclusive*, involving the residents not only as contributors of personal positions but as direct actors in the planning process too, and thus moving away from the purely centralist-technocratic approach to close in on a bottom-up one.

The last paragraph in this paper provides descriptions of a few applications presenting the above attributes whose potential opens new horizons to the use of technology for developing participative democracy in urban planning. The dialectics of the settlement model as the driver and product of new systemic urban sets now taking shape in the notion of the Smart City is thus signalling the onset of congruent guidelines for aligning the town planning project to it.

2. Behavioural urban planning of the Smart City

Scant consideration is being given to the urban plan by the now fairly extensive literature on Smart Cities. This is particularly true for the documents – and initiatives – of the European Union, a fact that unfortunately may depend on the traditional, and in some respects taken for granted, lack of knowledge (due to disesteem, undervaluation, or unawareness) of the urban planning discipline or at least because the latter is drawing very little interest at European Community level[3].

The above circumstance may also be linked to structural characters of the concept itself of the Smart City, which, be it right or wrong, could be deemed not very congruent with the traditional principles of urban planning.

Going over numerous documents directly or indirectly related to the idea of Smart Cities (a selection of the main documents consulted is provided in the reference list), it is possible to extract a few general connotations, or

3 As it turns out, for example, from the little importance attributed to Smart Cities by the RTD Framework Programmes of the EU. Even the last FP (VII Framework Programme) denies it recognition in its work programme and identity as a research area capable of generating significant results for the advancement of knowledge and knowledge applications. Also, no specific actions on urban planning are foreseen in the programme of the EU Initiative on Smart Cities (*http://setis.ec.europa.eu/about-setis/technology-roadmap/European-initiative-on-smart.cities*).

elements, which seem in prospect to characterise its plan and to collide in some cases with the current principles of the urban planning discipline.
Most assuredly the Smart City opens wide the doors to technology in particular by grounding its construct, as noted before, on the primacy of new (and renewed) technologies of value to the town.
In recent history the relationship between urban planning and technological systems features for not having been especially favourable to the latter in terms of consideration in the configuration of the urban settlement. Still now in the prevalent conception the technological systems are assigned a subordinate role in designing the plan in comparison with other factors such as morphological control, collective urban equipment endowment, urban rent control, safeguarding of the historic and cultural heritage, and so on. Urban technology, and in particular the new technologies, integrated in infrastructure networks, building systems, services, and collective spaces, "follow" the plan which is so characterised in its contents by scant or no consideration or significance as regards technology. In this multiple causes concur, including relevant cultural factors linked to the urban planners' education, training, and competences and, still talking culture, to the *modus operandi* and impermeability to innovation of the main dialogue partners of the planners, that is, the building contractors. However the Smart City does not tally, or does so very badly, with the leading current way of planning (*a-technological plan*), and, vice versa, such a way does not tally with the Smart City given that it does not ensure direction and help for its deployment.
The Smart City approach requires reversing the stance towards technology, in the sense that the technologies or rather their applications become basic elements and starting points in the planning process. So in its directions for the physical and functional organisation of the town the plan should also configure itself, mainly on the basis of values and choices of a technologic nature. This is a *first element* that is distancing the urban planning discipline from the Smart City; the opposite also holds true.
Linked to this is a *second element* distinguishing the urban plan for the Smart City. The massive introduction of technologies into the town aims at improving the quality of life and rational use of resources but also at being a driver of economic growth. Urban technological innovation is acknowledged as a factor of competitiveness for enterprises, contributing to the productive

and cultural specialisation of the whole town or parts of it. In this context, planning of the physical urban organisation has to directly or indirectly match the theme of the local growth expressed in terms of sustainable development[4].
It seems that in other ways and with other ends, and hoping for better results, the relationship between planning and development established during the 1970s (the so-called "season of programming") is going to reopen. The themes are different in that they are focusing not on heavy industrialisation and urban armature but on how, by means of the new light technologies and the provision of new specialised services, the organisation of the town may, in these times of global competition, concretely generate assets for urban marketing and contribute to a sustainable local development.
However the discipline of urban planning, for years folded in on itself in the search for a specificity based essentially on methodologies and procedures for the normative plan, seems unprepared for tackling the present critical themes of socioeconomic development requiring different specialist knowledge, competencies, and (most of all) sensibilities to connect with the context and real processes of our time.
The *third element*, emerging later but overbearingly from conceptual elaboration, is the factor relating to the intense component of participatory governance characterising the Smart City, undoubtedly the widest ground for a localism understood both as extensive decentralisation of institutional and administrative powers and development of participatory direct democracy.
In general the local approach to "city smartness" is seen as structured on three progressing levels describing actions of the local authority[5] whose meaning is patent, that is:

1. leading by example;
2. governing the private urban actors;
3. conceiving and implementing an integrated approach at the local level.

4 The concept of sustainable development has undergone many revisions of its first orthodox principles (e.g. those of H. Daly) towards an evolutive idea, particularly as regards the definition of urban sustainability or sustainable urban development. Reference is made here to progressive design such as that of the transition town combined with the notion of eco-efficiency.

5 See e.g. Smart City Initiative; How to Foster a Quick Transition towards Local Sustainable Energy Systems, *http://think.eui.eu*

The third level is the nearest to "city smartness" and the one most characterised by decentralised powers and widened participation (though with some centralised decision-making, anyway, performed by local bodies acting as process leaders).

Actually there is also a fourth level, dealt with hereinafter, but even going no farther than the third level a directing line stands out pointing to the plan as a process more than to a defined and codified "product". The general plan, as currently intended, seems to be slim in content, lose all operativity, and also to limit its strategy to far-sighted visions and a few structural elements. But under the thrust of the intense factor of decentralised participatory governance the action of the urban planner takes the characterisation of continuity and is converted into "planning by doing". The plan becomes more "work ongoing" than a stable document. So the planner also acts as animator and facilitator of participatory processes and eventually may take charge of, or serve as, an interface for activities of information, communication, education, and training, which, by the way, present significant features from the technological point of view.

Technology shapes the plan not only as regards interventions in the town (plants, infrastructure, systems, components, materials, etc.) but also operates in the planning process. Therefore it seems that the urban plan should be able to manage a complex elasticity, on the one side tending toward a structure complying with the relevance of technology in urban interventions entailing precise and definite choices (but transformable and not irreversible ones), and on the other being dynamised by the push of a participatory governance imposing flexible and interactive planning. In this context the technologic value can increase its driving function in the urban plan until it reaches the role of bearing the structure of the plan itself.

The *fourth element* of adjustment of the urban plan consists in structuring it so as to direct the town residents toward virtuous behaviours. The plan tries to direct the construction and requalification of the physical and functional town to adapt its environment to emerging positive behaviours (e.g. "carbon free" ones) but also and above all to promote and tendentially enforce them. In any case the objective is to gain "virtuosity" by means of incentives and disincentives, constraints and facilitations, and also through the educational effect provided by a physical town expressly designed to develop virtuous

behaviours (consider for example the case of car-free quarters). The town is no longer only the response to behaviours of its inhabitants having more or less negative effects on the community, but becomes a spur to the development of positive environmental, social, economic, and emotional (i.e. aiming to ensure emotional welfare) attitudes and behaviours pursuing common objectives of urban quality. Urban planning will succeed in contributing to the attainment of the global and local sustainability targets set by the extant international agreements most of all by focusing the attention on a town configuration that helps to modify the behaviours of city residents.

This kind of urban planning, which could be defined as *behavioural*, aims at affecting urban ways of life, favouring or contrasting them by means of the physical and functional configuration of the town, or of parts or elements of it, but at the same time is directed to progressively and dialectically act with the abovementioned flexibility in order to contribute to modifying the cultural model along a virtuous loop.

The *fifth element* characterising the urban plan for the Smart City, highlighted in the literature and directly or indirectly descending from the four above, is its elaboration path. The distinctive features of relevance of the technology, inclusivity, flexibility, and behavioural incidence recommend starting from the bottom, that is, taking a bottom-up approach. The urban part (quarter, district, etc.) proves to be the proper logic for ensuring operativity and effective deployment of said elements[6]. Evidence of this is given by the recourse to the energy parameter for organising the territory in energy basins or by use of the participatory factor to define optimal territorial dimensions ensuring direct participation efficiency.

But the Smart City also needs a top-down systemic integration of its parts on the basis of one or more overall structural elements, more or less simple and progressively pervasive, in order to combine the parts themselves into a body reducing differences, supporting synergies, and first of all favouring the development of the physical and functional organisation of the urban settlement[7].

6 See e.g. A. Duany, J. Speck, and M. Lydon, The Smart Growth Manual, McGraw Hill 2010, point 2:5, “A metropolis is composed of regional centres, neighbourhoods, districts and corridors”.

7 Consider e.g. the territorial organisation of Greater Copenhagen around its energy infrastructure infrastructure described and analysed by many authors, and with regard to its imposing energy

Thus the Smart City plan is generated by the dialectic convergence of the two approaches to decision-making (bottom-up and top-down) and two fields of intervention (small scale and large scale) in ways which for now seem far from having been defined. It is highly probable that the traditional path of elaboration of the urban plan will be followed only in part, but clearness is not the strong point in Smart City planning. As a matter of fact even the expression "Smart City" appears more and more a self-referential one being used to characterise the multi-dimensional value, grasped more by intuition than specifically decoded, of the concept inherent in it[8].

It seems obvious that a given urban set is smart because of the smartness of its component parts but the problem is to understand in depth what this smartness is made of. Nowadays however the use (or should we say misuse?) of the expression is spreading, so continuing with it we can think of, and make reference to, Smart City planning in terms of both contents (connectivity, ecology, local development, rational use of resources, safety, comfort, and so on) and ways and processes of elaboration and implementation of the urban plan (flexibility, inclusivity, interactivity, reversibility, incrementality, etc.).

A *sixth element* characterisation of the innovative plan covers the changes in the framework of the operators involved in urban transformation.

Urban planning has traditionally chosen the main interlocutors between economic operators involved in the construction industry and buildings (builders, promoters and developers, general contractors, real estate companies, engineering companies, etc.).

With the birth of the metaphor of the digital city in the 1990s, subjects have appeared from other areas[9] but are too weak to be interlocutors of the planning or to become agents of urban transformation.

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infrastructure in particular see Lars Gullev, Heat Plan for the Capital Area of Denmark (*http:// www.e-pages.dk/dbdh/11/*) and District Heating in Copenhagen (*http://dbdh/images/uploads/pdf-diverse/ District_heating_in_Copenhagen.pdf*).

8 In comprehensive and heterogeneous terms the Smart City is considered a system composed of interlinked subsystems (smart economy, smart mobility, smart environment, smart people, smart governance); see:
http://www.safecity-project.eu/index.php/mod.pags/mem.detalle/id.10/relcategoria.1077/relmenu.5/chk.8def43cf5ccb30aed0f0c0433f2c3eab

9 "… Digital cities have been initiated by three distinct actors: 1) non-profit electronic community

Instead, very powerful economic actors with significant weight come into the Smart City: structures outside the construction industry, coming from industry in the strict sense and industrial services, such as companies operating in different fields of ICT, in the production and distribution of energy, in transport, new materials, bio-agro technologies, advanced logistics, innovative finance, and so on. These sectors, unlike the construction industry, are characterised by intense processes of internationalisation and high sensitivity and interest in research and innovation. The match of international competitiveness is played in the city, in big cities but also more and more in medium-sized cities.
Implant consultation with these parties includes the possibility and need to make significant changes in the manner and content of urban planning, as mentioned above, and also to expand the cultural level of the negotiation. At the moment the problem is, however, to understand whether these actors are willing to take on the role of new agents for urban transformation or whether their role is confined to that of applicators and sellers of pre-packaged systems and technologies to fit with the slightest change of the existing city, as appears to be the case at present. It is unclear if the new entrants, that is, willing to take on the role of changing the genetic structure of urban transformation, with all that entails in the revolution of modes and content, or leave the field to the old actors and are satisfied with the subordinate role of suppliers.

3. Technological applications for urban governance and behavioural planning of the Smart City

The ongoing elaborations about technology applications for smart urban planning are filling a catalogue that is growingly bulky and articulate. Herein, however, it is difficult to distinguish what could be defined as simple technology marketing from the presentations of instruments clearly susceptible to real incidence in the physical and social urban context (in the

forums such as the 'freenet' movement in the US, 2) commercial services as local information portals by private companies, and 3) governmental initiatives for city informatization. …", Mika Yasuoka, Toru Ishida and Alessandro Aurigi, The Advancement of World Digital Cities, *http://cs.gmu.edu/~jpsousa/classes/895/readings/0933.pdf.*

race to smartness the city sometimes gets lost).

After a specific survey and analysis of the catalogue above *four fields of applications* might be identified in which the new technologies can contribute to bringing developments in the elaboration and governance of the urban plan. The list is not intended to be exhaustively comprehensive regarding the possible relationships between technologies and plans. However, on the basis of the analysis made, these fields appear at present to be those where the most interesting potentials of said relationships are emerging. They are also showing a direction for observation and interpretation of oncoming developments predictably full of proposals and applications. Their reference frame as regards methodology and operativity is the one sketched before, centred on processes of continuous planning and "planning by doing" and marked by a specific structural value definable as behavioural urban planning. As an additional character of the physical and functional urban plan, this value aims at contributing by means of the plan itself to progressively guide the town residents towards virtuous behaviours and support them in practising them, mainly with regard to issues of environmental protection and eco-sustainability, with the purpose of directly involving them in the decision-making and implementation phases of the planning process. Regarding this, it seems that the new technological applications tend to put special value on interactive communication between the individuals and the local community and to promote the participation of the former in the management of the latter within the urban planning context. In four fields, dealt with in the following, technology seems capable of providing an important support given that in the development of planning processes it is increasingly serving functions that are in some respects inescapable. These functions refer to a first contribution provided by the application itself of advanced technology (new and better services, rational use of resources, better comfort, increased urban competitiveness, etc.) and to a second one brought to the advancement of democratisation processes in local planning and administration. Such processes are seeing the use of technology as the constituent element along their whole progress, so technology applications go beyond a role of simple support to become an integral part of the methodology and path of urban planning. Lacking technology, the plan would be impaired if not even impracticable.

3.1. Systems for perceiving individual impact

Considering the features of the new local governance, the necessity of continuous personal involvement in the attainment of the objectives fixed by the plan in conformance with the modalities and behaviours it establishes is increasingly evident. To this end great import must be placed on the continuous and timely provision of information to the inhabitants about their own personal incidence on the urban context and the indirect effects on it produced at the very moment when a given behaviour is adopted.

One of the cardinal factors in implementing the plan consists in encouraging perception of the personal impact. Planning becomes a process of co-operation, with the residents showing their individual positions and therefore their behavioural congruence with respect to the attainment of established objectives. The first step along an effective participatory path is that of being aware and understanding our own role within the urban system.

Recording the individual impact with suitable elaborations may at the same time provide continuous checks on the effects on behaviours that the plan is producing. Deviations from what was foreseen can provide inputs for plan recalibrations or more radical changes.

At present various experimentations are underway, in different sectors and also applying different technologies, including:

- on-line and real time computerised systems calculating carbon dioxide emissions at a given moment or over a time span;
- recording systems, which also provide georeferential information, recording daily displacements and more or less habitual behaviours in using urban spaces (for parking, services, sport) as well as their effects on health;
- more or less sophisticated measuring systems and devices to ease the demand side management of instant energy in dwellings, offices, and so on and for forecasting purposes;
- real-time location and tracking systems for produced or differentiated urban solid waste, also signalling the place of destination and disposal modes;
- devices and systems for monitoring and managing the use of public spaces and collective urban infrastructure.

Other important information, spreading and evolving over time and on which townspeople focus attention, concerns the economic and financial effectiveness of foreseen or already implemented technological applications. Correct and continuing individual information on economic costs and benefits of measures adopted on a large scale, such as that of the urban part or whole town, plays a fundamental role in their acceptance, successful deployment, and in case sequent development. This holds true particularly when the measures directed to individuals are linked to their own specific behaviours. It is to be noted, for example, that the various technologies available for the abatement of polluting emissions show economic unit values that are very diverse and also quickly evolving over time, compared to expected results; determinative is the case of the wide ranging unit costs of carbon dioxide reduction per technology[10].

Continuous personalised information also acquaints people with their own contribution to the return on investment and payback period of the technology considered, ensuring, moreover, a perception of its cost-effectiveness. Without this kind of information, people's appraisals may remain grounded on false or outdated knowledge. All of this helps residents to get over the so-called "Tragedy of the Commons" dilemma, according to which in the urban environment, as in the global one, technical measures to be adopted or already implemented to give immediate individual benefit often result instead only in inconveniences and sacrifices (be these real or supposed on the basis of the current cultural-anthropologic model).

3.2. Systems for continuous monitoring and interconnection of the urban settlement

This field includes a number of pervasive technologies essentially based on sensors and systems for the transmission and elaboration of the data which the sensors, conveniently placed, are collecting from the whole urban settlement or sizeable or particular parts of it. Inputs are also provided by

10 McKinsey & Company publishes the unit cost curve of emission abatement per current technology; see Impact of the Financial Crisis on Carbon Economics. Version 2.1, 2010 and *http://209.172.180.115/clientservice/sustainability/pdf/Impact_Financial_Crisis_Carbon_Economics_GHGcostcurveV2.1.pdf*

cell phones and other mobile devices as well as through the Internet[11].
These applications result in complex and evolving systems for continuous monitoring which record crisis points in the town settlement and deviations from what was planned. When forecasting models are in use, moreover, they can be continuously validated by comparison with the collected and elaborated data. Building on this information it is possible to gain competitive advantage for local firms and urban marketing and to develop specialist finalised services for the benefit of the urban organisation and public or private operators (e.g. information on buyers' behaviour, tourists, use of services, etc.).
For a planning design that is not only functionalist, the experiences aimed at recording the emotional relationship of affection and attachment between persons and urban places appear most interesting; the basic concept here is that of "place identity". The experiences of bio-mapping[12] fall into this category and aim at drawing emotional cartographies recording people's reactions linked to places by means of portable electronic tools. Coupling the two technologies GPS (Global Positioning System mobile technology) and GSR (Galvanic Skin Response sensor technology), individual emotional variations are detected and registered on a satellite map. Integration and elaboration of a plurality of individual records allow the compilation of collective emotional cartographies; from these it is possible to directly draw up plan proposals or define participatory planning process paths. Anyway, all of this can be seen essentially as an evolution enriched with technology applications of K. Lynch's studies on the human perception of the city.
These systems, when related to those concerning the perception of individual impact reviewed *supra* at point 1, appear to serve a reciprocal function in order to make explicit the urban impact on both the individual

11 There are many systems already available and operating. The platform Minteos (*http://www.minteos.com/*), winner of the Mind the Bridge Competition 2011, appears very interesting. It is a system of environmental monitoring permitting real-time gathering and elaboration of data provided by a net of wireless sensors distributed over wide natural or urban areas and employed for land and town plans and also to forestall natural and environmental disasters; see also the Smart Cities platform from Libelium, which allows system integrators to monitor noise, pollution, structural health and waste management (*http://www.libelium.com/smart_cities/*).

12 See Christian Nold Emotional Maps at *http://biomapping.net/new.htm.*

and the community. And all these systems are grounded on the existence and efficient working of a wide wireless network, designed to create a shared and interconnected urban set and necessary to link projects and initiatives strengthening the connection between interests and needs of the different urban actors. Processes of communication transmission may also make use of systems of amplification and intensification of information and messages employing sophisticated technologies of augmented reality[13] that allow georeferential localised images and graphs of urban phenomena to be superposed on information from the net of sensors.
Another important advantage, not to be forgotten, is the reduction of the costs of drawing up the plan entailed by using these systems when fully operational. Automatic gathering and provision of the up-to-date reliable data needed by continuous planning cuts survey costs and minimises incertitude levels.

3.3. Systems for health protection and for managing safety and emergencies
The issues of security and emergency bear increasingly on the urban plan, which, more and more, is being asked to incorporate them in its provisions and interventions particularly when concerning the requalification of existing settlements.
Making use of specific advanced technologies as well as the network system described above for continuously monitoring the urban set and its parts, steering virtuous behaviours, and adjusting or recalibrating what is planned, the establishment and activation of safety and emergency plans is thus becoming an integral part in the design and implementation of the general urban plan.
Security is essentially meant as individual and community freedom from danger, risk, or injury at the level of the quarter or other urban part, whilst emergency refers not only to natural catastrophic events but also to sudden dangerous conditions of the urban infrastructure and services (power

13 With regard to the use of virtual reality systems in urban planning, see e.g.:
htpp://www.planningtoplan.net/session-5-back-to-augmented-reality-part-2;
http://www.isprs.org/proceedings/XXXVIII/part1/10/10_01_Paper_106.pdf;
http://www.inria.fr/en/innovation/industrial-sectors/energy-transport-sustainable-development/demos/artefacto-augmented-reality-and-urban-planning;
http://nguyendangbinh.ord/Proceedings/ISMAR/2002/papers/ismar_ishii.pdf.

blackouts, public transport blockage, waste disposal emergencies, etc.) demanding immediate action. Actually, however, reference should be made to the wider concept of dependability more than to the above one of security. The systems in heading not only have to be reliable but must also be seen as such in the eyes of their users in order to optimise and increase their use. This clearly apparent feature of reliability leads people to use the systems they trust. Dependability thus becomes a complex characteristic, the synthesis of many attributes such as reliability, maintainability, availability, performability, safety, and security[14], which can be translated into practice through the integration of information and telecommunication technologies with the applications of several branches of specific technologies for protecting the territory, the built-up area, and the inhabitants. Dependability plays an outstanding role in urban liveability and must be evaluated and applied from the first phases of planning the town system.

This category includes the integrated systems and devices for health protection as well as those for the inclusion of people with disabilities and in general of persons potentially or actually at risk of social exclusion.

In particular, there is now keen attention to the issue of "city health", to be understood as "the town for its residents' health", read not so much in terms of provision of medical care as in terms of prevention and specific responses to diseases, even with the complexities all this entails, ensured by the settlement organisation itself[15], and so tackling the concepts of disease from the perspective of social factors and behaviours induced by the urban structure.

The field of new technologies for urban security, regarding in particular those systems and devices to combat crimes against property and persons (aggression, terrorist attack, theft, extortion, kidnapping, etc.), presents ambiguous interpretations and critical applications.

In various writings Stephen Graham (see References below) points out that this attention to security and the corresponding growth trend of these urban

14 On the concept of dependability see Algirdas Avižienis, Vytautas Magnus U. Kaunas, Jean-Claude Laprie, and Brian Randell, Fundamental Concepts of Dependability. *http://www.cert.org/research/isw/isw2000/papers/56.pdf.*

15 On the difficult issue of the uncertainties and contradictions in the idea of health in relation with the built environment see the interesting exhibition "Imperfect Health. The Medicalization of Architecture" by the Canadian Centre for Architecture, Montreal, *http://www.cca.qc.ca/en/exhibitions/1538-imperfect-health.*

technologies, in both rich countries and poor ones, corresponds in fact to an insidious process of urban militarisation.
In the sense that the centralised use of these pervasive technologies actually conveys systems of social exclusion, segregation, racism, political discrimination to defend the interests of dominant groups and classes. The poor and the disordered are excluded, as well as minorities, non-state actors, social movements, and other struggles. Indeed these systems are used against them to build the city of the rich or the "revanchist city".
The new security technologies become an instrument of social control, separation, and marginalisation, which is also in evidence in the physical organisation of the city[16]; in this way the conditions of real colonial war, fought in the same city in terms different from conventional ones but with similar aspects and results, are gradually being created.
The survey work described here moves along the opposite direction to the discriminatory use of new technologies highlighted by Graham. The basic approach of the investigation is precisely the study of the potential of social inclusiveness in the application and management of these technologies. The goal is stated in the title: the examination of the characters and contexts of application of these technologies to contribute to the development of democracy in urban planning.
There is a good chance that this will happen; Graham is also optimistic about the enlargement of the social context, in particular with regard to access to these technologies by social movements and communities: "There is a *politics of data and of digital information* in the city expressing the need for robust, democratically organised social movements to really harness these technologies in their full range"[17].

16 "… Rather than castles, city walls and siege warfare, however, the new military urbanism combines walls, fences and barriers with biometric scanning. It adds killer robots and cyborg insects to the revitalising sciences of urban fortification and 'control architecture'. And it blurs globe-straddling attempts to track people, information, money and trade to a proliferation of more or less militarized or securitized camps, bases, security zones and enclaves. Many of these, however – far from being split-off from the world – are linked together through the very circulations and infrastructures that make neoliberal globalization possible" – from S. Graham, the New Military Urbanism, in Nonkilling Geography, edited by James Tyner and Joshua Inwood, Center for Global Nonkilling, 2011, *http://nonkilling.org/pdf/NKgeo.pdf*.

17 Urban Militarism: Excluding the "Disordered", S. Graham interviewed by Vijay Nagaraj, 13

3.4. Other systems for direct involvement of the residents in local urban planning: the case of energy and the new energy technologies

Under point 2 above, after listing three levels of local approach to "city smartness", mention was made of a fourth one, with which we shall now deal.

This fourth level is reached when participation takes the form of residents' property or joint property with local authorities and infrastructures and plants serving quarters, districts, or other urban parts. The most advanced implementation line consists in the establishment of comprehensive (inclusive) structures of an entrepreneurial kind, similar in many ways to public companies, in which the inhabitant or partner, bearing on the administration of the service, plays at the same time the roles of owner, producer, and user and is thus compelled to reconcile social, economic, and environmental interests which usually conflict when these roles are played by separate actors.

The energy sector proves particularly suitable for this approach; in Denmark for example a relevant share of the overall energy system is covered by residents' co-operatives, also established thanks to specific national support policies[18], ensuring relevant social, environmental, and economic benefits to both the individual partners and their local communities.

It has to be said that two evolving systemic drives are converging on the development of energy localism and its role in the reorganisation processes of settlement: on the one hand the increasing decentralisation of legal jurisdiction and powers, which is reaching the matters of energy and the environment; on the other the development of the process of liberalisation and privatisation of the energy markets. This second drive is countering the traditional monopolistic-centralist model of national energy systems. Proposing wider and distributed new systems tendentially promoting the local context in their operational planning and therefore modifying the relationship between energy and territory, this opens an important new potential to the local plan.

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13 September 2011, *http://www.opendemocracy.net/5050/vijay-nagaraj/urban-militarism-excluding-disordered.*

18 See *http://dbdh.dk/images/uploads/pdf-key-articles/best-practice-in-danish-district-heating.pdf.*

In many countries the opportunities offered by these changes are being taken by several local communities, on the initiative of far-seeing local authorities or groups of residents. Experiences are even at an advanced stage in some Northern European states.

Especially suitable for the development of these local participatory initiatives are the new technologies of rational use of energy (RUE) and renewable energy sources (RES), in particular the systems for district heating and cooling by combined heat and power generation from traditional and renewable sources (biomass, urban solid waste, etc.), the small-scale combined heat and power generation plants (micro-cogeneration), and wind, thermal solar and photovoltaic power production systems as well as the recent "smart grids" using more or less complex ICT systems for optimal on-time matching of the fluctuating energy demand with the energy supply from a mix (depending on the different particular circumstances) of carbon and renewable sources.

By installing these technologies, by the way, the residents' participatory initiatives mentioned before can obtain additional income for their proceeds from energy generation through the sale of the white and green certificates or other negotiable titles obtainable by their low-impact plants.

All this highlights at least three points having relevant importance in the plan and project of a Smart City:

- The inhabitants directly contribute to modifying their behaviours as regards urban sustainability through their choice of efficient technological applications of low environmental impact. They are led in this direction by the conformation itself of the planned city.
- The inhabitants can also participate financially in planning the town, or parts of it, and in implementing what is planned. Moving beyond the logic of immediate profit maximisation, at least part of the income from their sales of energy and related services may be allocated to interventions for the enhancement of urban quality (e.g. parks, social housing, etc.) and reduction of global urban impact.
- Energy efficiency and environmental compatibility, both typical of these applications, may be considered ribs of the urban plan, that is, structural values for the pursuance of urban development and settlement requalification within the logic of collimating energy

demand and supply exactly on those ribs. Since setting out the plan, these new systems may be taken as the basis for establishing the energy basin or district, the functional mix, the dimensions of intervention, and the whole urban physical and functional organisation.

4. Conclusions

The survey and the previous elaborations suggest some preliminary conclusions:

- The widespread application of advanced technologies characterises the visions of the future of the city (Smart City); this setting directly and indirectly affects the physical and functional organisation of the city, but can also be a formidable factor in the evolution of the form and content of urban planning in terms of the advancement of participatory democracy.
- This prospect of redefining the plan is based on some structural features of these technologies that are pervasive, embedded, and inclusive, facilitating the insertion of the individual in participatory processes and urban management.
- In the configuration of the new directions of the plan, however, resistance to innovation must be overcome and some problematic elements that characterise the traditional approach to urban planning must be dealt with, including:
- The modification of current approaches concerning the cultural foreclosure of technology in planning; technology should be one of the cornerstones of contemporary plans; the idea of the Smart City is not in line with the a-technological plan, and vice versa, the latter does not lead to the Smart City.
- The consideration that the massive introduction of new technologies in the city should serve not only to improve quality of life and the efficient use of resources but also to promote socio-economic development; new technologies in planning as engines of local development and competitiveness.
- The incorporation of advanced governance in devolution of powers and participatory processes; technology shapes the new plan not only

in content but also in the process of preparing as regards information, training, communication, decision-making procedures, and so on.

- The addressing of physical and functional organisation of the city to encourage and accompany virtuous behaviour of people (behavioural planning); not making the city conform to the behaviour of the inhabitants, but planning the city to generate the behaviour.
- The acquisition of the dynamic value of the plan produced by the dialectic convergence of two operational directions (bottom-up and top-down) and the two fields of intervention (large scale and small scale).
- The facilitation of change within the framework of the actors of urban transformations giving roles to new entrants. In the smart city this opens up the possibility that the traditional interlocutors of the urban plan are at least partially replaced as agents of urban transformation by the producers of advanced technologies and services. The plan must take this opportunity to facilitate innovation and development processes and raise the cultural level of the negotiation.
- Specific fields of technological applications seem to open up interesting possibilities for the development of planning processes in terms of advancement of direct and inclusive participation in planning and urban management; technology application seeks to go beyond the simple role of support to become an integral part of the planning methodology.
- The widespread urban application of these new technologies, particularly those for security also involves, however, possible misuses in the direction of systems marginalisation, segregation, and discrimination which find evidence in the production of functional and physical organisation of the city; their use in the plan must be considered under the democratic control of the community in terms of inclusiveness and enlarged urban management.
- Advanced technologies, properly implemented, enhance the dynamic and evolutionary value of the plan; the direction is towards the “plan-process” and “planning by doing”. The dynamic characterisation of the plan is likely to drive the dialectic of city–behaviours and to respond appropriately to the information obtained in real-time.

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