TeMA

Journal of
Land Use, Mobility and Environment

This special issue collects a selection of peer-review papers presented at the 8th International Conference INPUT 2014 titled "Smart City: planning for energy, transportation and sustainability of urban systems", held on 4-6 June in Naples, Italy. The issue includes recent developments on the theme of relationship between innovation and city management and planning.

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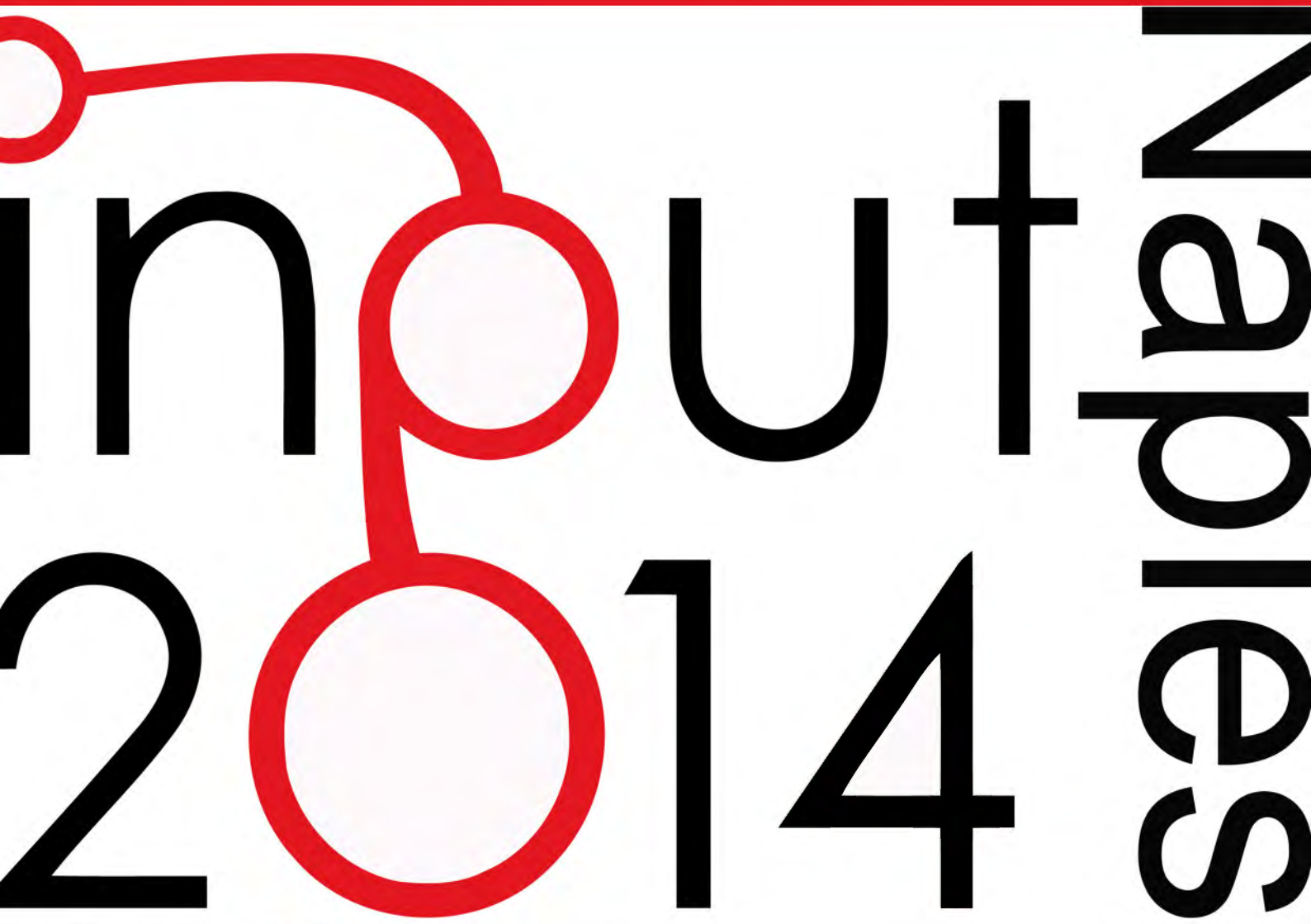

Smart City

planning for energy, transportation and sustainability of the urban system

Special issue, June 2014

print ISSN 1970-9889 e-ISSN 1970-9870
University of Naples Federico II

TeMA Journal of Land Use, Mobility and Environment

SMART CITY

PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

Special Issue, June 2014

Published by
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"

TeMA is realised by CAB - Center for Libraries at “Federico II” University of Naples using Open Journal System

Editor-in-chief: Rocco Papa
print ISSN 1970-9889 | on line ISSN 1970-9870
Lycence: Cancelleria del Tribunale di Napoli, n° 6 of 29/01/2008

Editorial correspondence
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TeMA Journal of Land Use, Mobility and Environment

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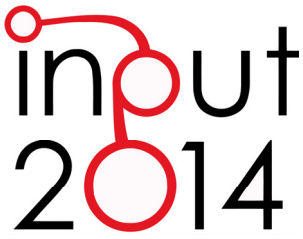
This special issue of TeMA collects the papers presented at the 8th International Conference INPUT 2014 which will take place in Naples from 4th to 6th June. The Conference focuses on one of the central topics within the urban studies debate and combines, in a new perspective, researches concerning the relationship between innovation and management of city changing.



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EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

SMART CITY. PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

This special issue of TeMA collects the papers presented at the Eighth International Conference INPUT, 2014, titled "Smart City. Planning for energy, transportation and sustainability of the urban system" that takes place in Naples from 4 to 6 of June 2014.

INPUT (Innovation in Urban Planning and Territorial) consists of an informal group/network of academic researchers Italians and foreigners working in several areas related to urban and territorial planning. Starting from the first conference, held in Venice in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies (ICTs) as key planning support tools. The theme of the eighth conference focuses on one of the most topical debate of urban studies that combines , in a new perspective, researches concerning the relationship between innovation (technological, methodological, of process etc..) and the management of the changes of the city. The Smart City is also currently the most investigated subject by TeMA that with this number is intended to provide a broad overview of the research activities currently in place in Italy and a number of European countries. Naples, with its tradition of studies in this particular research field, represents the best place to review progress on what is being done and try to identify some structural elements of a planning approach.

Furthermore the conference has represented the ideal space of mind comparison and ideas exchanging about a number of topics like: planning support systems, models to geo-design, qualitative cognitive models and formal ontologies, smart mobility and urban transport, Visualization and spatial perception in urban planning innovative processes for urban regeneration, smart city and smart citizen, the Smart Energy Master project, urban entropy and evaluation in urban planning, etc..

The conference INPUT Naples 2014 were sent 84 papers, through a computerized procedure using the website www.input2014.it . The papers were subjected to a series of monitoring and control operations. The first fundamental phase saw the submission of the papers to reviewers. To enable a blind procedure the papers have been checked in advance, in order to eliminate any reference to the authors. The review was carried out on a form set up by the local scientific committee. The review forms received were sent to the authors who have adapted the papers, in a more or less extensive way, on the base of the received comments. At this point (third stage), the new version of the paper was subjected to control for to standardize the content to the layout required for the publication within TeMA. In parallel, the Local Scientific Committee, along with the Editorial Board of the magazine, has provided to the technical operation on the site TeMA (insertion of data for the indexing and insertion of pdf version of the papers). In the light of the time's shortness and of the high number of contributions the Local Scientific Committee decided to publish the papers by applying some simplifies compared with the normal procedures used by TeMA. Specifically:

- Each paper was equipped with cover, TeMA Editorial Advisory Board, INPUT Scientific Committee, introductory page of INPUT 2014 and summary;
- Summary and sorting of the papers are in alphabetical order, based on the surname of the first author;
- Each paper is indexed with own DOI codex which can be found in the electronic version on TeMA website (www.tema.unina.it). The codex is not present on the pdf version of the papers.

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TeMA
Journal of
Land Use, Mobility and Environment

TeMA INPUT 2014
Print ISSN 1970-9889, e- ISSN 1970-9870

DOI available on the online version

SPECIAL ISSUE

Eighth International Conference INPUT
Smart City - Planning for Energy, Transportation and Sustainability of the Urban System

Naples, 4-6 June 2014

GEODESIGN
FROM THEORY TO PRACTICE:
IN THE SEARCH FOR GEODESIGN PRINCIPLES IN ITALIAN PLANNING REGULATIONS

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ABSTRACT
Geodesign is a trans-disciplinary concept emerging in a growing debate among scholars in North America, Europe and Asia with the aim of bridging the gap between landscape architecture, spatial planning and design, and Geographic Information Science. The concept entails the application of methods and techniques for planning sustainable development in an integrated process, from project conceptualization to analysis, simulation and evaluation, from scenario design to impact assessment, in a process including stakeholder participation and collaboration in decision-making strongly relaying on the use of digital information technologies. As such, the concept may be not entirely new. However, it is argued here, its application have not reached expected results so far. Hence, more research is needed in order to better understand methodological, technical, organizational, professional and institutional issues for a fruitful application of Geodesign principles and method in the practices.
In line with the above assumptions, this paper is aimed at supplying early critical insights as a contribution towards a clearer understanding of the relationships between Geodesign concepts and planning regulations. The auspice with this first endeavour along this research issue is to make a more explicit and robust link between policy principles and planning, design and decision-making methods and tools, possibly as a small contribution to bring innovation in the planning education, governance and practice.

KEYWORDS
Geodesign, urban and regional planning regulations, Strategic Environmental Assessment.

1 INTRODUCTION

Since the middle-Eighties in Italy, territorial governance faced an evolution towards more environmentally savvy approaches to urban and regional planning. Besides environmental sustainability, transparency, communication and participation are all components of further innovation to the planning paradigms towards a broader scope in sustainability of development. In the last decade at the European level, the Directive 2001/42/EC on Strategic Environmental Assessment (SEA) was transposed in national and regional legislation frameworks introducing a new approach and shifting the scope of urban and regional planning towards decision-making processes aiming at governing territorial development according to sustainability principles. However, many pitfalls have been reported in the SEA application in Member States (Parker, 2007; COWI, 2009). Many of them can be found also in the SEA of spatial planning at the regional and local level, including -but not limited to- unsatisfactory explanation of how the environmental sustainability issues inform the plan options and in evaluating relevant impacts, unclear explanation of uncertainties and difficulties in analysis, and last but not least unclear impact of public participation in the decision-making process (Fisher, 2010). All this pitfalls may be related to the lack of a clear shared vision on how to implement SEA in spatial planning both in terms of principles, methods and tools.

In order to address these evident and common issues in a fruitful implementation of SEA in spatial planning, Geodesign, as a digitally aided design approach for the creation of change proposals and impact simulations in their geographic contexts (Flaxman, 2010), may support to bridge the gap between SEA policy principles and implementation in the practice with an operational methodology. This approach appears to be particularly actual with regards to the Italian spatial planning governance which recently faced innovation drivers thanks to the current development in regional Spatial Data Infrastructures (SDI), as enabling technical platform supporting spatial governance.

In the light of above premises the aim of this study is to analyse the Italian national and regional legislative framework and investigate where in the past and current regulations is it possible to find elements of coherence with the Geodesign principles, methods and tools in order to supply an explicit and clearer framework for its application.

The paper is organized as follows: the next section gives a clearer definition of Geodesign based on the literature review with the aim of supplying an operational framework for the following analyses. The third section illustrates the study methodology which focuses on the analysis of the relationships between the Steinitz' Geodesign Framework (GDF) (2012) and selected national and regional regulations shaping the planning process in Lombardy, Tuscany and Sardinia. The results of the analysis aim at making these relationships more explicit in order to reduce the gap between policy principles and their technical implementation. Current results does not pretend to be systematically exhaustive at the present stage of development, nevertheless they already offer some interesting critical hints for addressing the given issue.

As a matter of facts many concepts entailed in the Geodesign Framework can be found in past and current planning legislative frameworks defining the planning systems in many countries. To mention but one example, the exercise of Environmental Impact Assessment (EIA) which is central to the GDF, is concerned by United States' regulation since 1970 with the National Environmental Policy Act (NEPA). Similarly EIA was introduced in European environmental aquis since the middle-Eighties (i.e. Directive EIA Directive 85/337/EEC). On a similar vein, relationships between many concepts and methods, which found integration in the GDF, and normative rules defining the planning systems and procedures guiding the practice can be found in national and regional planning regulations. However, these relationships may not be always evident to the practitioners, thus creating weaknesses and pitfalls in their implementation. The reasons are many

including the lack of reliable expertise (having this issue implications also with regards to planning education) and contextual socio-cultural and political settings (i.e. role of actors, level of rationality of the process, availability of data and tools, and the like). Thus, it is argued contributing to make a more explicit link between good planning and design methodology approaches and actual planning regulations may eventually help to achieve more effectiveness in the implementation of the underlying principles of a planning system.

2 THE EMERGING GEODESIGN PARADIGM

The term Geodesign, introduced by Jack Dangermond in 2005 to indicate the design activity in the geographic space, is relatively new (Artz, 2010). Nevertheless its application has long back origins. In fact, "any design-related activity which depends on or in some way changes the context of our surroundings can be considered geodesign" (Miller, 2012).

Geodesign employs a multidisciplinary and synergic approach to solving complex problems that involve not only territorial and environmental issues, but also social and economic concerns (Dangermond, 2010). Integration of different information in a design workflow, either at the local or at the global scale, is achieved through methods and tools borrowed from Geographic Information Science (GIScience - Goodchild, 2010; 2012). The growing interest in Geodesign is demonstrated by an increasing number of conferences and even more by many new curricula on Geodesign flourishing within the School of planning in the United States (Foster, 2013).

In order to apply Geodesign to regional landscape design studies Carl Steinitz recently synthesized (2012) a complete methodology framework oriented to understand how the context should be transformed. Steinitz's Geodesign Framework (GDF) represents a particular adaptive methodology for decision-making in urban and regional planning and design informed on (digital) spatial information. The framework enables the planning (or Geodesign) technical team to develop a holistic view of the multiple issues involved in a planning process and, using geospatial modelling and impact simulations, to get real-time feedbacks on the performance of alternative development scenarios in form of maps, charts and reports (Ervin, 2011). An example of this approach has been recently implemented by Campagna and Matta (2014) on the case study of the SEA of local land-use planning (LLUP) in Sardinia, which implements among other concepts Harris's (1989) idea of interactive sketch planning in Planning Support Systems, which is also central to Geodesign.

The core of the GDF relies on six models which allow designing future development scenarios and identifying the possible consequences of those changes, through territorial reference context description, analysis of its own dynamics and evaluation of its potentiality. The first three models describe the present situation of the territorial context: the Representation Model abstracts information into a set of digital spatial data layers, the Process Model combines them to describe how spatial phenomena evolve in time, and the Evaluation Model supports to explore which implications have these processes in the area. Then, in the light of the results of above analysis, the last three models describe how the territorial context could develop or become in the future: the Change Model delineates possible alternative options for transformation, the Impact Model evaluates the presence of beneficial or harmful impacts on natural and human environment deriving from those alternatives, and eventually the Decision Model help the stake-holders to express preferences on alternative and eventually to make a final decisions.

A complete Geodesign study should consist of three iterations along the six models: in the first iteration (i.e. scoping) the framework steps are driven from model one to model six and the intent is to understand the scope of the analysis; during the second iteration (i.e. metaplanning) models are conceived in reverse order with the aim to define in details how to carry out the study. Lastly, in the third iteration (i.e. implementation) the design/planning study method and models are carried out from the first to last one again. Linearity along

the iterations is not strict and feed-back loops or shortcuts may be necessary several times before the study is completed. One of the elements that most make geodesign useful in terms of spatial planning is that analysis inform design since the early stage of planning process and goes along with it until the end in a not linear course enriching it through several iterative possible loops. With these respect the GDF shows a consistent logic with SEA which should be run since the early stages of the planning process in order to inform decision at any stage, and it may contribute to address many current SEA pitfalls encountered in the urban and regional planning practices (e.g. how to inform design alternatives). Moreover, in the emerging Geodesign debate its practical implementation is closely connected to the use of digital data and technology in planning and design, which since few years is slowly starting to characterize current planning governance and practices in Italy thanks to development in regional geographic information systems according to a Spatial Data Infrastructure paradigm.

3 METHODOLOGY AND CASE STUDY

This study springs from the assumption that design in geographic space, or Geodesign, may become a reliable way to drive the planning process towards more sustainable spatial decision-making and development processes. Many of the ideas underlying the concept of Geodesign are not new though, and references to them can be found looking back to the evolving urban and regional planning regulatory framework, and this is done here with regards to in the Italian planning system. Nevertheless, while the ideas may be already there, their practical implementation as discussed earlier often lacks to fulfill the underlying principles. To this end, understanding the relationships between methods and norms may help to ensure a more responsible and proactive application of the regulations. Starting from this assumption, the research methodology of this study involves a critical review of selected Italian national and regional planning laws in order to detect links to Geodesign key concepts into them. After a brief review of the evolution of the national planning legislation from a Geodesign perspective, the study focuses on three specific regional case studies: namely Lombardy, Tuscany and Sardinia. Hence, relating the six models of the Steinitz's GDF with each of them, existing (or missing) links are identified and analysed critically. The results are outlined in a summary matrix shown in the last section, which is aimed at contributing to put light on which issues are of particular relevance in order to properly take into account in integrated way Geodesign principles in the planning regulations. The final objective is to eventually contribute to inform guidelines to foster the Geodesign diffusion and its proactive implementation as a mean to address current pitfalls in urban and regional planning SEA.

3.1 THE ITALIAN PLANNING SYSTEM

The structure of the Italian planning system dates back to the 1940s. Since then it has evolved to the present day through slow steps of innovation. Since 1942 the Italian National Planning Law n. 1150 promotes a top-down three tiers hierarchical system which basically includes territorial plans, local land-use masterplans (usually at the municipal level), and sub-municipal implementation sectorial plans. Initially the system was intended as a tool to deal with strong urbanization pressure in the first half of the XX century and urban reconstructions in the aftermath of World War II. After few decades, in a period of considerable residential expansion, the issue of urban quality standard came to stage as a consequence of the need to equip cities of modern social services and infrastructure facilities. Therefore land-use plan design priorities became related the need to ensure the proper balance between housing and services for residents. Law n. 765/1967 and the Ministerial Decree n. 1444/68 addressed these issues introducing standards for land-use design, as well as physical parameters for urban development. The zoning instrument was also somehow

institutionalized by the same law, encoding in a standard classification future development land-use categories. The attention paid to such services as education, cult, health, as well as recreation, parking and green areas contribute to shift the scope of planning from quantity to quality and community well-being. While the latter can be considered one of the perspectives of Geodesign, the solution proposed at that time (i.e. the introduction of minimum quantity standards) can be nowadays considered an unfledged approach to be further innovated.

New breath of innovation was brought in the Italian planning system in 1985, when Law n. 431 introduced the contemporary conception of territory as a unitary system and finite resource storage to be preserved. Modern landscape plans were introduced bringing to stage the environmental planning approach. This is the time in Italy when first environmental services started to become mandatorily an object of analysis. Territory started to be considered as an environmental, economic and socio-cultural system, the savvy management and development of which had to be based sound knowledge and informed decision-making. More recently, with Code of Cultural Heritage and Landscape n. 42/2004 the planning model undergoes an important qualitative evolution towards a slight different concept of landscape as brought by the European Landscape Convention. Environmental or landscape compatibility assessment became a significant element of contemporary urban and regional plans. Environmental systems carrying capacity is becoming the starting points of contemporary territorial planning, where the planner is a coordinator of multidisciplinary pool of experts ranging from architecture to engineering, from history and archaeology, from geology to hydraulics, from sociology to economy, to which Geodesign add a new figure of spatial information specialists.

The evolution of the spatial planning approaches brought by the Italian legislation briefly outlined here, is intended not to be exhaustive, rather it is proposed as a general background framework for the analyses of the Geodesign key principles found in selected Italian regional case studies, as discusses in the next section.

4 GEODESIGN PRINCIPLES IN ITALIAN REGIONAL PLANNING REGULATIONS

In this section a more detailed discussion of the relationships between the legislation framework and the GDF models are given. At the end of the section a matrix is proposed synthesising the results.

The first stage of the GDF is the Representation Model (RM), whose purpose is to understand how the geographic study area should be described. The description should be as complete as possible in space and time. There is not a predefined set of data to analyse, but it is important to select those needed in relation to the case study at hand, and to organize them in the geographic space (Steinitz, ibidem).

The RP is perhaps the one among the other GDF models which is never missing in a planning and design study. However looking back to the first Italian Law 1150/42 and following modification and integrations, its content has deeply evolved along time. In the last decade, regulations on Strategic Environmental Assessment (i.e. Directive 2001/42/EC) started to affect the content of urban and regional plan requiring to include in the SEA environmental report a complete description not only of the environmental, economic and social data, necessary to represent the local Environmental Framework, but also all the other existing local regulations and projects affecting territorial context (or, the Normative Framework). A correct Geodesign implementation would imply to treat all these relevant information spatially: this is a requirement that is not necessarily always properly addressed in the practice.

Also there is not a singular methodology to collect and display data, but it is recommended to choose visualisation methods and spatial scale of representation which provides the variation of different ways to look at the territorial context (Steinitz, ibidem). In the first iteration the RM should help to define boundaries of the study area, its geographies, and list existing sources of (digital) information and services. The later part is something that has currently started to be addressed by spatial planning law thanks to the recent

development in RSDIs, as demonstrated by the examples discussed in this section. In the second iteration, however it should be decided in the light of the input need of all the GDF models, exactly what data, what scale and accuracy, what processing services are required. Until recently, the representation of spatial data is more generally concerned by the recent European legislation on the development of the INfratructure for Spatial InfoRmation in Europe (i.e. INSPIRE, Directive 2007/2/EC). According to INSPIRE interoperability principles, public administration at all level in the Member States should give public online access to 34 spatial data themes according to common specifications. Moreover, many planning regulations and spatial plans require using public authorities' data resources in plan-making, thus affecting the format the representation model with important implications for the planning and design processes. Moreover, many planning regulations and spatial plans require using public authorities' data resources in plan-making, thus affecting the format of the representation model with important implications for the planning and design processes. This is the most challenging part of the process for data in RSDI are not necessarily created for planning purposes and their reliability should be carefully evaluated. One important implication is that SDI implementing rules, which define common data models, are eventually affecting the content and format of the planning knowledge in a European wide process. This issue which started to be addressed by Plan4All (http://www.plan4all.eu) an eContentplus EU project carried on by a consortium of 24 partners from 15 European countries, aiming at harmonizing spatial planning data and related metadata according to the INSPIRE principles, and it should be further analysed in order to understand the technical implications for the planning practice. Eventually, in the third iteration GDF data are collected and integrated for use. The latter seems to be an issue successfully addressed as current RSDI download and invoke services usually allow online open data access.

Looking at the regional level in Italy, the Lombardy Regional Territorial Government Law n. 12/2005 (Lombardy LR12/2005) in Article 3 institutes the Territorial Information System (TIS) as a new tool to coordinate local information. The TIS or the Lombardy regional SDI (L-RSDI) integrates thematic datasets from multiple sources, including public authorities at all levels and the scientific community. Public authorities also provide approved plans and projects in digital form updating dynamically the L-RSDI knowledge base. In Lombardy LR12/2005, Article 8 specifies the municipal territorial government plan (PGT) documents content: the territorial knowledge framework of the municipality should include historical development of settlements, geological, hydrogeological and seismic characteristics, mobility infrastructures, risk vulnerability sites, natural habitat sites, the agricultural landscape structure, and urban fabric, among other spatial data themes. This way both the environmental and the normative frameworks are constantly updated and made available. With the possible limitations explained earlier in this section, the L-RSDI allows to acquire relevant data to be used in the GDF iterations for the representation model.

Also in Tuscany, thanks to Article 28 of the Regional Territorial Government Law n. 1/2005 (Tuscany RL1/2005), the regional government together with the provinces and the municipalities are responsible for the management of the Regional Geographic Information System (RGIS) in order to integrate the geographical knowledge, to organize, update, advertise it and make it available to all the stakeholders involved in the planning process. The Tuscany RGIS also features a geoportal which give access to download services. In the same law article the RGIS is also clearly defined as a key reference point for the construction of the knowledge framework useful in developing decision-support tools for spatial planning and environmental impact assessment.

According to Tuscany RL1/2005, Article 29 moreover, the RGIS collects information from the public authorities and the scientific community, which includes the following themes: topography and geology, orthophotos, satellite images and historical maps, thematic databases on the state of the local resources as well as the local knowledge as resulting from the local planning tools. The Regional Government is

responsible for regulating the information management process, the technical specifications and the standards to be adopted for preparation and diffusion of geographic data, affecting the first and especially the second iteration of the RM.

In Sardinia conversely, the Regional Spatial Planning Law n. 45/1989 (Sardinia RL45/1989), does not refer either to any specific Regional SDI, nor it recommends any specific data management technology unlike the former. This is not surprisingly for dating back to 1989 this law could have barely foresaw what would have been the evolution of the paper map based information system available at that time. Nevertheless integrations to Article 19, specifies that a landscape and environmental compatibility study attached to Local Land-Use Plan (LLUP) should contain the municipality cognitive framework with indication of geologic, geomorphologic, hydrologic, landscape and historic contents, and settlement and infrastructure transformations, somehow affecting the implementation of the RM and the overall GDF. Nevertheless, in Sardinia, recent SEA-LLUP official guidelines, while defining the Environmental Report contents (ER), requires a description of the current status (i.e. do- nothing alternative) of 11 given environmental components (e.g. air, water, waste, soil, flora and fauna biodiversity, landscape, settlement system, economic system, transport, energy and noise) through specific summary data sheets which lists the information to be included, the indicators to be developed and the maps to be produced. The same indicators should be compiled at a later stage (i.e. in the impact model) for design alternatives. This way, the SEA-LLUP guideline affects both the RM and the IM.

The second stage of the GDF is the Process Model (PM), whose purpose is to understand how the study area operates by identifying ongoing physical, ecological, human and geographical processes and relationships among them. In the second iteration it should be defined what analytical, simulation or forecast models should be used to describe selected environmental or anthropic processes, and how their results should be visualized and shared. To the latter respects, it is not easy to find clear links to specific steps of the PM within the body of legislation under analysis, possibly because no guidance was found on the methodology to be adopted for the plan preparation, of which this model is an essential part according to the GDF. However, it is possible to find some references to first the iteration in terms of which processes should be concerned in the analyses.

Tuscany LR1/2005 Article 33 specifies that the Regional Landscape Framework Plan should contain the analysis of territorial the transformation dynamics through the identification of risk and vulnerability factors, whereas in the Sardinian LR45/1989 the socio-demographic analyses and forecasts and consequently the housing requirements, represent a mandatory step, as stated in Article 19, in LLUP plan-making.

With regards to SEA regulations, both in Tuscany (i.e. RL10/2010) and in Sardinia (i.e. Reg. Dept. Env. Act n. 33/34 -2012) it is specified that ER should contain information about the likely evolution of the environment without the plan implementation. No reference is given to any method or tools to achieve comply with this requirement, which is actually transposed from Annex I of Directive 2001/42/EC which sets out the contents of the ER.

The third stage of GDF is the Evaluation Model (EM), which concerns such questions as if the current study area is working well, why or why not, what are the main problems and possible opportunities. This is a knowledge step in which it is important for decision-makers and stakeholders to choose suitable evaluation method (e.g. scientifically or judgement based), criteria related to the geographical context and to assign them weights and a values. This model strongly influences the decision-making process because determines areas attractiveness, vulnerabilities and risks, and as a consequence those who need to be changed or to be preserved.

In Lombardy LR12/2005, Article 8, it is required for the Municipal Territorial Government Plan to identify and portray in a suitable representation scale several functional suitabilities with regards to such objectives as

environmental, landscape, historic, geologic and ecologic preservation, or requalification, indicating also the possible actions and their purposes. In Tuscany LR1/2005, Article 53 states that the municipal masterplan should indicate the functional and territorial systems and sub-systems which define the territorial identity structures, the structural values as defined in Article 4, the criteria for the use of resources, the instructions for landscape safeguard and for environmental and cultural heritage protection, as well as significant public interest areas and properties. Article 33 moreover specifies that Regional Landscape Framework Plan contains analysis of relationships among historic, natural and aesthetic characteristics and as a consequence the definition of landscape value to be considered as attitude or vocation to change. In Sardinian LR45/1989, Article 19 specifies that the municipal land use masterplan should define the areas which need special protection and safeguard rules as well as the areas which need existent urban rehabilitation.

Thus, in all cases territorial systems or sub-systems to be evaluated somehow are pre-determined by the regional planning legislations. As in the case of the PM, also for the EM methods and tools are not mentioned. Nevertheless they could be concerned by technical guidelines complementing regulations. In fact, in Sardinia the SEA-LLUP official regional guidelines, in order to represent in a synthetic manner the results of the environmental analysis, suggest the application of the SWOT analysis, which allows the identification of Strengths and Weaknesses of an area and as a consequence Opportunities and Threats. This analysis aims to detect possible environmental critical issues that may be affected by the plan, and to highlight the vocations of the territory.

The fourth stage of GDF is the *Change Model* (CM), whose purpose is to understand how the geographic study area might be altered. This is the first stage of concrete design as traditionally intended in which strategic and physical development policies are proposed and simulated. The typical products of change model are data that will be used to represent future possible conditions (i.e. the zoning map in a land-use plan). The representations of chosen scenarios are then input for the next steps of GDF and could be used during communication and participatory phases.

In Article 8 of Lombardy LR12/2005 it is specified that the Municipal Territorial Government Plan identifies strategic development goals according to higher level territorial policies and then it defines quantitative development goals considering the importance of territory requalification, the soil consumption reduction, the rational use of environmental and the savvy use of energy resources. Tuscany LR1/2005 in Article 53 claims that municipal masterplan sketches territorial development strategies defining territory governance orientation and in the Article 11 on integrated assessment, it refers to possible alternative plan solutions. In the Sardinian SEA-LLUP guidelines it is specified that the SEA process should support the design of one or more possible alternatives for the development of the municipal area, also including participatory consultation in this stage. Likewise, Tuscany RL10/2010 in Article 24 describes the ER contents referring to the identification and description of the sustainable plan alternatives implementing the system of the objective. In Lombardy a regional Resolution on the SEA of PGTs n.13071/2010 refers to reasonable alternatives to be designed and documented during ER elaboration.

The fifth stage of GDF is the *Impact Model* (IM), whose purpose is to understand which effects the changes might cause in the whole territorial context. There is a broad set of phenomena to be considered, and their choice depends on the expected changes and on the local context to be analysed. Each phenomena being investigated need a different impact model which focuses on a specific potential consequence that will have to be evaluated: economic and demographic impacts, environmental impacts related to such parameters as water and air pollution, energy use, biodiversity, public safety, noise and so on. Different impacts are often linked to each other in networks and they need to be combined into geographic context and summarized to identify their interactions. The study result of this step of GDF is generally a set of thematic maps showing

qualitative, quantitative and spatial differences between the state of the place before and after plan choices. Impact matrixes, check-lists and network models, as well as complex systems of indicators are also used.

In order to promote resources preservation and sustainability development, Article 4 of Lombardy LR12/2005 requires the SEA of all territorial and urban plans since the early stage of decision-making processes toward the implementation of proposed actions, as prescribed from Directive 2001/42/EC. The environmental impact study should supply the identification of potential impacts resulting from alternative plan choices, verify if they are beneficial or harmful and foresee mitigation measures if needed. Article 8, which specifies content of the local plans documents, remarks the necessity to demonstrate the compatibility of intervention policies with public administration economic resources and with the effects generated in the affected territory. The main regulation never refers to the way of carrying out the analysis and does not specify which models are needed to assess and compare impacts deriving from potential changes.

Tuscany_LR1/2005 on Article 11 introduces the Integrated Assessment as a mean for evaluation of territorial, environmental, social, economic and human health effects before planning tool adoption since the first stage of the plan preparation. Integrated assessment should include compatibility assessment in relation to the use essential territorial resources as defined in Article 3 (i.e. air, water, soil, natural ecosystems, cities, landscapes, cultural heritage and infrastructural systems).

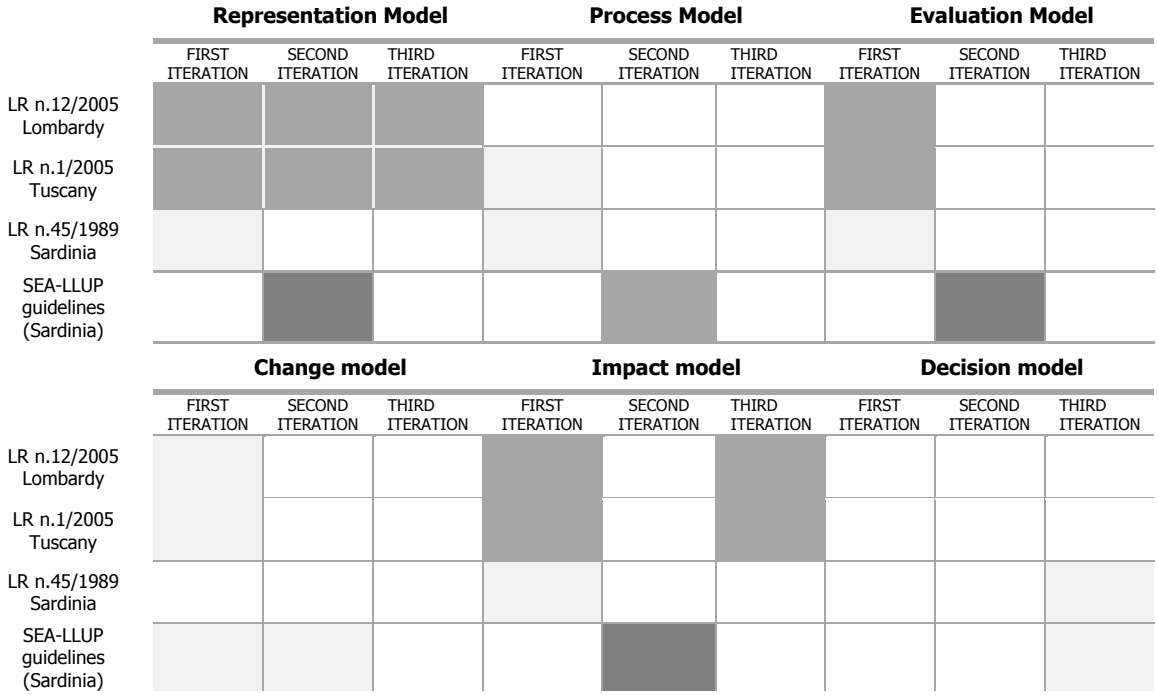
Sardinia LR45/1989 clearly states in its first article that planning should guarantee territorial resources protection and environmental protection, and artistic and cultural heritage safeguard, and on the integration of Article 19 refers to the SEA Directive specifying that landscape and environmental compatibility studies should include the environmental assessment of local plans. More recently, Sardinian SEA-LLUP guidelines specify that the assessment of the effects that the implementation of the plan on the environment should be carried out for all the design alternatives. The guidelines also suggest the usage of such methods as impact matrixes and overlay mapping. While matrixes are commonly used in the practices, complex overlay or spatial multi-criteria methods are not yet found often in ERs. These kind of analyses proposed by the GDF IM is among the contributions that SEA should bring to innovate urban and regional planning, perhaps to more consolidated in the practice.

The sixth stage of GDF is the *Decision Model* (DM), whose purpose is to understand how the study area should be changed through the identification of the best balanced possible alternative among those designed during the other steps of the Geodesign study. The DM also entails a series of activities which are relevant for the SEA of regional and urban plan for it should eventually demonstrates that the final choice is preferable in the light of the complex system of objective at stake. In Sardinian SEA-LLUP Guidelines it is generically specified that evaluation of the plan alternatives aims at identifying the one that, while ensuring the achievement of development objectives, determines the lower environmental impact.

Summarising the result of the analyses the matrix in table 1 shows in shades of grey (i.e. the darker the stronger) the relationships between the Geodesign framework models and the analysed regulations.

5 CONCLUSIONS

Most recent regional territorial government laws in Lombardy and Tuscany carefully take into account the role of the regional SDI as a base platform for knowledge management in design, planning and decision-making. Together with the ongoing process of transposition of the INSPIRE Directive this trend is likely to affect substantially the implementation of representation models in urban and regional planning. In Sardinia a similar trend is addressed by the new Regional Landscape Plan which sets directions for local land use planning including technical rules for plan content and portrayal. Altogether this trend may facilitate the diffusion of innovative Geodesign approaches also in other stages of the planning process.



Tab.1 Relationships between the Steinitz' (2012) Geodesign Framework Models and selected national and regional legislation in Italy

With regards to the other models to be implemented according to a Geodesign approach, so far less connections are found between planning regulations and applied methods, which should be defined in the second iteration of the GDF.

As noted elsewhere by Campagna (2014) the second iteration is strictly related to metaplanning, that is the activity of shaping the planning process in an operational workflow of activities. This is something missing in the planning legislation although it may have relevance to the process assessment as indicated by SEA regulations and good practices.

This is an issue which should be subject of further inquiry. More references are found however to the first GDF interaction, where the scope of the Geodesign study is defined, and to the third which define the practical implementation of the study up to the output, whose format is often partially pre-defined by law.

In synthesis the early results of this study highlight some of the gaps between underlying principles which frame by law the planning practice and actual design methods and planning outcomes. Whether this gap is deliberately kept or it may derive by a lack of methodological skills should be further investigated. Nevertheless, given the current Italian normative framework, a Geodesign approach may possibly help to solve critical issues for a proactive implantation of the principle brought by current regulations.

This study can be considered as a preliminary analysis which aims at mapping the relationships between methodological approaches within the normative framework. It can represent an early base for more systematic legislation analyses in order to find space for methodological innovation on top of developing territorial government platforms.

A clearer understanding of these relationships by educators, public administrators and practitioners may contribute to set up operative guidelines and tools to better interpret the principles brought by regulations. The Geodesign approach may turn out to be a reliable methodological way to bridge the gap between urban and regional planning strategic environmental assessment, exploiting the valuable knowledge that growingly is being embedded within developing spatial information infrastructure.

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ACKNOWLEDGEMENTS

The work presented in this paper was developed by the author within the research project "Efficacia ed efficienza della governance paesaggistica e territoriale in Sardegna: il ruolo della VAS e delle IDT" [Efficacy and efficiency of landscape and environmental management in Sardinia: the role of SEA and of SDI] CUP: J81J11001420007 funded by the Autonomous Region of Sardinia under the Regional Law n° 7/2007 "Promozione della ricerca scientifica e dell'innovazione tecnologica in Sardegna".