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Dealing with wicked environmental problems in urban and regional planning

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This Issue entitled "Dealing with wicked environmental problems in urban and regional planning " has been conceived for collecting a series of important topics included in current research interests and practical applications coming from young researchers regarding interdisciplinary and transdisciplinary works connected with social and environmental issues.

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Cover image: "Troubles' shadows", by S. Santoro, November 2020

Theory, methodology and practical approaches to address wicked environment-oriented problems in regional and urban planning and practices

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This issue of Plurimondi Journal entitled "Dealing with wicked environmental problems in urban and regional planning" has been conceived for collecting a series of important topics included in current research interests and practical applications coming from young researchers regarding interdisciplinary and transdisciplinary works connected with social and environmental issues. In particular, it tries to bring together young academics working in basic and applied science (engineering, architecture, planning, technology, economics and social sciences), to compare and discuss advances in research theories, methods, models, tools, applications and achieved results and to design some future perspectives for regional and urban planning and practices to address environment-oriented wicked problems in regional and urban planning and practices.

Authors have been asked to base their contributions on some key concepts:

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- *Climate Changes and Impact on Urban Environment* (including strategies for mitigation and adaptation, modelling and planning for resilience);
- *Complexity and Uncertainty issues in integrated environmental system* (including disaster risk management, disaster risk reductions, urban and regional resilience, risk assessment);
- *Sustainable management of natural resources* (including water management, land use and land cover changes, resource efficiency, biodiversity, ecosystem services, nature- based solutions);
- *Energy resources management* (including energy efficiency, renewable energy sources, smart energy systems, smart buildings, smart grids, energy planning);
- *Environmental dynamics and human influence* (including environmental impact assessment, strategic environmental assessment, life cycle assessment, corporate social responsibility);
- *Decision making, knowledge interaction & public participation in Environmental modelling* (including social inclusion, territorial cooperation, planning for resilient communities, participatory planning processes, urban environment).

Working on the territory means to realize, both theoretically and practically, an interrelated and rationalized complex of choices, in order to structure the space in such a way that a harmonic balance between population, productive resources and physical environment is determined. This set of choices on the one hand is based on precise criteria, for example of an economic nature, on the other hand is conditioned by cultural, ethical, historical needs and values, which are not reducible to straightforward scientific solutions.

A seminal paper by Rittel and Webber (1973) argues that solving planning problems means to deal with inherently wicked problems.

It should be noted that, because of the wide margin of uncertainty and non-scientific features that characterizes most planning aspects, and for the same essence of the problems that planning deals with, there will never be resolutive results (Rittel and Webber, 1973).

The contributions presented in this issue of Plurimondi address in different ways and on different scales a number of wicked environmental problems faced by urban and regional planning.

Specifically, although the topics of the papers are different in terms of case studies, issues and scales of intervention, it is possible to recognize a fil-rouge on themes of great debate in the field of urban and regional planning: (i) the complexity in the management of the territory (Marchau et al., 2019); (ii) the need for society to learn to live with risks because their assessment and management is increasingly difficult due to their own complexity (Beck, 1992); (iii) the importance of integrating bottom-up processes with traditional, sometimes ineffective planning techniques, through approaches such as action-research (Saija, 2017; Argyris, C., and Schön, 1991), or social mobilization that aggregates in small groups or organized movements (e.g., Friedmann, 1987), and (iv) the need to work on the existing environment aimed at the regeneration of a territory in economic and welfare terms rather than by increasing the expansion and consumption of land (e.g. Aigwi, Egbelakin and Ingham, 2018).

All the research efforts presented here arise from the will and enthusiasm of emerging researchers, in the field of urban and regional planning, to team up and work together, to join efforts of reflection, to open debates and considerations and

to work on an integrated planning concept, made of new knowledge and transversal interactions.
Going into the details of the present issue of Plurimondi, seven contributions have been collected.
The empowerment process of a group of citizens engaged in promoting a local project with the university has been the focus of the first paper (see *Caruso*). She proposes a reflection on i) the role of the actors involved within the process and of the university as an engaged party and ii) the capacity of an organized community to create strong and weak connections into planning processes.
Going ahead, from the second contribution presented by *Balena and De Lucia*, it is possible to understand how to manage the capacity of the social system to organize itself and to improve resilience to pre- and post-natural disaster events, through the analysis of the case-study of Haiti.
The theme of urban regeneration of underutilized areas and disused historic buildings is increasingly becoming a key intervention strategy to develop smart cities. The paper by *Vizzarri, Piludu, Calderazzi and Fatiguso* aims at selecting the best design solution for a specific the former Stanic refinery of Bari, starting from a multicriteria analysis concerning social, physical-morphologic, environmental and urban aspects.
The fourth contribution by *Balena* aims at understanding how the different forms of information, transmitted on Social Networks during an emergency, could help people to be safe.
Another perspective has been presented by *Dell'Omo, Limongi, Privitera, Somma and Vingelli*, whose contribution tries to recognize a fil rouge made up of common research interests of young Italian PhD students, oriented at identifying, through analogies and common traits, the

potential of interdisciplinary knowledge exchange and research networks.
The second last paper (see *Pavone*) aims to compare the traditional approach to risk management and the new challenges posed by the Anthropocene era, starting from the need to strengthen the relationship between technical-scientific knowledge and common knowledge for an integration of the resilience approach in local government practices.
Finally, *Damiano and Marino* focus their contribution on the integration of the objectives of two specific strategies, i) the National Strategy for Adaptation to Climate Change (hereinafter SNAC) and ii) the National Strategy for Sustainable Development, into spatial planning policies and spatial planning tools.

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Regenerating community places through collective action: the role of the University in community planning

Elisa Caruso*

Abstract

Recent experiments in collective management of a territory, generated by innovative processes of social learning are the precondition for building an organised community and the formulation of alternative models of territorial development. The focus of this article is the empowerment process of a group of citizens engaged in promoting a local project with the University. The aim is to propose a reflection on the role of the actors involved and of the University as an engaged university and on the capacity of an organised community to create strong and weak connections inside planning processes.

Keywords

Community; University engagement; Social learning; Bottom up

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Introduction: a new time for social involvement

In 1980, Giancarlo De Carlo wrote that the term 'participation' had different meanings and suspicious intentions. A few years later, Giancarlo Paba defined participation as an indefinite term but with a basic principle: 'the simple and elementary conviction that the collective products of human settlement in space (cities, villages, districts, neighbourhoods, landscapes, territories and environments) are built (or should be built) with the mobilisation of individual and collective energies, by putting in the pipeline the creativeness and innovation of the inhabitants and communities in all possible forms (Paba 1998b:33).

The term 'participation', in its 20 years of use in the field of planning, had a wide range of definitions A rich vocabulary was in fact created describing all individual approaches and numerous application tools have been tested. The proposals and experiments of deliberative democracy used a range of different practices and generated numerous types of citizen engagement such as participatory budgeting, town meetings, Open Space Technology, action planning and scenario workshops.

The season of democratic participation in Italy showed a strong public and social commitment and an important civic maturation (Cellamare 2019): however, it has increasingly become a form of mediation between representative and direct democracy.

The current geography of participation shows an articulated scenario: on the one hand, we are witnessing an institutionalisation of top-down processes, which have often become a purely-theoretical exercise to complete urban planning (Paba, Pecoriello, Perrone and Rispoli 2009; Morisi and Perrone 2013); on the other hand, a significant

number of citizen communities are experiencing new forms of grass-roots democracy.

This paper intends to propose a reflection on those active citizenship practices that are encouraging a radical political and cultural change (Magnaghi 2015) and the construction of new forms of community that can represent an innovative territorial government model. Through the proposed case study, this contribution tries to shed light on the features of the existing innovative transformation practices which are separately cooperating to achieve a long-term renewal of democracy (Ginsborg 2006).

What are the features that define these innovative practices? How can these practices influence other groups of active citizens and create an organised movement of democratic transformation?

To answer these questions, this paper aims to highlight the innovative features that characterise such practices. Each one of them, in fact, takes a step back from the most consolidated participation patterns and seems to reflect certain features of others. These practices can be summarised in three attitudes: the ability to create a community, the growth of knowledge and the production of relations.

The investigation focuses on two issues: the role of the actors involved in the collective action and their ability to produce increasingly positive developments (Della Porta and Diani 1998) and the role of the University as part of the 'ingaggio territoriale' [territorial engagement] (Saija 2016), reflecting on the development opportunities of the partnership between university and community within the Italian processes of collaborative research.

The proposed argument moves along two parallel multi-issue paths: the second section deals with the theme of community as a resource and discusses the issue of a

community's collective learning in a process of empowerment; the third section deals with the role of the University in promoting collective learning and engaging the community. The University is not an agent providing learning activities to communities in its consolidated functions (teaching and research). This paper refers to the so-called "third mission".
From this point of view, the University is not only concerned with teaching, but can learn and engage to deliver knowledge to the whole community. Besides, the community is engaged in collective learning and shared knowledge.
The fourth section, considering the outcomes of the previous sections, discusses the experience of re-appropriation of a place promoted by four 'returning' families (De Matteis 2017). This experience refers to the community project of Sant'Angelo Vico l'Abate which was co-built in partnership with the Department of Architecture[2] of the University of Florence, the Istituto Diocesano per il Sostentamento del Clero (IDSC), as owner and partner, and the Parish of Gesù Buon Pastore in Casellina.
The final section tries to create a tension between these two topics by defining a proximity direction in which the leading actors of a community-construction process, in partnership with the University, can experiment innovative construction practices for new democratic models.

The community as a resource

The top-down practices, which have been tested to date, are included in localised solutions, with poor propulsive and

[2] The research team is composed of the Regional Design Lab (ReDLab) and DarMed Lab

generative force. Some examples of these practices include the participatory processes conceived to support planning decisions that fail to generate ongoing processes and long-term groups of active citizens once the planning work is completed. The groups of active citizens which operate within the territory, on the contrary, are aggregated and built from the grassroots in search of a 'desire for community' (Bauman 2003).

These considerations require a necessary rereading of several over-used and generalised concepts like the concept of "community" which risks losing the fullness of its meaning. The importance of the concept of community (Olivetti 1956; Dewey 1971; Friedman 1979), which has overshadowed the concept of a society with individual rights and characterised the theory and practice of representative and deliberative democracy, triggers the reflection proposed in this paper.

Adriano Olivetti theorised a 'tangible community' which aims at building a community model which is structured as a network of democratic cells (Olivetti 1956) and based on the use and sharing of knowledge as a common good (Hess and Ostrom 2009). In the proposal of the tangible community we can find strong evocative features, such as the desire to reclaim citizenship and sovereignty from the bottom up. However, we are still stuck with the concept of community (Heskin 1991) related to the idea of proximity without considering the simultaneity dimension (Bonomi, Revelli and Magnaghi 2015) in which we live nowadays.

One point worth focusing on is the role that the community may have in renewing a conscious civil society that is capable of democratising democracy and starting a new path, in line with the 'third way' (Giddens 1998), based on principles of equality, inclusion and cooperation between government and civil society.

It is essential, therefore, to rethink the concept of community, understood herein as an aggregation of individuals who identify with the same values and are involved in a process that affects land government.
Starting from this interpretation, the study focuses on the role that each individual plays within the community and on how these individuals are capable of starting a process of mutual learning which leads the community to evolve.
Every individual who takes part in an empowerment process of a group of actors plays a pivotal role in the formation of 'local knowledge' (Paba 2003:31) and in the creation of a collective feeling closely related to the place. Each individual shares knowledge, values and ideas with the other members of the group, thus generating knowledge and collective memory. The added value is due to the interactions and relationships created between individuals and between groups that enrich individual learning.
The process hinges on the concept of collective learning and on the sharing of the generated knowledge with the broader community (Dewey 1938). The political project of Dewey, which aims to harmonise society through a community vision, introduces a theory where the individual shares values and knowledge by actively participating in the community life and taking part in more than one group, and thus strengthens the integrated personality of each individual (Dewey 1971).
The similar theory about the individual, who acquires an active role in mutual learning experiences, is proposed in Friedman's model of structured organisation of a society 'at the transition to action, so that social learning becomes possible. In social learning the results of action are examined in the light of expectation or altogether new discoveries' (Friedman 1979:69).

In collective action, the actor is a group that is held together by ties of dialogue among its members, but we come now to the crucial question of the size of the Good Society. 'Knowledge, action, learning: they are incarnated in the Good Society, each of whose members, forming part of the whole, also contains the whole and yet is separable and individual' (Friedman 1979:70).

The innovation proposed by Friedman's thinking, which lies in the integration of the collective learning approach with planning, identifies the hierarchical structure and size as the collective knowledge dissemination model. Such knowledge is generated by a collective process divided into several levels (Argyris and Shon 1978): on the first, individual knowledge is shared at the group level, and, on the second, the knowledge of the group is shared among multiple groups which, interacting together, create, define and institutionalise new collective knowledge and therefore a common heritage. The formation of a community awareness is a long process in which the community, therefore, becomes part of the action.

Recent experiments in collective management of the territory, generated by innovative processes of social learning, are the precondition for building an organised community (Alinsky 1917; Friedman 1979) and the formulation of alternative models of territorial development. The reading of the concept of community as a form of social dynamism, as proposed in this paper, may be the interpretive key to the construction of a conscious model of organised community which operates within the territory and creates a generative democracy (Minervini 2016).

The role of University in territorial engagement

A theme that is rarely present in Italian journals on planning and architecture is that of the university's third mission (Martinelli and Savino 2012; Cognetti 2013; Saija 2016) related to the British and American debate on university engagement (Votruba 1992; Boyer 1996).
In recent decades, the Third Stream activities in English-speaking countries and the Third Mission activities in countries on the European continent, have become part of university strategies, been the subject of evaluation and have attracted the attention of several research groups supported by the European Commission.
In Italy, the attention to the issue has grown thanks to the evaluation and classification work carried out by ANVUR and the monitoring of the technological transfer process inside Italian universities and in public research institutions conducted by NETVAL, i.e. the research enhancement network.
In the guidelines on compiling the annual single report on the Third Mission (TM) and the social impact of the university, 'public engagement' is inserted among the evaluation criteria in the ANVUR 2018 version[3], defined as 'the set of activities institutionally organised by the university or by its non-profit structures which have an educational, cultural and development value for society and that are aimed at a non-academic audience'. The 2018 report emphasises even more the institutional aspect that must

[3]ANVUR - Valutazione Terza Missione /Impatto sociale Università [Third Mission Evaluation/University Social Impact] – Guidelines SUA – TM/IS - 2018 version, see https://www.anvur.it/rapporto-biennale/rapporto-biennale-2018/ last accessed June 2020

characterise initiatives and adds an explicit reference to the non-academic target, even though the wording 'other institutional initiatives: policy-making, children university, participatory democracy, and knowledge co-production initiatives' remains unchanged in the evaluation of activities. The TM concerns a new relationship between universities (Boyer 1990). However, the focus of this paper is the field of 'public engagement' that takes on new social responsibilities and produces knowledge and learning environments (Cognetti 2013) thanks to the contribution from students and lecturers.

The image provided by the research (Ramella, Perulli, Rostan and Semenza 2018) presented on "La terza missione degli accademici italiani [The third mission of Italian academics]", is different from the normally accredited one; it is not in fact about closed universities but about lecturers and researchers who have an active relationship with their territories. The activities of *Public Engagement* by Italian academics are similar to those recorded in the UK (Ramella, Perulli, Rostan and Semenza 2018).

The territory can be a key resource for the university in terms of cultural *milieu* that is favourable to innovation, but also as an 'action factor' (Martinelli and Savino 2012), which is why Italian universities should move towards the dimension of territorial engagement (Saija 2016). A dimension much closer to the 'University militant' (Geddes 1917, Paba 2010) and to the territorialised university vision as a factor for the development of local territorial systems and producer of relations between 'codified scientific knowledge and common contextual knowledge' (Magnaghi 2006:17).

In the recent experiments on 'engaged' activities and in their social role, the TM appears to be more and more integrated with the other two missions in pursuing institutional purposes. We are witnessing a process of "combination" of

the three missions and a shift in focus from the "third" mission to the societal impact that any academic activity may have (Ramella, Perulli, Rostan and Semenza 2018:205).
As demonstrated by the British and American debate and by the timid discussions in Italy, universities play a role of engagement and network activation, and in addition are also an integral part of a process of collective learning and mutual exchange of knowledge and resources. Reciprocity means transforming the process in an exchange where university members and local collaborators share knowledge with each other in an open dialogue that includes mutual respect.
It is a change of approach to learning and knowledge. This shift in approach offers university-trained members (students, scholars) the opportunity to deepen understanding of the world by allowing their taken-for-granted assumptions, related to their world, to be challenged by the experience of others (Reardon 2006).
University can and must become an instrument of growth, so that the community can be influenced by the University and vice versa, an instrument strongly integrated with the territory that generates processes of (co-) production of knowledge and tangible impacts on society.

Sant'Angelo Vico l'Abate, a community project

The Italian context is full of bottom-up practices that can be substantially related to three major areas of action: forms of self-organisation, innovative production institutes that are connected to the self-enhancement of common heritage assets and bottom up planning tools.
These practices of re-appropriation of places using self-organisation forms, usually described by a rich literature related to the city (Paba 1998a; Cellamare 2019), also find

significant interest in low-density areas and inland areas, where they are used for the creation of social and economic alternatives and for network weaving. In Tuscany, to name one among many, the "Mondeggi Bene Comune" [The Mondeggi farm. A common good] (Comitato Mondeggi Bene Commune 2014). The Mondeggi farm fought in a self-organisation format for the common good farmand chose collective agriculture to save the farm from being abandoned.

The paper summarises the path of empowerment of a group of individuals in the countryside around the Metropolitan City of Florence who jointly endured issues regarding public water supply and formed a consortium (Consorzio Idrico Sant'Angelo), deciding to create a new connection with the public water supply.

Following the experience of the self-construction of the aqueduct, the group began to 'inter-act' (Saija 2016:114), recognising their own heritage value in a historic settlement. By claiming the public's right of use of the Church, the group decided to take care of the countryside and the places of agricultural, social and religious life that once revolved around the series of buildings around the church called "Chiesa di San Michele Arcangelo".

Four families of young entrepreneurs decided to 'go back to the land' (Dematteis and Magnaghi 2018) and take care of it by investing in innovative forms of agriculture and proposing the project "Sant'Angelo ritorno alle origini" [Sant'Angelo, a return to the origins].

The University's research group became part of the process when the group of farmers presented the project for the redevelopment of the complex to its owners, proposing the creation of a corporate network for managing the entire complex.

Although relations always remained calm, a dichotomy started between the two parties in question; the proponents believed that the project was of great interest and attraction for new networks while the owners thought the project was not very practical nor viable because of the lack of available resources and the significant number of parties that were directly and indirectly involved.
The strong sense of belonging to the place, determined by the historical roots of the families involved, on the one hand represents the strength of the group's aggregation and on the other, represents a disadvantage for the process in action. The sense of belonging to a community and the sense of redemption of the life places that are now lost, can determine actions that are hardly inclined towards dialogue. When the project was presented, in fact, there was no constructive dialogue with the owners, instead they had a defensive attitude with respect to the common good.
However, the university researchers, through the involvement of students and the use of collaborative practices, managed to establish a relationship or mutual trust between the parties and to activate a dialogue between the actors involved.
Through dialogue on a multidisciplinary level which involved the members of the associations, the community of Sant'Angelo, the researchers, lecturers and students of the University, public administrators, the IDSC and the priest of the neighbouring parish, an active and collective process of mutual learning was activated, in which all the players involved shared the common goals of regenerating their community and of taking care of and enhancing the value of the property.
This path starts with a seminar. The program of seminar has been articulated in multiple formative activities: lessons, visits, design workshop and final presentation of the projects

with different stakeholder: property, socio-economic agents, local community, politicians and technicians of the Municipality of San Casciano Val di Pesa.
The first visit was attended by the Mayor who presented the territory, the owners who presented the mission of the project and the members of the community who presented their project "Sant'Angelo ritorno alle origini" and expressed their needs in a sort of lesson about the place and its history.
The first brainstorming activity, which involved students and inhabitants in identifying a keyword for Sant'Angelo, clearly shows the strong belonging the places and the strong sense perceived of community. During the workshops the students were involved in activity of learning-by-doing process of post-it clustering, reflection on the concept of community and place.
The parties felt part of the process and co-designed, together with students and researchers, the best solutions to recover the complex and give life to their projects.
In addition, the activity was characterised by recreational and convivial moments in order to create solid relationships among all actors.
The "on-field" activity of the University was carried out on two parallel levels: the first was in action with the actors of the process, the second one with the students of DIDA[4]

[4] The students from the Department of Architecture involved in the thematic seminar called "*Rigenerazione e ritorno alle origini. Un progetto di comunità per Sant'Angelo Vico l'Abate" [Regeneration and return to origins. A community project for Sant'Angelo Vico l'Abate]*. The seminar programme was divided into multiple training activities: lessons, inspections, project workshops and final presentation of the projects with the various stakeholders (owners, social and economic parties, local community, Administrators and technicians from the Municipality of San Casciano in Val di Pesa).

through the experimentation of innovative collective planning practices and new didactic approaches such as service-learning (Reardon 1998) (Figure 1).

Figure 1 – The brainstorming activity with students and inhabitants

The research team reasoned on the sense of regeneration which was therefore understood as a re-construction, in the broadest sense, and on the belonging to a place, a history and a community. Belonging to a place and a community is not the effort of a civil "being together", or a random group of people. It means creating a 'caring community' (Bonomi, Revelli and Magnaghi 2015), starting from the recognition of a common destiny and from the place that generates memory and rediscovers the conscience of place (Becattini and Magnaghi 2015).
The complex of Sant'Angelo Vico l'Abate became a place of proximity and experimentation: a laboratory of ideas of community, of sharing space and knowledge in which each one among the inhabitants, priests, administrators, students, researchers and lecturers shared their experiences and co-produced innovative ideas (Figure 2).

Figure 2 - Sant'Angelo Vico l'Abate. A laboratory of ideas of community

The promotional activities and the organised workshops revealed a strong sense of belonging with respect to the places, the community formed by a group of families with a choral vision of rebirth.
The construction process of the community of Sant'Angelo started with the constitution of the water consortium and evolved with the establishment of a cultural association[5] which marked the structured beginning of an organised community (Rathke 2011) with a strong leadership and a capacity for voicing its opinions.
The organised community has been able to build strong and weak relations (Granovetter 1973), which have increased local cohesion and created a climate of collaboration among the actors. The strong relational ties have facilitated trust, motivation and commitment of the members, while the weak ones have expanded learning, skills and access to information.
A strong leadership was established, represented by the oldest person in the group, the one who holds the knowledge and historical memory of the places and the real-life stories and who successfully shared his values with the others.
Mr. Serafino, the community leader, engaged all the actors in the process in an emotional dialogue in which the narrative

[5] The Sant'Angelo APS Association is made up of small entrepreneurs from neighbouring farms, who have implemented short chain production and pay attention to environmental issues. In this sense, a significant role is played by the SlowFlowers Italy association, a branch of the international network with the same name, which supports the community and is responsible for producing indigenous flowers and floral arrangements in a sustainable way. In fact, the Association has undertaken training activities, using agriculture as a means of promoting training, educational, therapeutic, rehabilitative and socio-occupational inclusion actions.

(Ganz 2011) 'is not talking "about" values; rather, the narrative actually embodies and communicates those values. It is through the shared experience of our values that we can engage with others'.

Conclusion: what are the perspectives for the future?

The aim of the paper is to identify reading paths onto which we can build a multidisciplinary debate geared to proposing a new proximity direction where innovative practices, which are co-operating separately within the territory, can find common work grounds.
The three attitudes that have been identified as innovative characters represent a first attempt to identify three preparatory fields for critical reflection.
It is not sufficient to activate bottom up practices or to feel part of a community because one may share the same living spaces, it is rather about creating a fibrous structure of organised community groups capable of powering innovative practices and their ability for generation. Organising a community takes time, effort and resources on the part of all actors, including the leader, and energy to fuel the process in order to create a conscious civic base and give the right role of power to the community.
The case of Sant'Angelo Vico L'Abate therefore includes all three attitudes highlighted in the paper: the ability to create an organized community, the growth of knowledge and the generation of relationships.
In the described experience, the University played a role of engagement and network activator, but was also an integral part of a process of collective learning and mutual exchange of resources.

Small places like Sant'Angelo Vico l'Abate are often perceived as pulverised centres at the edge of the metropolitan city which are related to non-urban areas, and are characterised by depopulation, lack of access to major urban polarities and discontinuous and poor presence of basic services. Acting in these communities means understanding, above all, the significance of the settlement that characterises such areas and their issues, not only in relation to the metropolitan sphere (accessibility, services and localisation of jobs) but also in relation to the construction of new "caring" communities.
The partnership with the University allowed us to draw a road map on how ideas could be turned into tangible results in a unanimous vision at the metropolitan scale. Having successfully affected the decision-making tools of the metropolitan government is definitely one of the tangible results of the collaborative approach and the partnership with the University, which was rooted at an institutional level thanks to the effective mission of territorial engagement. The community project was taken as a pilot case and included in the metropolitan strategic lines[6] for the definition of an action model for the construction of policies aimed at developing new economies and new lifestyles related to the management and collective care of local heritage, by activating innovative forms of social action and wealth production.

[6] The project was included in the metropolitan strategic lines in the drafting of the Metropolitan Strategic Plan (PSM) of the Metropolitan City of Florence, among the forecasts and actions aimed at encouraging new forms of living for internal areas.

The experiences of engaged universities have two responsibilities: an internal one and an external one. The first is towards the lecturers, who experiment new forms of knowledge production; the second is towards society, which experiences new forms of usability (Cognetti 2013).
As regards the students, two main topics can be addressed: the first one is related to the teaching sphere and the second one to the civic sphere.
Teaching activities in the field can and should be strengthened. The Department of Architecture, for example, has thematic seminars which offer students the opportunity to work practically and in the research field, and also involves students in a learning-by-doing process by stimulating learning in action through experience. In addition, the University can be the conveyor of themes about democracy and issues regarding individual and collective sense of citizenship.
By introducing this reflection on the third mission we hope that the theme of the Territorialised University may have greater importance in the university-community partnership debate, becoming part of the strategies of Italian universities and being seen as a growth opportunity in the Italian collaborative research paths.

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Predictive analysis of social streams for natural disasters risk assessment

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Abstract

The aim of the present paper is to manage the capacity of social systems to cope with natural disaster events. Based on the Sendai Framework for Disaster Risk Reduction 2015-2030, the latest developments of Information and Communications Technology (ICT) and the tools for Public Participation Geographic Information Systems (PPGIS), we emphasise the role of community participation with the use of social networks.
We argue about Content Management System (CMS) to create open-source Web platforms, contribute to the construction of knowledge and diffusion of information and enhance a sense of participation across the public in view of disaster management initiatives.

Keywords

Social sensing; Machine learning; Natural disasters; Spatial data infrastructure; Social streaming.

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Introduction

In the last decades there has been an increase in the public awareness of natural disasters events. The latest contributions of the international community to monitor and assess natural disasters and the increasing role of the media attention at a global scale have shaped the scientific research to analyse, study and model catastrophic events in response to climate change. Climate change is currently altering the frequency, magnitude, spatial coverage and the duration of many natural disasters (Van Aalst, 2006; World Bank, 2010; IPCC, 2014).

The impacts of natural disasters on social and ecological systems are recognised at various geographical scales and offer significant challenges to develop knowledge-based governance for resilient societies through increased worldwide interdependency between people, places and natural systems (Hung et al., 2016).

The above global transformations and interdependencies also concern the use and management of portals which offer opportunities for the development of networking across communities. These opportunities also arise from rethinking the perceptions of the needs in an emergency context and the creation of new values (Watson et al. 2011). Often, it is difficult for researchers and practitioners to gain an overview about the needs of a community in disaster risk management. Classical economic models (Varian, 2009) generally consider need(s) as embedded into socio-economic processes. Alternatives to these models are the use of ontologies: a powerful approach to share knowledge across society. In the context of natural climatic events ontologies provide '*the essential characteristics of the event*' (Borgo and Guarino, 2015, p. 6) and can contribute to uncover latent community needs in emergency situations.

The disclosure of new community needs and information sharing (Kamalahmadi and Parast, 2016) within the global network supports the evolution of the adaptive capacity to natural disasters. This favours the effectiveness of a continuous knowledge construction to help society with the establishment of new practices to enhance community adaptive responses to extreme climatic events.
What roles can international bodies and national governments play to accelerate the degree to which a community cope with natural disasters? What if these roles are coordinated but not harmonised? (Shaw and Nerlich, 2015).
In the last twenty years under the lens of the sustainable development concept and numerous international accords (Agenda 21, Millennium Development Goals, Aarhus Convention) we witnessed the growth of various initiatives to involve public participation in the decision making process. Recently, the increase in mobile phones and smartphones and the realization of Public Participation Geographic Information Systems (PPGIS) application (Floreddu, 2012; Hilburn et al, 2020) have progressively favoured geo-database collection in a more structured and systematic way (crowdsourcing) enriching the existing Spatial Data Infrastructure (SDI) (Mansourian et al, 2006) often used as support platforms in risk assessment. Consequently, new specific Content Management System (CMS) platforms are helpful to create open-source Web platforms that use "crowd-sourced" information. The Ushahidi (www.ushaidi.org) project is an example of CMS that turns citizens into potential sensors (Zeile et al. 2012) in favour of a 'social sensing' mission (Ali et al. 2011; Aggarwal and Abdelzaher, 2013; Shao et al., 2020).
The aim of this study is to manage the capacity of social systems to cope with natural disaster events. Based on the

insights of the Sendai Framework for Disaster Risk Reduction 2015-2030 (United Nations, 2015) which sets, among its goals, '*the strengthening of resilience of people and assets to withstand residual risk*' (United Nations, 2015, p. 11), the latest developments of Information and Communications Technology (ICT) and the tools for PPGIS, we reach the above aim by emphasizing the role of community participation through social sensing technology. This technology integrates dedicated tools to gather structured knowledge on catastrophic events and to engage the crowd with structured on-line forms (To et al. 2014). In addition, the above technology uses social networks (e.g. Twitter, Facebook) to collect and classify unstructured knowledge by means of text mining and machine learning techniques.

The contribution of our work to the current literature is to build a conceptual model which emphasizes the role of community participation to natural disasters with the use of CMS and current PPGIS tools. The conceptual model is then applied to the case of 2010 Haiti earthquake. The conceptual model serves as a good practice to strengthen communication and collaboration among stakeholders and decision makers and among citizens to take action and foster community resilience to natural disasters.

The paper is structured as follows. In the next section, we briefly review and contextualize ICT platforms to natural disasters. The subsequent sections illustrate the conceptual model its application to the case of the 2010 Haiti earthquake, respectively; finally, the last section discusses the obtained results and concludes the work.

Literature background

In this paper we consider the use of CMS and PPGIS as tools to increase the resilience of societies to natural disaster

events. Since the mainstream of ecological engineering and economics in early 1970s, the concept of resilience, defined as '*the measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables*' (Holling, 1973, p. 14), has taken various shapes and extensions over time. It has gradually interested social sciences, natural disaster risk and land use management researches (Adger, 2000; Perrings, 2001; Folke, 2006; Norris et al, 2008). The UNISDR (2005) argues that resilience lies in the capacity of societies to learn from past events and reduce future risks.

The study by Folke (2006), in particular, considers resilience in terms of innovative responses through social behaviours. We agree with the author that resilience is a '*way of thinking*' (Folke, 2006, p. 260) where society plays an important role. According to Folke, the social dimension is able to empower the adaptation of ecosystems to new equilibria through collaboration among various stakeholders operating at different social and ecosystem levels and provide in favour of a knowledge-based organization of the society.

In 2009, again the UNISDR (2009) establishes a glossary of terms under the umbrella of disaster risk reduction strategies in order to increase public participation to the issue of, among other things, resilience. Later in time, the IPCC (2012, 2014) reports emphasise that community participation favours the increase of resilience to reduce the risks of natural disasters and climate change. The Sendai Framework for Disaster Risk Reduction 2015-2030 (UNISDR, 2015) also sets, among its goals, '*the strengthening of resilience of people and assets to withstand residual risk*' (UNISDR, 2015, p. 11). The key priority actions of the UNISDR document is to ensure that disaster risk management has a strong institutional base at local level in order to identify a knowledge-based administration at all levels of governance.

The multi-level governance system would then be able to enhance early warning, strengthen natural disasters preparedness and supply an adequate response to reduce risks to socio-ecological systems. Bruneau et al (2006), assess the four dimensions of community resilience such as technical, organizational, social and economics – before and after seismic events. In particular these dimensions respond to the four 'R' of 'Robustness', 'Redundancy', 'Resourcefulness', and 'Rapidity' of a resilient system. In similar studies, Cutter et al (2008, 2014), emphasizes that '*resilience [...] includes pre-event measures to prevent hazard-related damage and losses (preparedness) and post-event strategies to help cope with and minimize disaster impacts*' (Cutter et al, 2008, pp 600). In this work we do not investigate a comprehensive review of the concept of resilience. We attempt to extend this concept in the light of the latest developments of ICT as described below.

The beginning of 1990s witnesses the first attempts of active citizens participation to various decision making initiatives born after numerous international accords such as the Agenda 21, the Millennium Development Goals, the Aarhus Convention and various EU funding programmes as Leader, Urban, Interreg and Equal. These initiatives and under the lens of sustainability, environmental protection and support to disadvantaged populations provide communities to set up and/or enhance democratic mechanisms through the direct participation of citizens to the decision-making process (Harwood, 2015).

With the introduction and diffusion of web technology in 2004, the public participation to the decision making process evolves to the digital paradigms such as e-Democracy, e-Participation, and Gov 2.0 (Floreddu, 2012; Latre, 2013; Graziano, 2017).

The growing exchange of information on the world wide web and in particular on the social media plays a key role to the development of ICT for the management of a natural disaster event (Palen and Liu, 2007; Simon, 2015; Orimoloye et al, 2020). This latter is a complex mechanism to manage. It involves the spatial and international coordination of thousands of people who volunteer to help with the local community. To assess resilience, these people can either act as independent agents or as 'citizens as sensors for crisis events' (Schade et al. 2013). As a consequence, interaction evolves across local and /or international institutions and organizations, through knowledge and participation sharing using social media tools such as Twitter and Facebook (Mostashari et al., Sprake and Rogers, 2014; Hung et al. 2016,). The above media tools provide the building of real time knowledge frameworks during rescue operations in emergency situations (Teodorescu, 2015). As a result, the resilience of urban systems and communities to natural disasters significantly improves (Asadzadeh et al., 2015).

Alongside the diffusion of social media tools, new techniques and methodologies arise for the development of open source platforms to comply with international regulations for the sharing of real time geospatial information, mitigate the side effects of natural disasters and facilitate rescuing operations. The 2007 EU Inspire directive establishes an infrastructure for spatial information and contributes to close the gap of semantic aspects and harmonisation of data sharing and formats across member states (European Commission, 2007). Similarly, in the US, the National Spatial Data Infrastructure (NSDI) promotes the implementation of geospatial data across various levels of government, sectors of the economy, organizations and academia (Federal Register, 2003). At the international level, the United Nations advocate the necessity to set an agenda

for geospatial data information and management (https://www.fgdc.gov/nsdi/nsdi.html). One of the key areas of work is disaster risk management and emergency response. Crowdsourcing platforms for disaster management play an important role in response to natural and environmental disasters (Yang et al., 2014). Some platforms deal with citizen participation and engagement, such as the Austrian Ministry of Environment (www.partizipation.at), the think tank INVOLVE (www.involve.org.uk) or the geospatial website GeoPlatform (www.geoplatform.gov), Pan European eParticipation Network (www.pep-net.eu), and many others. The aim of these platforms is to disseminate knowledge about public participation and share trusted data to organizations, government, and citizens. Few platforms purpose specifically the assessment of participation programs. Examples suggest Ushahidi and Participedia (www.participedia.net), which focus on sharing large amounts of data on public participation based on real world cases. In particular, the Ushahidi platform was used to collect geo-referenced reports from citizens during the Haiti earthquake on the 12th January 2010 and Fukushima nuclear disaster on the 11th March 2011.

However, scholars sound unconvinced about the degree of diffusion and utilization of these new digital tools among citizens for the effective assessment design of risk mitigation (Becerril-Chavez et al., 2012). There already exists particular tools such as PPGIS that are used to create bottom up digital knowledge maps for risk assessment (Ai et al., 2016) and the Volunteered Geographic Information (VGI), which is conceived the same way as the PPGIS but is independent by any institutional aspect. Nonetheless, these tools exhibit some drawbacks. First, they are difficult to interpret; and second, it seems not easy to contextualize the type of

knowledge they offer. Therefore, it is urgent a clear-cut idea of the participatory tools that web designers intend to realise including knowledge-based methodologies (Leighninger, 2011).
In the last decades, technological progress has grown fast and found solutions to allow the sharing of transformations within the society. Contrarily, international research on cognitive aspects has moved slowly to deepen the study of human behaviours (Lindell, 2013) and the satisfaction of real needs in emergency situations from natural disasters (Cherry, 2009). This aspect affects the efficacy of crowdsourcing platforms and their application to disaster risk management (To et al.2014; Horita et al. 2018).
The complexity of community resilience to natural disasters other than being intrinsically unpredictable also depends by several spatio-temporal and socio-economic factors which require specific knowledge and studies.
We investigate, from a cognitive point of view, the role of various agents and needs in disaster risk management. In particular, we analyse unstructured information in social networks and attempt to make them functional to the rescuing operations where the semantic components appear decomposed in single elements as the 'who'(i.e. agents), 'what'(i.e. needs) and 'where' (i.e. spatio-temporal needs) to realise SDI (Latre et al., 2013).

Methods

We propose the following conceptual model (Figure 1).
The construction of common knowledge on disaster risk is based on a combination of social sensing and machine learning approaches.

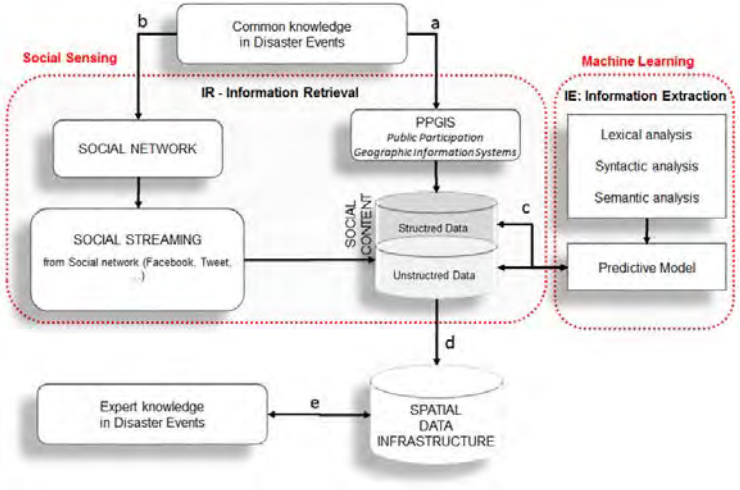

Figure 1 - Knowledge based conceptual model for a resilient community to natural disasters

The former includes both structured information from public participation retrieved from platforms such as PPGIS, Ushahidi, or VGI to cite a few, and unstructured data from social networks such as Facebook, Twitter and many others. These form the social content containing useful information from people's perception about type, extent, intensity, impacts and emergencies in the event of a natural disaster. The latter includes a machine learning approach which is based on information extraction to obtain the final dataset to compute the predictive model. The results obtained by the predictive model feed back onto the social sensing context to form the SDI to enrich both the knowledge of the public and that of the expert. Next, we describe the steps of our conceptual model summarised above.

Social Sensing Section: Social sensing gathers ex-ante, present, and ex-post common knowledge in emergency situations in the event of a natural disaster and is arranged as follows:
a) *Structured knowledge:* It uses a specific app to collect information which is saved in a database. The app is designed through a dedicated web interface where the user inputs his/her message such that it is possible, in real time, to geo-localize the thread on an interactive map and classify it in a given category. As for data analysis and machine learning, our study makes use of a dataset created during the aftermath of the Haiti earthquake on January 12 and July 5th, 2010. Figure 2 shows the web interface realised with the Ushahidi platform used by the Haitian community during the dramatic events of the earthquake. The information collected are organised according to: *Incident Title, Incident Date, Location, Description*, *Category*, *Latitude,* and *Longitude*.
Our analysis is based on the archived data available in the fields *Description* and *Category*. The former contains the description of the message, the latter its classification. Figure 2 illustrates the various categories used to classify the messages such as 'emergency', 'treaths', 'response', 'person news' and many more. b) *Unstructured:* This type of knowledge uses information retrieval based on social network streaming, Ushahidi platform and / or other crowdpulse websites which, through specific application programming interface (api) functions, gather messages from Facebook and/or Twitter filtering data using special hashtags. However, the posts retrieved in such a way present some drawbacks. These should be validated and classified at a later stage by appointed experts. Therefore, the timing of these operations can last several days and suggest the presence of inefficiencies, should the community proceed with the elaboration of the posts in natural disaster events.

Figure 2 - Ushahidi platform used to submit emergency requests from the Haitian community

Our study attempts to overcome this limitation. The assessment of the particular stream of information available on the social networks could save human and animal lives and the ecological system, should these assessed information be promptly read and /or observed by the rescue team.
Machine Learning Section. The main aim of machine learning is to observe, learn and classify through proper algorithms the common knowledge (Bishop, 2006) as described earlier and

make it available on an SDI as well as an expert knowledge system.

We argue that a simple operation that can save lives is to extract as rapidly as possible high priority posts compared to other messages containing the request for minor emergencies. To do so, we apply a predictive model to our structured and unstructured knowledge base retrieved from social networks and the Ushahidi platform. We employ RapidMiner Studio v. 9.0. RapidMiner is an open-source software for data mining enabling data analysis and reporting simultaneously. It has several advantages that inspire us to use it for: i) an immediate graphical user interface for input and output processes; ii) the handling of data from several formats; iii) a comprehensive text mining; iv) the ability to apply several methods for model predictions (http://docs.rapidminer.com/).

However, it is necessary to perform pre-processing activities with the use of text-mining techniques to obtain an unbiased data entry matrix to run the predictive model. We proceed with the text-mining analysis as follows: i) *tokenize* allows to isolate every single word (token) from the others; ii) *stopwords* allow to drop all irrelevant words listed in the stopwords dictionaries (English, French and Haitian); iii) *replace token* replaces compound words with single words; and iv) *stemming* reduces the number of the words collected and that have in common the same root in a single token (Verma, 2014).

At the end of the text-mining phase, we obtain the data matrix to run the predictive model in which the words are classified as *primary* if they contain the following primary needs, in the three languages English, French and Haitian, as defined by the Maslow's (1943) hierarchy of needs: 'Food', 'Water', 'Home', 'Maison', 'Need', 'Kay dlo manje', 'San', 'Blood'; and *not-primary* otherwise and the absolute and

relative frequencies of each word in each document. The total number of the messages in our matrix is 3,593.
Among the available algorithms in RapidMiner, we use Näive Bayes and K-Nearest Neighbors (K-NN) predictive models which produce the best performance. The Näive Bayes model is based on assessing to an event a posterior probability which is obtained by a normalised 'a priori' conditional probability that the feature of that event occurs (Mitchell, 2015). The k-NN model is a non-parametric model typically used in machine learning to classify an object (the word in our case) to a class according to its nearest neighbour (Duda et al., 2000). Both Näive Bayes and K-NN models are popular in machine learning due to the ease of application in natural language classification (Valsamidis, 2013; Khan, 2014).
Both models use a training set obtained over 1,000 posts randomly chosen. The remaining part of the dataset is used for the model prediction analysis.

Results

Figure 3 illustrates the training and predictive processes in RapidMiner.

4018	not primary	Elianie Valentin	May 3, 2010 8...	18,539167	-72.335	664 Blv. Jean...
4029	not primary	Shelters needed for school in Delmi	Feb 15, 2010 ...	18,539838	-72.406425	Carrefour, zo...
4030	not primary	Help needed in Tere section, Leogane	Apr 26, 2010 ...	18,499145	-72.651215	"corail l...
4033	not primary	Help needed in Brochette	Mar 17, 2010 ...	18,52519	-72.458954	Brochette 99,
4035	not primary	Clogged toilet in canape vert	Mar 19, 2010 ...	18,539513	-72,327118	Canape Vert
4050	not primary	now haiti is right now and how it was during the earthquake	Jun 24, 2010 ...	22,278381	114.174287	centre
48	primary	Border road down. Looting stared in P-au-P	Jan 13, 2010 ...	18,521283	-72,372437	border crossi...
76	primary	Looking for Hemst Marcelin (age 5) and Nalexia Marcelin (20 m...	Jan 13, 2010 ...	18,533333	-72.266667	Bon-repos, h...
194	primary	URGENT - College Canape Vert, PaP	Jan 14, 2010 ...	18,539269	-72.336408	Canape Vert
209	primary	Person Trapped - 66 Rue St. Gerard	Jan 14, 2010 ...	18,527235	-72,338513	66 Rue St. G...
212	primary	Need Help with Crowd Control	Jan 14, 2010 ...	19,54085	-72,316313	christ-roi rue ...

Figure 3. An example of the classified social post

To validate the robustness of our results, we proceed with a cross-validation approach. Generally, cross-validation procedures distinguish *n*-fold and leave-one-out cross-validation (Suh, 2010). The former is carried out with a nested approach and is the algorithm included in Rapidminer. Data are split into *n*-folds of equal size and trained and tested *n*-times. Of these *n*-subsets, a single subset is hold as input of the testing sub-procedure, and the rest of the *n*-1 subsets are then applied as training data in the subsequent reiteration (i.e. as input of the training sub-procedure) (http://docs.rapidminer.com/). The cross-validation is repeated *n*-times treating the *n*-subsets as holdout sets each time. The cross-validation procedure predicts how sensitive is the model (i.e. how well performs the model) to a hypothetical holdout dataset. The results of the cross-validation are illustrated in Table 1.

Performance Vector (Näive Bayes) Accuracy: 55.33% +/- 13.94% (mikro: 55.38%)			
Confusion Matrix:			
True :		Actual	
		not-primary	primary
Predicted	not-primary:	346	243
	primary:	201	205

Performance Vector (K-NN) Accuracy: 55.94% +/- 16.38% (mikro: 55.88%)			
Confusion Matrix:			
True:		Actual	
		not-primary	primary
Predicted	not-primary:	326	218
	primary:	221	230

Table 1. Cross-validation results for the Näive Bayes and K-NN models.

Both models present the following accuracy rates: 55.33% and 55.94% for the Näive Bayes and the K-NN performance vectors, respectively. Error diagnostic tests are shown in the confusion matrix results in Table 1. A confusion matrix (Kohavi and Provost, 1998) is a contingency table containing information on actual *vs* predicted classification results. It

can be interpreted as follows: i) The cells 'not-primary/not-primary' with values 346 and 326 tell us the number of correct predictions that a word is classified as not-primary (TN - true negative rate); ii) The cells 'primary/not-primary' with values 201 and 221, respectively, indicate the number of incorrect predictions that a word is classified as 'not-primary' (FP – false positive rate); iii) The cells 'not-primary/primary' with values 243 and 218 show the number of incorrect predictions that a word is classified as 'primary' (FN – false negative rate); and iv) the cells 'primary/primary' with values 205 and 230 display the number of correct predictions that a word is classified as 'primary' (TP - true positive rate).

The information retrieved by the accuracy rate of the model(s) is(are) not enough to give us an indication of the magnitude of an 'emergency' message during the classification procedure. Generally, the accuracy rate computed above would respond to the question of 'What is the probability that any primary and not-primary word is correctly classified?' What is important to determine in our analysis in terms of community resilience to a disaster event is to respond to the question: 'What is the probability that a primary event is correctly classified?'. To answer this question we compute the precision rate at which the models classify the primary words. This is given by the ratio TP/(TP+FP) and take the values of 50.49% (Näive Bayes) and 50.99% (K-NN), respectively.

Discussion and conclusions

The study of cognitive aspects in emergency situations from natural disasters is not extensively analysed in the literature. The main reason is that, until recently, the study of human

behaviors and the satisfaction of real needs during the aftermath of a natural disaster has moved slowly. This aspect is important to strengthen collaboration among the parties involved in emergency situations to take prompt actions and increase resilience in disaster preparedness and survival planning.

While it is evident that international and national governments play a key role to accelerate the degree of community resilience to natural disasters, there emerge some doubts whether collaboration across countries is harmonized to provide an efficient allocation of resources between demand and supply when the states of the world are altered by unforeseen natural events. As Folke (2006) argues, innovative responses through social behaviours are necessary to boost the coping capacity of socio-economic and ecological systems to the challenges posed by the global transformations due to climate change.

The present paper responded to the above doubts and attempted to manage the coping capacity of the social system to improve community resilience to disaster events. The presented conceptual model sheds light on the role of community participation using social sensing technology that integrate structured knowledge (i.e from crowdsourcing) and unstructured knowledge (i.e. from social networks) with the use of text mining and machine learning techniques. By doing so, the information obtained enrich the SDI of both un-expert and expert knowledge bases.

The results obtained from the application of our conceptual model to the 2010 Haiti earthquake indicate that the predictive models, classification and cluster analysis should attain in the near future increasing attention from the international community, as is at present for the case of the Ushahidi platform in disaster risk management. The conceptual model other than being considered as content

management system for the collection of geo-localized data opens new scenarios from social media. At present, the effort made by the crowdepulse platform goes into the direction of supervised processes such as the proposed conceptual model. The crowdepulse platform integrates somehow some modules of machine learning which are still of unsupervised type. We argue that integrated platforms are capable of improving community resilience to natural disasters. In addition, these platforms contribute to save human and animal lives, re-stabilize ecological systems and improve the quality of life during the immediate aftermaths of a natural disaster event. Future directions of this research should also consider cognitive models based on a comprehensive view of agents and community needs to manage efficient emergency situations from natural disasters and include the construction of ontologies (Borgo and Guarino, 2015) to further improve the classification mechanism of social sensing data in machine learning approach.

Finally, inspired by the pioneering work of Schön (1984) we argue on the importance of a 'learning by doing' mechanism to set up models which are finalised to a shared knowledge in disaster risk management. The study by Yu et al (2016) also supports this view and extends it to the learning mechanisms for a resilience-based management. The capacity of the society to learn, transform and revise shared targets for an efficient resource allocation including the assessment of consumer behaviour is the key for generating resilient socio-economic and ecological systems.

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Preliminary analysis for the urban regeneration of derelict industrial sites through Adaptive Reuse interventions: the former Stanic refinery of Bari

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Abstract

The theme of urban regeneration of underutilized areas and disused historic buildings is increasingly becoming a fundamental intervention to develop smart urban regeneration policies. The city is a dynamic and malleable place according to the needs of the population, where abandoned places are reinvented and converted to generate new opportunities and centralities. Important resources to activate sustainable urban densification policies are abandoned industrial areas, once the engine of nations' economies, today relegated to unused skeletons. Towards revitalizing and generating sustainable recovery actions of these sites, adaptive reuse is adopted as a process of modifying, transforming and reusing obsolete volumes in contemporary architectures with new functions, extending their useful life. The adaptive reuse intervention on industrial heritage sites shouldn't modify their settings and historical relevance. This paper aims to select the best design solution for the former Stanic refinery area in Bari, starting from

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multi-criteria analysis concerning social, physical-morphologic, environmental, and urban aspects. The research methodology is designed starting from a literature review about urban regeneration processes and adaptive reuse interventions and finishing with a weighted checklist of the selected parameters for each scenario. Adaptive reuse strategies contribute to reduce urban sprawl and demolition activities, applying smart conversion activities and technologies on derelict industrial sites of existing heritage.

Keywords

Adaptive reuse; MCDM Analysis; Design strategies; Building adaptation; Decision-making model

Introduction

The regeneration of disused industrial heritage buildings is a topic of fundamental importance in today's social, cultural and architectural debate. Recovering the spaces that have been abandoned by industrial production or conferring new environmental, economic and social qualities on decayed urban sites fit perfectly into the concept of sustainable city. These processes limit urban dispersion and reduce the environmental impacts that are naturally part of the built-up areas. In addition, the redevelopment of decommissioned industrial sites is a central issue for the implementation of Regional policies and for the creation of numerous intersections linked to the promotion and regeneration of marginal abandoned sheds through adaptive reuse procedures (Calderazzi, 2015). In Italy, abandoned industrial areas occupy the 3% of the entre Italian surface (ISTAT,

2012). The theme of disused industrial areas also occupies the Italian urban and architectural scene with the aim to develop conversion strategies for these unused spaces, transforming them in modern multipurpose containers. These urban-scale recovery actions have brought out not only morphological and environmental problems, linked to the intervention dimensions for reducing pollution problems, but also social and economic constraints regarding the ability of the industrial building to meet population needs (Calderazzi, 2012). The possibility of rebuilding the city no longer by expanding its boundaries, but by working within them, in a process of self-regeneration with strong cultural and social motivations, acquires, today, a fundamental value and opens up important reflections on the enhancement of history, architecture, landscape restoration and conservation measures (Piludu, 2017). Reusing decommissioned areas as a result of decentralization, deindustrialization and obsolescence becomes an opportunity to set in motion urban regeneration activities of those places whose specific values in terms of identity and recognisability have been acknowledged. The idea to refurbish abandoned industrial heritage sites is based on the need for its reuse, giving new dignity to these derelict and unused areas. The regeneration of an industrial building goes beyond the idea of conservative restoration and always implies an act of repurposing that can make the building useful to the community and active in the city dynamic system. Old and decommissioned factories become the starting point to set evolution smart processes that can transform the existent and reduce urban sprawl. A derelict industrial site isn't considered as an empty space but as a potential flexible area to introduce functions useful for the community and attractive services to develop tourism policies in the city periphery. At the same time, all these

transformations on industrial heritage buildings should be done with accuracy and taking into consideration the architectural-morphologic aspects of the site. The adaptive reuse models expand the possibility of reusing a building, converting it into a new usable and functional space, without compromising the spatial composition and the architectural features that have characterized its history. In addition, accurate preliminary context analysis, regarding physical-morphologic, social, urban and environmental aspects, can indicate the procedural steps for the definition of these intervention strategies. The paper analyses the four categories mentioned above and identifies through a multi-criteria analysis which of the possible plausible options is the one that best reflects the current needs of the local population and satisfies wider and longer-term expectations to make them attractive and integrate also urban suburbs to the city core.

In particular, the paper firstly focuses the attention on the theme of adaptive reuse and subsequently defines the methodology, applying it to the case study of the former Stanic refinery in Bari, Puglia. The aim is to draw up guidelines to activate urban and ecological regeneration paths of the disused industrial site, considering the iconicity and historical memory of the place and reviving the desire to recreate a reality of landscape and environmental value necessary for the city of Bari. According to Robiglio, adaptive reuse can be an optimal opportunity to convert the existent if social participation, preservation of the building memory and flexibility are taking into account simultaneously (Robiglio, 2017).

Adaptive Reuse

Today, the preservation and transformation of heritage industrial buildings is increasingly becoming one of the main aspects of sustainable urban planning. It could be easily managed if stakeholders analyse accurately all the categories and parameters that affect building adaptation. To achieve this goal, it's important to deepen the theme of adaptive reuse. As stated by the Department of the Environment and Heritage of Australian Government (2004), adaptive reuse is the process that changes a disused or ineffective item into a new item that can be used for a different purpose. This process, if it's applied on an historic building, must not affect the heritage significance of the site and its setting. The most successful examples of built heritage adaptive reuse projects are those that best respect and retain the buildings history, adding contemporary layers that increase site attractiveness. This type of renewal strategy has the potential to bring new life to disused or abandoned assets. In fact, the process increases space attractiveness and social benefit by creating sites that satisfy community needs and re-engage people to use them, hosting new services, sometimes connected with the old ones.

Giving a new identity to abandoned industrial sheds serves to reintegrate and re-functionalise these vast areas in the metropolis system without losing the historical sites memory that have characterized industrial and productive cities. Many underutilized historical buildings are viewed as the starting point for city regeneration and play a crucial role in the social, economic and cultural development of society. In addition, there is a strong awareness in the community that it is cheaper to convert abandoned sites rather than to demolish and rebuild them. This consciousness promotes the vast interest in adaptive reuse strategy and, at the same

time, amplify the studies regarding the parameters that should be considered in the refurbishment process or that can affect building conversions (Aigwi et al., 2018; Ball, 2002; Pearce et al., 2004).
Many authors have tried to identify the factors that most influence the stakeholder's choices to activate adaptive reuse strategies, implementing multi-criteria analysis models to evaluate the potential and feasibility of the recovery intervention. The Adaptive Reuse Potential (ARP) Model of Langston (2011; 2012) and the AdaptSTAR Model of Conejos (2013; Conejos et al., 2013) allow to understand the effectiveness of the building reuse intervention and evaluate the weight of each factor affected by the process. The Adaptive Reuse Potential Model examines buildings adaptability in terms of seven categories of obsolescence that are closely related to sustainability. It helps to prioritize existing derelict buildings that have a substantial embedded physical life remaining in them (Yung et al., 2014). The AdaptSTAR Model is a decision-making tool that contributes to underline climate change adaptation strategies for built assets. It provides a weighted checklist of factors that assists in the development of building transformation policies for future reuse interventions (Conejos et al., 2015).
In order to identify the best building recovery strategies and the parameters involved in the building conversion process, it is necessary to develop preliminary analyses in order to fully understand the advantages that this modern intervention solution may entail and the constraints that can emerge. Bullen and Love (2011) in their articles have highlighted and listed the potential of using adaptive reuse processes and the weaknesses associated to them. As stated by the authors Adaptive Reuse is seen as a sustainable and effective alternative to address the "environmental gap" by functionally improving a building's performance while

simultaneously reducing its environmental loading. The success of an adaptive reuse intervention depends on the factory adaptability to host new functions. Industrial buildings that incorporate surfaces that are flexible and easily manageable require less frequent and less costly refit and remain sustainable over longer periods. The decision whether to reuse a historic factory entails a complex set of considerations, including location, heritage importance, architectural assets, market trends, quality of the environment and physical site conditions (Bullen & Love, 2011). It is, therefore, essential to analyse all the peculiarities of the considered context before hypothesizing design solutions for its recovery and adaptation. The study of historical, architectural, environmental and social aspects not only provides interesting data regarding the current places conditions and social trends, but they simplify the decisions to be made in the early design stage, ensuring the satisfaction of the population needs and developing a sustainable contemporary city model through urban regeneration. Adaptive Reuse is seen by professionals as an effective strategy that enables a building to suit new conditions, amplifying its useful life and reducing urban sprawl. It's more sustainable and cheaper to reuse the existent disused industrial sites rather than to demolish them.

Methodology

Reusing rather than replacing buildings is the most resource-effective strategy to guarantee city development. The preliminary study of the context and areas covered by intervention simplifies the decision-making process regarding the actions to be taken for their recovery. The present section describes the steps and analyses that can be

carried out in advance to guarantee feasible and sustainable regeneration policies through adaptive reuse policies. This paper focuses on the testing that need to be developed at the preliminary design stage in order to direct intervention decisions and strategies for the preservation of decommissioned industrial sites. In particular, the research consists of six main steps that allow to frame the case study main features and to choose which is the function that, according to social, morphological, environmental and urban settings, is more beneficial to the characteristics of the context and satisfies the needs of the local community.
The steps are listed as follows:

1) Historical and evolutionary analysis of the former Stanic refinery in Bari: a narrative review is made for a comprehensive and detailed description of the site history and evolution. This first part frames the main aspects concerning the historical evolution of the site and district, and highlights all the interventions and transformations that the factory has undergone during its life cycle, up to its decommissioning and dismantling.
2) Environmental analysis of the site: it identifies the landscape characteristics of the area, as well as the presence of places to be safeguarded and with high natural quality. The presence of Lama Lamasinata is an extra point of attraction to consider in the site transformation processes but, at the same time, a constraint if a proper management of rainwater and maintenance activities is not guaranteed.
3) Physical-Morphologic site analysis: this paragraph focuses on the characteristics of the disused industrial site according to the compositional-formal structure and the degree of obsolescence of pre-existences. Each Stanic pre-existence is catalogued with the aim of having an initial database of qualitative and quantitative information

with the aim of activating building recovery processes, trying to maintain the historical memory of the place.

4) Study of urban fabric: this paragraph focuses on road infrastructures, distances of the site from major points of interest and from the city centre, urban existing composition, as well as urban fabrics and services in the area. The vastness of this site also involves the study of the relationships between the context, the natural environment and the refinery with the aim of establishing connections and the relationship between the different types of place.
5) Identifying demographic and social data: qualitative data underline the number of inhabitants in the Stanic district and their subdivision by age groups. In addition, the section describes the needs of the local community. Social analyses allow to frame the possible activities and services to be included in the site regeneration project, trying to understand what are the human and multi-ethnic relationships that can be established in the district to guarantee social inclusion.
6) Application of Multi-Criteria Decision-Making (MCDM) Analysis for the reuse of Stanic refinery area. The implementation of multi-criteria approach considers the following steps:

a) Identification and definition of attributes and sub-attributes. The section frames the preliminary criteria evaluation for choosing the best solution to adopt to the selected case study.
b) Elicitation of the value functions for each parameter affecting building adaptation processes. Three different qualitative functions for factor assessment are identified.
c) Description of different planning solutions. The paragraph focuses on the identification of possible design

and functional scenarios that can be adopted to the case study.

d) Identification of specialized decision makers who can provide significant contributions to the classification of the considered categories and sub-criteria. The composition of a focus group allows the direct comparison between professionals and a pairwise evaluation of the identified parameters with the selected design solutions, taking into account the qualitative data of the value functions.
e) Weighting attributes and sub-attributes to indicate the relative importance of each parameter for the specific case study. Specialized figures in the fields of construction, recovery and environmental protection express their opinions on the selected parameters through interviews, quantifying their importance in the preliminary stages of site analysis.
f) Calculation of the partial and total values of each parameter depending on each considered scenario and selection of the most feasible design solution to adopt for Stanic site. The normalized value of each parameter is multiplied by the coefficient extracted from the value functions and discussed by the focus group for each use target. The sum of the values provides the percentage of feasibility of each intervention.

Preliminary surveys and scenarios identification and description are the starting point to summarise all the obtained data about the case study in cataloguing sheet, inserting all the architectural, social, physical and functional aspects found in the monitoring and characterization of site morphology. All qualitative and quantitative information represent the input data for the definition of adaptive reuse strategies through the Design Criteria System (DCS)

(Vizzarri & Fatiguso, 2019; Vizzarri, 2020; Vizzarri et al., 2020).

Case study

The former Stanic refinery area of Bari has been considered a symbol of Bari industrial past for over fifty years. The conversion of this vast empty area is at the basis of the local debate concerning the recovery of abandoned industrial sites in the city of Bari and their importance for the development of smart and sustainable planning and regeneration policies. This area is grafted between the natural and authentic landscape of the Lama Lamasinata and buildings seriality in the industrial area of Bari - Modugno, many of which have been abandoned. The area of the former refinery covers about 530.000 sqm, approximately 3.7 km perimeter, and is located within the district with the same name (Figure 1).

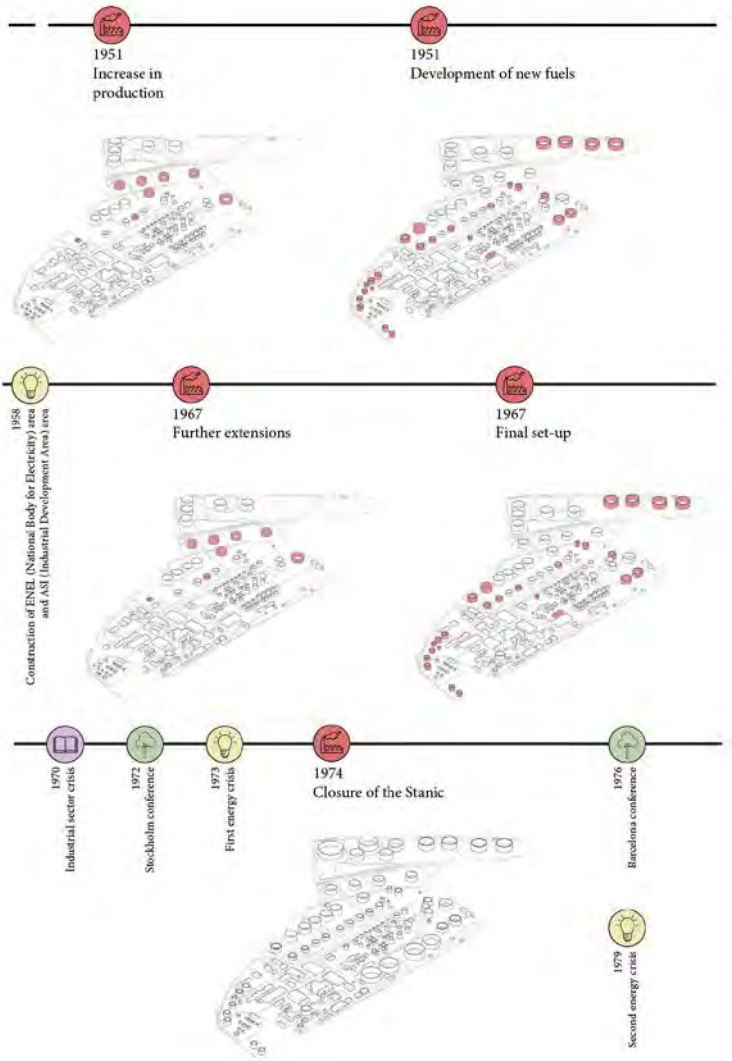
Figure 1 - Satellite image of the city of Bari with indication of the area of the former Stanic refinery.

Historical analysis

This section traces the salient stages of development and transformation of the Stanic area, up to its abandonment and progressive dismantling. From the information acquired on the architectural evolution of the refinery's time, it emerges that the industrial site has undergone many transformations over time that have gradually changed the composition of its spaces.
Today, after the dismantling and repeated remediation of the site (1999-2010), only a few buildings remain which preserve the historical character of the industrial area. To understand the urban development that the Stanic area has undergone over the years, the evolutionary history of the area is analysed.
Built in 1937, the Stanic industrial complex began operating in 1938. Over the years, the area in question has undergone significant expansions, due to the growth in demand, the increase in processing and the subsequent differentiation of processes. In particular, from 1947 to 1967, to obtain the possibility of developing new fuels, new tanks and infrastructures were added in the already rich presence.
The refinery was active in the area until 1974, and until the 1990s it assumed the function of coastal storage. After the disposal of the cisterns, which took place in 2002, and the subsequent reclamation of the area, which lasted until 2010, the situation has remained unchanged within the area up to the present day.
The high level of degradation of the Lama Lamasinata, the environmental, acoustic and air pollution and the proximity to an industrial area without attraction promoted the growing tendency of the site to remain unused and to make it less prone to be subject to new transformations (Figure 2).

Environmental analysis

The refurbishment of abandoned or disused industrial buildings is a difficult process to manage, since it is characterized, in most cases, by problems related to site pollution and consequences for future generations in terms of health and economic commitment. The remediation of these areas entails a significant increase in costs for the realization of the conversion project. At the same time, it becomes an opportunity to transform the city, create new possibilities and change the quality of the surrounding urban fabric. This concept is strengthened considering the environmental and landscape aspect as another key element to be incorporated into the building design and urban regeneration process. One of the main characteristics that the Apulian territory presents are shallow erosive furrows that convey rainwater to the sea, called "Lama". These canals present a high porosity of the soil with circulation of water in the subsoil. Considering the extreme proximity of the Lama Lamasinata to the site of the former Stanic refinery, the aim is to regenerate, protect and re-naturalize not only the abandoned industrial area, but also to include the surrounding areas, creating an ecological urban system.
The Preliminary Planning Document (DPP) (Comune di Bari, 2008) identifies this natural system as the main feature to develop sustainable regeneration policies, reusing soils as agricultural spaces, managed by the population, keeping in mind the hydraulic characteristics and relative hazards of the rivers.


1951
Increase in production
1951
Development of new fuels
1958
Construction of ENEL (National Body for Electricity) area and ASI (Industrial Development Area) area
1967
Further extensions
1967
Final set-up
1970
Industrial sector crisis
1972
Stockholm conference
1973
First energy crisis
1974
Closure of the Stanic
1976
Barcelona conference
1979
Second energy crisis

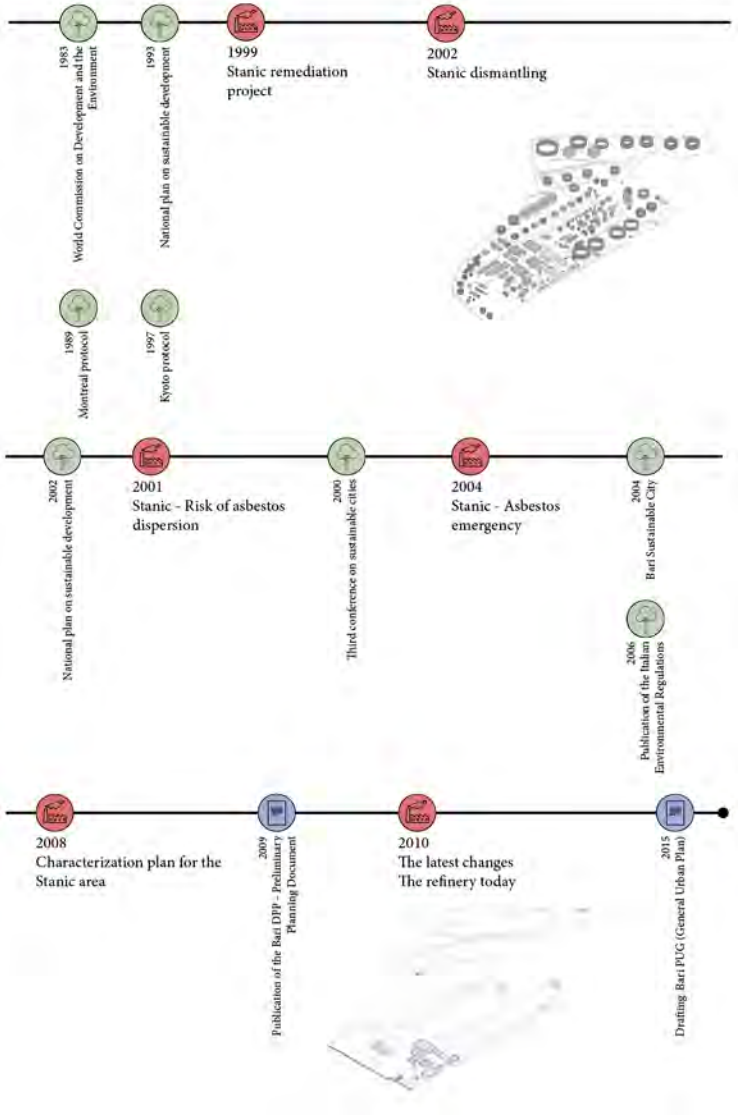


Figure 2 - Representation of the temporal evolution of the Stanic refinery (Piludu, 2017).

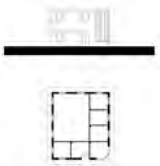
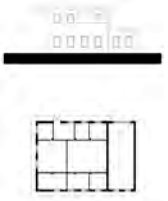
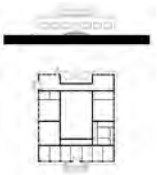
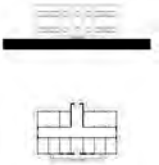
Lama Lamasinata is affected by scarce natural sensitivity and urban decay. Its path is marked by several interruptions, like dams and infrastructures, or artificial elements as terraces that modify in an impressive way the landscape continuity increasing hydraulic risks.
Over the years the Municipality of Bari and local authorities have proceeded to carry out various interventions of mitigation, gradually increasing the degree of artificialisation of the canals and consequently triggering a process of serious alteration of balance relationships between surface and underground hydrology.
The rural landscape is characterized by the dominance of cultivated fields, especially with olive groves and vineyards. The green areas are related to the native tree essences that make up the natural and environmental system of the Lama Lamasinata. This landscape has been defaced, over the years, by the high degradation, the transformations of the urban fabric by human and pollution caused by the presence of illegal landfills. Urban interventions and improper uses have progressively triggered processes of reduction and fragmentation of the herbaceous, shrub and arboreal cover of erosive furrows so much that in some cases spontaneous vegetation is presented in residual form.

Physical-morphologic analysis

At the time of its construction and expansion, the refinery contained hundreds of structures including buildings, warehouses, service rooms and tanks. Today only a few buildings remain in the refinery site. The research carried out has made it possible to identify 18 buildings: eight are the historic entrance of the refinery, two are tanks and eight are other buildings for storage use scattered in the abandoned area (Figure 3).

Figure 3 - Stanic area buildings and characteristics (Piludu, 2017).

The most relevant buildings, from an architectural point of view, are those facing the main avenue, of which there are still evident traces. The six buildings, described in Table 1, have been surveyed and analysed to understand the possible functional scenarios to insert in these industrial spaces.
All the existing buildings present advanced conditions of physical obsolescence caused by neglect and by the disposal of the refinery.

ID	Plans and sections	Building function	Year	Structure typology	Surface
1		Reception	1936	Concrete, two storey buildings	360 m²
2		Infirmary	1936	Two volumes joined with a reinforced concrete bearing structure.	459 m²
3		Chemistry laboratory	1936	Volume of a single mezzanine with load-bearing structure in reinforced concrete.	806 m²
4		Management and offices	1936	Volume with two floors outside earth with load-bearing structure in reinforced concrete. Load-bearing staircase placed on the back of the building.	714 m²

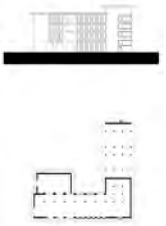
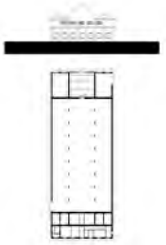
5		Storage	1936	Single volume a double height divided into three naves. Load-bearing structure in concrete reinforced and trusses arranged on the nave central, at the skylight.	2209 m^2
6		Power station	1936	Three volumes with load-bearing structure in reinforced concrete.	4654 m^2

Table 1 - Analysis of pre-existing buildings in Stanic refinery (Piludu, 2017).

Urban analysis

The connection of the area with the city consists mainly of urban roads for transports, while alternative routes of soft mobility are completely absent. The main entrance to the area overlooks the urban road of Via Bruno Buozzi, which connects the area to the F. Crispi Metro station and the F. Crispi railway station, until the waterfront. Via Bruno Buozzi, represents one of the most important crossing axes of the city, and allows the connection of the site to the nearby routes SS96 and SS16. Another important urban street of the quartier is Viale Europa, which runs alongside the ENEL electric power area adjacent to Stanic and which

connects the city to the San Paolo district, crossing the Lama Lamasinata (Figure 4).

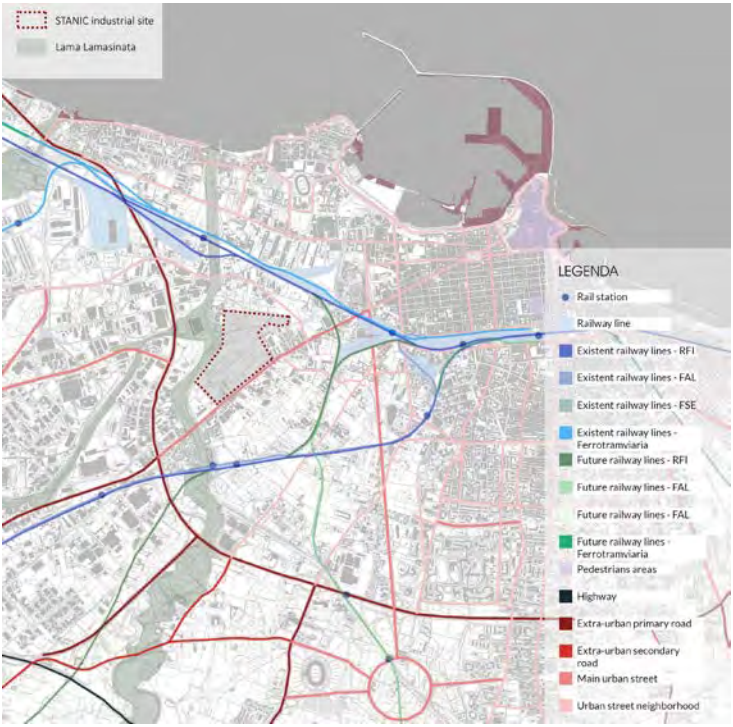


Figure 4 - Urban analysis map (Piludu, 2017).

Inside the former industrial area, it is still possible to see the remains of the internal viability of the refinery, characterized by a cardo-decuman structure and a series of orthogonal paths. The internal infrastructure system identifies strong connections with the city and the presence the old railway path. Analysing some links with the greatest functional polarities of the city immediately highlights the scarcity of direct connections and the high times and distances to reach Stanic district (Figure 5). Public transportation would be optimal in terms of traffic and environmental impact, but the

area does not have a strong network of bus connections, so it is cheaper and convenient for people to arrive at the refinery on feet.

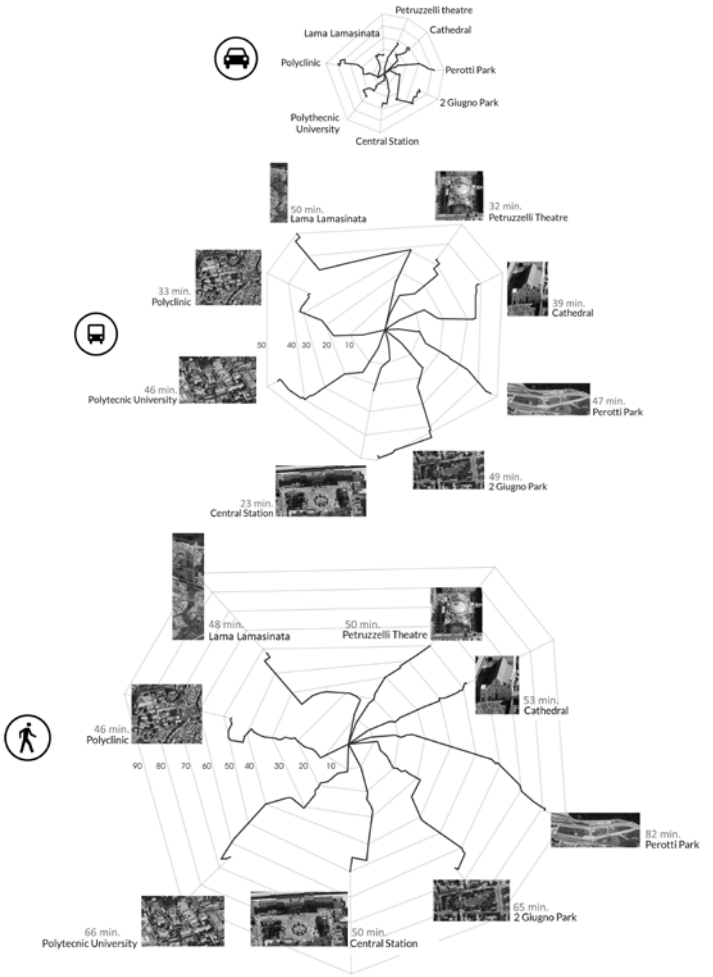


Figure 5 -Isochronous connection between the Stanic area and the functional polarities of Bari. (Piludu, 2017).

Although the area appears distant and difficult to reach, with an adequate connection to the main polarities it can absolutely be integrated with the rest of the polarities, developing a unique landscape scenario. Analysing the area in detail, it is clear how much its vastness makes it challenging to move on foot. The perimeter of the area is just over three kilometers and a half. This means about forty minutes walking. The problem is partially solved walking on the east-west axis, long about two kilometers (Figure 6).

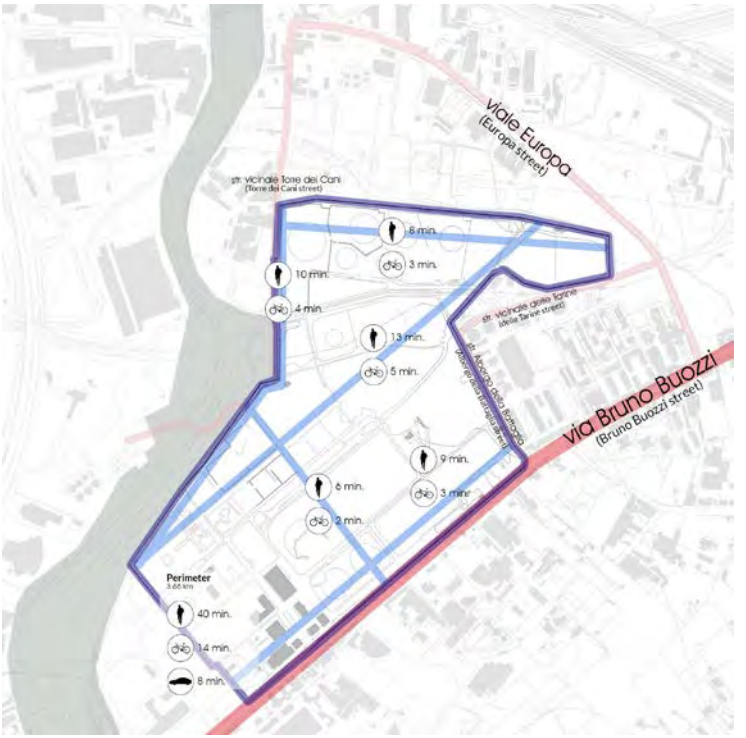


Figure 6 - Travel times inside the Stanic area (Piludu, 2017).

Considering that the site is close to the Lama Lamasinata, the connection of the Stanic refinery with the city, through pedestrians and cycle paths, could be an optimal solution. Slow mobility, especially cycle paths, could become a fundamental resource for the use of this abandoned area.

Social analysis

The Stanic district is part of the Municipio 3 area of Bari, together with San Paolo, Marconi, San Girolamo, Fesca, and Villaggio del Lavoratore neighborhoods. Analysing the context from social, cultural and community perspectives, it is possible to identify the needs of the population and create a project tailored to them.
The area around the Lama Lamasinata appears strongly fragmented and isolated from the rest of the city. Due to the absence of connections and structures capable of catalysing attention in this marginal district, the landscape and the entire periphery of San Girolamo, San Paolo and Stanic districts present high level of degradation and obsolescence. The former services, after the refinery divestment, gradually closed or moved to other parts of the city, bringing the district to the current degraded situation. A few services are located near the social housing residential complex (IACP), where it is possible to find a nursery school, a post office, an elementary school, a pharmacy, and some other small shops for necessities. There are no cultural or sports polarities, in the absence of which the residents are forced to travel by car to reach places in the city with more services.
Considering the urban scale, the main data regarding the structure of the population residing in 2011 in the Stanic district is showed in the Table 2 (Comune di Bari, 2017). By comparing the data from 1991 and 2001 and then from 2001

to 2011, a decrease in the population is shown in Tables 3a and 3b (Comune di Bari, 2017).

District	People residing on 08/10/2011					
	Total	Men	Women	Foreign citizens	Children of 0 - 5 age	People of 20 - 29 age
Stanic	**3.555**	**1.776**	**1.779**	**92**	**227**	**467**

Number of resident families on 08/10/2011			Surface inhab./sq km	Density inhab./sq km
Total	With nominees or citizen foreigner	Single-component families		
1.254	**31**	**234**	**10,55**	**337**

Table 2 - People and families registered as residents on October 8, 2011 in the Stanic district.

	Variations from 1991 to 2001					
	Value			%		
	Men	Women	Total	Men	Women	Total
Stanic	**- 629**	**- 497**	**- 665**	**-20,13**	**-24,21**	**-22,19**

Table 3a - Resident population registered in the Stanic district, divided by sex and former administrative quarters (1991 – 2001).

Variations from 2001 to 2011					
Value			%		
Men	Women	Total	Men	Women	Total
291	**267**	**558**	**16,39**	**15,01**	**15,70**

Table 3b - Resident population registered in the Stanic district, divided by sex and former administrative quarters (2001 – 2011).

Multi-Criteria Decision-Making (MCDM) Analysis

The widespread diffusion of MCDM Analysis in urban planning is connected to the need of justifying feasible policy choices and to the possibility to involve a large number of people in the process (Belton et al., 2002; Huang et al., 2011; Nijkamp et al., 1990; Ksiazek et al., 2015). The identification of qualitative data, using evaluation schemes to solve planning problems, is an important communication tool to facilitate decisions. The decision support system simplifies the selection of adequate strategies of conversion of disused industrial sites. In order to set up a procedure for the selection of the most suitable adaptive reuse solution for the

Stanic site, the first step regards the definition of preliminary design parameters and interventions.
This section applies six macro-phases, already summarized in the previous sections. The three initial parts identify and describe the sub-attributes, the hypothesized uses and the criteria value functions. The fourth part focuses the attention on the selection of decision makers for the creation of focus group to evaluate parameters in relation to each design proposal, considering the quantitative data of each value function. The last two parts implement the MCDM Analysis, multiplying each weighted parameter with the corresponding coefficient obtained by the value function for that specific solution. This methodology identifies the most suitable transformation intervention for the Stanic refinery.

Attributes definition

It has been generally agreed that Multi-Criteria Decision Analysis (MCDM) may simplify decisions, taking into account available technical information and design factors. These methods consider several criteria simultaneously and help decision makers to select the feasible scenario for the conversion of disused sites (Ferretti et al., 2014; Giuliani et al., 2017). As previously mentioned, the first step of this process consists in the structuring of the decision problem, underlining and describing all the sub-attributes that should be considered in the preliminary design survey. In particular, starting from the four main topic analysed, major factors that can influence the choice of the optimal design solution for Stanic area have been identified. The selected criteria are described as follows:

1. *Social analysis parameters (8)*

- Job opportunity: analysis of the quantity and quality of job that the new destination offers.

- Public spaces and green areas: analysis of the quantity and quality of the present public spaces and green areas. Green areas and public spaces are places of aggregation, socialization, and act as catalysts for inhabitants and visitors to the city.
- Pedestrians areas and slow mobility: the presence of sustainable roads makes it possible to improve the socialization and use of public land by visitors and residents. The amount of slow mobility routes and public spaces guarantee the development of society and urban asset.
- Services: the quantity, differentiation and quality of functions that can promote Stanic as a stable, sustainable and self-sufficient city context. It allows to increase the wealth of its inhabitants and thus to improve their living conditions.
- Social activities: increasing of the satisfaction of the inhabitants and quality of life. This parameter evaluates the presence of activities to create neighbourhood relationships and social inclusion.
- Attractiveness: the ability of an area to attract and manage different flows of people due to its activities or structures.
- Connection with the city centre: the analysis of the times and methods of moving not only between the services and places within the project area but also with the rest of the city makes it possible to identify and trace the best connection routes to the various services.
- Gentrification: the insertion of new services and fast public mobility increases the quality of life and re-evaluates district role in the city urban structure.

2. *Physical - Morphologic analysis parameters (4)*

- Recovery of the historic-architectural pre-existences: study of buildings and works of considerable architectural

or artistic interest, in order to assess the best strategy for their conservation and restoration.
- Compatibility of the intervention with the context: the analysis of the present context allows to structure feasible intervention strategies without dominating or designing elements in contrast with the pre-existences.
- Introduction of new volumes: the possibility to introduce new volumes in the existent site morphology, considering current regulations in the field of restoration, construction and urban planning.
- Maintainability: this criterion considers the feasibility of maintenance activities on an historical building.

3. *Environmental analysis parameters (5)*
- Landscape quality: it measures the natural potential of the place and its values in terms of greenery and environmental attractiveness.
- Presence of green areas: the amount of green areas is not only important in social or landscape terms. Green areas trigger an increase in biodiversity, a better quality of air and water, having consequences on the quality of life of the inhabitants.
- Safeguard of the natural native species: the ability to enhance and conserve native species and biodiversity, making users aware of the conservation and respect of local species.
- Site renaturation and remediation: the analysis of the level of pollution and degradation of the area.
- Compatibility of the new natural species with the local context: it measures the level of integration of the planned green areas with pre-existing species, without compromising the context morphology and landscape.

4. *Urban analysis parameters (5)*
- Iconicity: the ability of a place to be identified as a reference point for the city.

- Space flexibility: the analysis of space flexibility is a fundamental prerogative for the architecture of reuse. The more flexible a space, the more it can adapt to as many functions as possible.
- Usability: the ability of an object to be used easily and without major hitches by as many people as possible.
- Flow management: it explains how, at urban level, the connections between the place and the nerve points of the city can be integrated and improved.
- Accessibility: includes the characteristics of a place to be reached easily, to be crossed with different transportation systems and by different kinds of people, with specific needs and objectives.

Definition of value functions

The next step consists in the elicitation of the value functions, which represent mathematical graphs based on human judgements. The sub-attributes are described by a value function, which allows to evaluate each criterion to a qualitative range and facilitates pairwise comparison between items. The construction of a value function for the single criterion is a task that can be accomplished through different types of techniques (Von Winterfeldt & Edwards, 1986; Kirkwood, 1997). For the assessment of marginal value function, a range-based technique is used. In particular, for all the identified parameters, only three different qualitative graphs are identified. The first step is the description of the criteria and the identification of score range. The second step is the determination of the qualitative characteristics of the marginal value function with the specification of numerical data. Figure 7 and Table 4 describe the value functions that have been constructed for

the sub-criteria considered in the application and the relative scores.

Figure 7 - Value functions graphs.

Attributes	Sub-attributes	Parameters of value functions									
Social analysis parameters	Job opportunity	VL	0	L	0.25	M	0.5	H	0.75	VH	1
	Insertion of public spaces and green areas	NS	0	PS	0.5	TS	1				
	Insertion of pedestrians areas and slow mobility	NS	0	PS	0.5	TS	1				
	Introduction of new services	NS	0	PS	0.5	TS	1				
	Social activities	VL	0	L	0.25	M	0.5	H	0.75	VH	1
	Attractiveness	VL	0	L	0.25	M	0.5	H	0.75	VH	1
	Connection with the city centre	NS	0	PS	0.5	TS	1				
	Gentrification	VL	0	L	0.25	M	0.5	H	0.75	VH	1
Physical - Morphologic analysis parameters	Recovery of the historic and architectural pre-existences	NS	0	PS	0.5	TS	1				
	Compatibility of the intervention with the context	VL	0	L	0.25	M	0.5	H	0.75	VH	1
	Introduction of new volumes	VH	0	H	0.25	M	0.5	L	0.75	VL	1
	Maintainability	VH	0	H	0.25	M	0.5	L	0.75	VL	1
Environmental analysis parameters	Landscape quality	VL	0	L	0.25	M	0.5	H	0.75	VH	1
	Presence of green areas	VL	0	L	0.25	M	0.5	H	0.75	VH	1
	Safeguard of the natural native species	NS	0	PS	0.5	TS	1				
	Site renaturation and remediation	VH	0	H	0.25	M	0.5	L	0.75	VL	1
	Compatibility of the new natural species with the natural context	VL	0	L	0.25	M	0.5	H	0.75	VH	1
Urban analysis parameters	Iconicity	VL	0	L	0.25	M	0.5	H	0.75	VH	1
	Space flexibility	VL	0	L	0.25	M	0.5	H	0.75	VH	1
	Usability	VL	0	L	0.25	M	0.5	H	0.75	VH	1
	Flow management	VL	0	L	0.25	M	0.5	H	0.75	VH	1
	Accessibility	VL	0	L	0.25	M	0.5	H	0.75	VH	1

Table 4 - Value coefficient scale for each parameter.

Design proposals

Considering the previous analysis, three design proposals are defined. The interventions differ not only in the relationship between built and natural landscape, but also in the type of use (public, semi-public and private). Each solution includes functions strictly related to the population needs and to the urban shape.
The three scenarios are listed as follow:

a) *Environmental and thematic park:* the proposal focuses on recycling the buildings, production structures, machinery, and even the grounds themselves. Through bio-phytoremediation techniques, the soil and water would be "cleaned and greened". The preservation and adaptive reuse of existing structures allow to safeguard the historical memory of the place. The recovered buildings are used as incubators of recreational functions and community services that frame the park not only as a large green walking lung, but also as a place to perform outdoor activities, sports, creative and educational workshops.
b) *Technological, cultural and education park:* the concept is to create a large urban park, which in part tends to reconnect to the existing urban fabric through a series of ecological corridors, in order to stimulate the creation of sustainable urban mobility, supported by the presence of an interchange hub. The role and naturalness of the Lama Lamasinata is restored, making it an integral part of the new system. Remediation and bio-phytoremediation activities are two techniques that become even more fundamental today in an environmentally damaged area. Laboratories, offices, areas for the study of plant species, educational and hemp production laboratories, archives, areas for the transformation and packaging of products and zero-km commercial areas compose the functional program.
c) *Manufacturing and industrial park:* this functional typology restores the pre-existences and increases the density of the buildings with the aim of introducing functions relating to the manufacturing and craft field. It is conceived as an innovation accelerator for all companies that aim to enlarge their market with eco-efficient solutions. The naturalistic-environmental aspect is always present in order not to damage the landscape quality of

the place, prevailing a purely private use of the site . Start-ups, incubators, spin-offs, warehouses, smart offices and design, production and assembly laboratories occupy most of the area of the former Stanic refinery area.

Stakeholders analysis and interviews

The stakeholders analysis allows to define the main actors of the process under investigation. At the same time, very often, decision makers have conflicting ideas and interests on the possible conversion interventions of abandoned industrial sites. Decision problems, relating to the design and implementation of urban transformation and regeneration process, involve multiple actors with different views, design solutions and objectives. In this context, the valuation of alternative scenarios is a complex process, because various items need to be compared. Through focus groups, twenty-one people, specialized in the construction, recovery and environmental-historical-architectural values preservation fields, discuss the theme of the recovery of the Stanic area, trying to quantify the importance of each parameter in relation to the different proposed design solutions. This involves the selection of the numerical data of each criterion from the value functions, according to the considered possible solutions. In addition, a questionnaire is submitted to the same actors to quantify the weight of the attributes and sub-attributes. Table 5 lists the values of the parameters with respect to the building adaptation interventions that emerged from the focus group.

Attributes	Sub-attributes	Environmental and thematic park	Technological, cultural and education park	Manufacturing and industrial park
Social analysis parameters	Job opportunity	0.25	1	1
	Insertion of public spaces and green areas	1	1	0.5
	Insertion of pedestrians areas and slow mobility	1	1	0.5
	Introduction of new services	0.5	1	1
	Social activities	0.75	1	0.5
	Attractiveness	0.75	1	0.5
	Connection with the city centre	0.5	1	1
	Gentrification	0.5	0.75	0.75
Physical - Morphologic analysis parameters	Recovery of the historic and architectural pre-existences	1	1	1
	Compatibility of the intervention with the context	0.75	0.75	0.75
	Introduction of new volumes	1	0.75	0.5
	Maintainability	0.75	0.5	0.5
Environmental analysis parameters	Landscape quality	1	1	0.5
	Presence of green areas	1	0.75	0.5
	Safeguard of the natural native species	1	1	0.5
	Site renaturation and remediation	0.5	0.5	0.25
	Compatibility of the new natural species with the natural context	1	0.75	0.25
Urban analysis parameters	Iconicity	0.5	0.75	1
	Space flexibility	1	1	1
	Usability	1	1	1
	Flow management	0.75	0.75	0.75
	Accessibility	1	1	1

Table 5 – Parameters values extracted from the value functions.

Weighting criteria

Once the alternatives have been evaluated, it is necessary to define the weights of the different attributes of the decision problem. Twenty-one different experts in the context of urban planning, history of architecture, cultural heritage and refurbishment fill out a structured questionnaire to estimate the parameters that most affect the composition and design choices of building conversion in the preliminary design stage. The survey, therefore, is based on the evaluation, in a range from 1 (very unimportant) to 5 (very important), of

the categories and sub-parameters identified in the previous sections. The results show that most of the criteria are fundamental for the activation of urban regeneration policies for abandoned industrial sites.
However, especially for sites with architectural importance, a parameter to be considered is the recovery of pre-existences with the aim of safeguarding the historical memory of the place. Even the environmental aspects are not to be overlooked, especially when intervening on polluted industrial areas which therefore require soil remediation. The parameters, relating to site attractiveness, flexibility of spaces and usability features, are also relevant.
Table 6 contains all the weights related to each parameter and normalized according to the category they belong to. These considerations are reflected in the weight of the four main categories, where the most important attribute is the urban analysis (25,59%), followed respectively by the environmental analysis (25,29%), social analysis (25%) and physical - morphological analysis (24,12%).

Aggregation and discussion of results

In the last methodology phase, each attribute score extrapolated by the value functions is compared with the corresponding weight, arisings by the focus group survey. In addition, the estimation and normalization of parameters percentages allow to calculate the total feasibility score of the three alternatives. MCDM Analysis includes different aggregation models, but the simplest and most used one is the additive model and, in particular, the following equation:

$$V(a)=\sum wi \times vi(ai)$$

Where V(a) is the overall value of alternative a, vi(ai) is the single attribute value function reflecting alternative a´s

performance of attribute i, and wi is the weight assigned to reflect the importance of attribute ì. On the right side of Table 6 the partial and overall values and the ranking of the design solutions are calculated. For each analysis category, the partial average values of each individual design option are outlined. This multicriteria evaluation methodology shows that the technological, cultural and education park obtained the highest ranking in the section containing the social parameters. This means that the considered design solution better meets the needs of the community and attracts more users. The second option, regarding the environmental and thematic park, is the best scenario in the categories of environmental and physical-morphologic parameters. The hypothesis of creating an urban park with multiple activities for each age group incorporates an intervention aimed at recovering the native landscape and the union of multiple functions related to the naturalistic aspect of the site. The question that this solution, from the physical-morphologic aspects, has obtained a high score lies in the ease of maintenance of the site, in the low insertion of new volumes and in the non-invasiveness of the intervention. The manufacturing and industrial park does not achieve high values in the first three categories of criteria most likely linked to the strictly private function of the new intervention and the need to introduce new volumes on the site. At the same time, it has the best evaluation in the section concerning urban analyses, as it converts the primitive function of the site in a modern key, preserving the historical memory of a productive and manufacturing area. From the total values obtained, the technological, cultural and education park solution (total score: 86,05/100) is the best alternative according to the four considered preliminary analysis categories.

Attributes	Sub-attributes	Values	Environmental and thematic park	Technological, cultural and education park	Manufacturing and industrial park
Social analysis parameters	Job opportunity	2,82	0,70	2,82	2,82
	Insertion of public spaces and green areas	3,31	3,31	3,31	1,66
	Insertion of pedestrians areas and slow mobility	3,08	3,08	3,08	1,54
	Introduction of new services	3,35	1,67	3,35	3,35
	Social activities	3,20	2,40	3,20	1,60
	Attractiveness	3,42	2,57	3,42	1,71
	Connection with the city centre	3,01	1,50	3,01	3,01
	Gentrification	2,82	1,41	2,11	2,11
25,00			16,65	24,30	17,79
Physical - Morphologic analysis parameters	Recovery of the historic and architectural pre-existences	6,63	6,63	6,63	6,63
	Compatibility of the intervention with the context	6,87	5,15	5,15	5,15
	Introduction of new volumes	4,21	4,21	3,16	2,11
	Maintainability	6,40	4,80	3,20	3,20
24,12			20,80	18,15	17,09
Environmental analysis parameters	Landscape quality	4,95	4,95	4,95	2,48
	Presence of green areas	5,25	5,25	3,94	2,62
	Safeguard of the natural native species	5,13	5,13	5,13	2,57
	Site renaturation and remediation	4,95	2,48	2,48	1,24
	Compatibility of the new natural species with the natural context	5,01	5,01	3,76	1,25
25,29			22,82	20,25	10,16
Urban analysis parameters	Iconicity	4,18	2,09	3,14	4,18
	Space flexibility	5,45	5,45	5,45	5,45
	Usability	5,45	5,45	5,45	5,45
	Flow management	4,75	3,56	3,56	3,56
	Accessibility	5,76	5,76	5,76	5,76
25,59			22,31	23,36	24,40
FINAL SCORE			82,58	86,05	69,44

Table 6 – Partial and overall attributes and sub-attributes values.

Considering the landscape aspect, the insertion of new social, cultural and educational functions not only allows to activate policies of urban regeneration and sustainable development of the neighborhood, but, through bio-phyto-remediation activities for soil reclamation, it increases the feasibility and maintainability of the intervention.

Conclusions and future developments

The work focuses on sustainable regeneration of disused industrial heritage site in Bari. This building typology is increasingly used for adaptive reuse interventions, due to its significant historical memory and space flexibility. At the same time, it is characterized by environmental constraints, strong decay and marginal urban location. Starting from the identification of building typology values, based on the formal and historical background, the possibilities to reuse have been investigated through literature review. In particular, the case of Stanic refinery is carried out under Multi-Criteria Decision-Making (MCDM) Analysis. This method has been applied on three detailed design solutions and a great number of attributes relating to social, physical-morphologic, urban and environmental aspects. These four main categories have been accurately analysed during the preliminary stage of activities for the development of refurbishment strategies.

Thanks to its versatility and adaptability to different problems, MCDM Analysis is an interesting tool to rank the satisfactory, efficient and sustainable uses for Stanic refinery area. The adaptation of industrial derelict warehouses to different uses plays an important role in ensuring the continued efficient use of the building stock, extending its useful life. Adaptive reuse interventions not only increase the site attractiveness, but also develop modern and feasible strategies to reuse dismissed or abandoned structures, reducing urban sprawl.

Future research developments will focus on the cataloguing and synthesis of data obtained from preliminary analyses in a summary table of the case study. Starting from these input data, it will be possible to define, through the Design Criteria System (DCS), the best strategy to be adopted with the

selection of the attributes and sub-attributes to be considered in the building transformation process. The sum of the weights of each parameter will allow to obtain the feasibility coefficient of the adaptive reuse process. To complete the analysis, it will quantify and evaluate intervention costs and the potential building score to undergo sustainable site conversions, through the use of the ARP model (Langston, 2012) and the AdaptSTAR Model (Conejos et al., 2013; Conejos et al., 2015).
Multi-criteria models, decision support systems and virtual analysis platforms aim at simplifying the procedures for the recovery of existing abandoned sheds, framing the steps that characterize the adaptive reuse activities and quantifying the incidence of parameters that can influence design stakeholders' choices.

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Spatial cognition and local knowledge in open space: ontologies in risk situations

Pasquale Balena*

Abstract

Recently, the diffusion of social networks is opening new research scenarios in risk assessment. In an emergency, during critical events, massive flows of information (text messages) posted on social networks could contribute to save lives or to help people in danger – provided they were tapped into and correctly interpreted by emergency agencies. These potential sources of information, in most cases, consist in unstructured social contents reflecting people's intentions, perceptions and needs and they often have elements of complexity and uncertainty, hindering interpretation and thus thwarting response management.
The text messages are in natural language; they frequently contain locational information which, if properly extracted and processed, could make a key contribution to disaster management, and search and rescue in particular.
This research aims to contribute to understanding, in the context of social streaming analysis in a risk situation, how locational information and other implicit spatial knowledge may be organized to be effectively shared between all actors

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involved in disaster management. To that aim, an integrated approach involving machine learning and ontological models has been tested to help discover spatial knowledge.

Keywords

Local Knowledge, Ontology, Social Sensing, Text Mining, Spatial Analysis

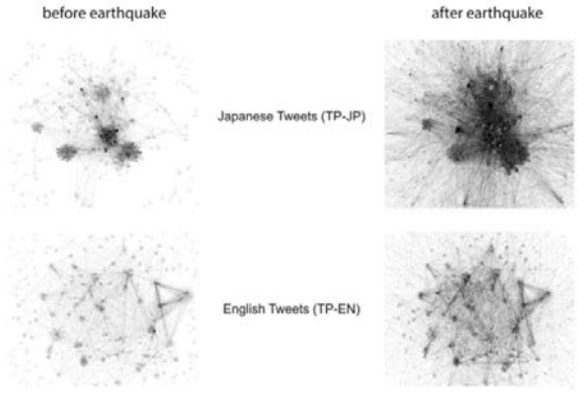
Social Sensing and disaster management

Over the last decades, natural disaster events (such as flooding, earthquakes, tsunamis and hurricanes) have caused extensive damage (to housing and infrastructure) and severe loss of lives in vast regions worldwide.

When these events occur, the role played by international organizations and cooperation to ease the management of emergencies and available resources are key aspects, which are widely debated in the literature (Quarantelli, 2006; Reddy et al., 2008). Similarly, since the 1950s, scholars have highlighted the valuable contribution of citizens as active participants to handle emergency events. Lately, this contribution has been closely linked to the diffusion of new *Information and Communication Technology* (ICT) (Simon et al., 2015; Whittaker et al., 2015), which has enabled a wider public participation in the decision-making process.

The large increase in the use of Social Networks in risk dynamics is a relatively recent aspect. The international literature considers several studies on the Haiti Earthquake of 2010, Tōhoku (Japan) earthquake and tsunami of 2011, Christchurch (New Zeland) earthquake of 2011, Queensland

(Australia) flooding of 2012 and/or Haiyan (The Filippines) hurricane of 2013 to cite a few (Hughes and Palen, 2009; Vieweg, et al., 2010). These studies have in common the analysis of *messages* posted on different social media during and after the occurring of a disaster event. Also, text messages are analysed to shed light on their dynamics during rescue operations (Qu, et al., 2011).
Figure 1 shows the findings of a study by Lu and Brelsford (2014): the authors emphasize a communication stream across thousands of people on Twitter[2] soon after the 2010 earthquake in Japan.



LANGUAGE	PERIOD	USER	TWEETS
Twitter Post-JP	Before	36893	42678
	after	36893	114247
Twitter Post-EN	before	36234	49095
	after	36234	64507

Figure 1 - Network structure and community evolution on Twitter: Before and after the earthquake in Japan 2010. Adapted from Lu and Brelsford (2014).

[2] Twitter is a social networking service where users post and read short messages called 'Tweets'. Registered users can post and read tweets, but those who are unregistered can only read them.

The work also draws attention to data exchange and availability on the web during the event, and the potential of exploring local knowledge associated to this data.
In particular, the study analyses the communication streams occurred on Twitter before, during and after some above mentioned disaster events. The contents of the text messages are analysed according to the event (e.g. earthquake, flooding) and phase types (*ex ante, in itinere, ex post*).
The text messages are written in natural language; they frequently contain locational information which can be explicit (i.e. coordinates) or implicit (i.e. place names or toponyms). These descriptions are characterized by different people's spatial perception and specific place knowledge. Hence, to be used by an emergency system, they must be transformed into structured information (quickly usable in computer processing).
The specific objective of this research is to contribute to understand, in the context of social streaming analysis in a risk situation, how locational information and other implicit spatial knowledge may be organized to be effectively shared between all actors involved in disaster management.
To that aim, different data mining methods have been tested to single out every element that is necessary to identify and locate the place described in the text messages, while an ontological approach is introduced to bridge the communication gap between different communities of practice (Oltramari et al. 2003; Gaio et al., 2010).

Ontologies to improve emergency domain

Formal ontologies can be a bridge between different communities (Oltramari et al. 2003; Gaio et al., 2010). They

identify, within a specific domain, entities and their respective properties and relations based on a logical system. Ontologies pursue one or more among the following three goals (Gaio et al., 2010: 108): "the representation of information; the description of a certain domain; the development of a systematic theory for a specific entity".

Over the last decades, several types of ontologies have been established. These differ in terms of the level of abstraction of the real world and the formalization and representation. One of the key differences within the field of formal (or computational) ontologies is the one drawn between foundational (upper) and lightweight ontologies.

In recent years, the development of methodologies to implement these ontologies has generated a debate around the heterogeneity issue. It should be remembered that one of the principal objectives of an ontology is to facilitate knowledge sharing. The scientific community should aim to create a shared integration mechanism whereby ontologies that describe the same domain or have overlapping areas adopt unambiguously the same concept.

Noy (2004) identifies two methods for tackling this issue. The first one, which has met wide consensus in the literature, turns to foundational or upper-level ontologies to identify the classes that serve as a link between specific ontologies. The second approach includes heuristics-based techniques or machine learning that take advantage of the distinct features of ontologies (structure, definitions of concepts, instances of classes) to work towards a shared mapping.

The information sharing can be treated at different levels, and this operation involves the use of both foundational – such as the Descriptive Ontology for Linguistic and Cognitive Engineering (DOLCE[3]) (Masolo et al., 2002), shown in Figure 2 – and lightweight ontologies realized to draw the different forms of Social Media Geographic Information(Campagna, 2016).

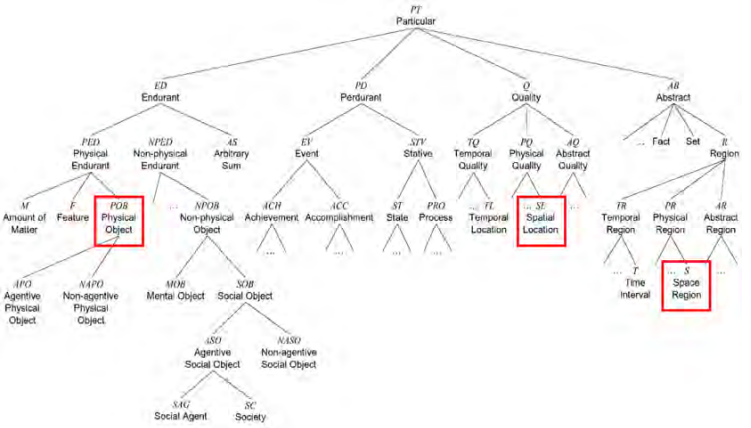


Figure 2 - DOLCE's taxonomy of entities. Adapted from Masolo *et al.* (2003).

DOLCE is also a Multiplicative ontology since it has a general view of the real world and admits distinct entities that can share the same Spatio-temporal area (i.e. entities can be co-localised) (Masolo et al., 2003).

[3] DOLCE is based on the OntoClean methodology developed by LOA-CNR as a validation tool aimed at assessing the robustness and adequacy of the taxonomy's relations (Guarino and Welty, 2009).

Generally, the latter is structured as a taxonomy of concepts, often hierarchically structured (Oltramari et al., 2003; Gaio et al., 2010). The former, on the other hand, faces more general and cross-cutting issues between different domains and communities that generate ambiguities across meanings arise.

Using ontologies to improve knowledge organization in the emergency management domain is well established in the scientific literature. Wang et al. (2006; 2009) define an ontological model of events, processes and actions based on sharing a vocabulary to exchange information. Xu et al. (2014) use specific geo-ontology libraries to describe an earthquake event. A geo-ontology is oriented to a geo-spatial hierarchy of information, and it offers a semantic interpretation of concepts.

Murgante et al. (2009) address seismic risk in urban areas through the use of an ontology. The model is developed to share knowledge so that concepts are fully understandable and accessible to the intended stakeholders.

Lee et al. (2013) apply an ontological model to develop a smart-type approach through the use of a context-aware platform and address real-time emergency operations/situations.

Apisakmontri (2013) uses an ontological approach for Refugee Emergencies in Disaster Management, which resonates with the approach adopted in the present work, as it involves the construction of an ontology to define needs or integrating a lightweight ontologies with four foundational ones (namely, DOLCE, SUMO, FOAF, and SWEET).

Recently, specific ontologies have been developed to describe social media concepts of the like of 'Semantically Interlinked Online Communities' (SIOC) ontology - which was originally developed to model websites such as blogs

and online forums (Imran et al. 2015) - while Meaning-Of-A-Tag (MOAT) implements an ontology with semantic tagging of social media data (Passant and Laublet, 2008).
The conceptual aspects of the ontology are inspired to the work by Mele and Sorgente (2011): The Eventory project. This project takes its roots from the journalism field and adopts the model called 'W's and one H'. This model uses six fields to represent an event: 'Who', 'When', 'Where', 'What', 'Why', and 'How'. Regarding the design aspects, the ontology refers to the model proposed by the W3C Incubator Group Report 2009 (Ianella, 2009), which is based on three fields: 'What', 'Where', and 'Who'.
The analysis of the simulation study illustrated in this section and by the recent literature (e.g. the Haiti earthquake[4], the Hurricane Sandy5) justifies the ontological model structured into the following macro-fields: 'What', 'Where', 'Who' and 'When'.
Before illustrating the entities attached to the fields of 'What', 'Where', 'Who' and 'When', it is relevant to briefly introduce the 'Why' field (which is not included in the above taxonomy). Under certain aspects, this field can be present in text messages and justifies the existence of the domain.
The W3C Incubator Group Report (Ianella, 2009) focuses on the major aspects of communication between rescue operators in a post-disaster situation, and uses foundational

[4] Haiti crisis map
https://datahub.io/dataset/ushahidi/resource/81d058a8-173a-49d9-8ce9-4edf5e7cafc9

https://github.com/unthinkingly/haiti.ushahidi.com-twitter-export

[5] Hurricane Sandy http://www.zubiaga.org/datasets/hurricane-sandy-tweets/

and non-foundational ontologies. The ontological model (Figure 3) is built around three sections: i) 'What' deals with needs issues; ii) 'Where' refers to spatial aspects; and iii) 'Who' deals with the actors involved in the post-disaster event. The model W3C does not focus on the time frame ('When') although it is an important aspect (e.g., 'I need food by tomorrow').

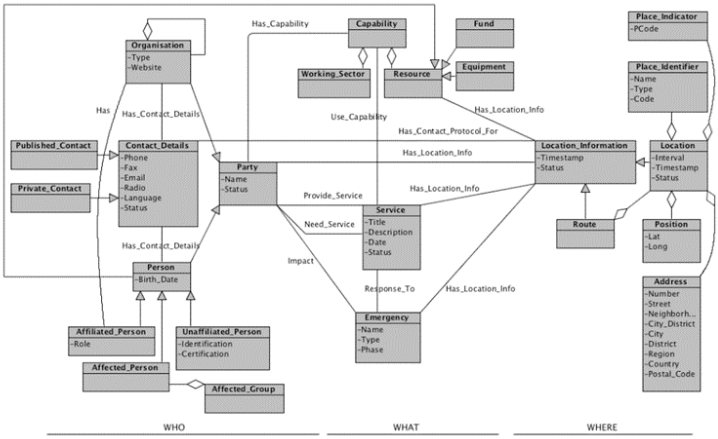


Figure 3 - Who, What, Where information models. Adapted after the W3C Incubator Group Report (Ianella, 2009).

Knowledge Discovery in Text

Text messages, albeit heterogeneous, tend to show common characteristics that are suitable for clustering and classification analysis. Two steps and two methods are taken into account, in order to illustrate the process:

- Step 1: Identification of two types of methods that allow to reorganize the information in emergency situations,

through supervised algorithms instructed by a training set.

- Step 2. Processing of Information Extraction aiming at limiting the text, it's extracting only conceptual principal entities (needs, geo-location, people) (needs, geo-location, people) (Liu et al., 2011; Ritter et al. 2011, Imran, 2015). The extracted concepts will first be structured by an ontological analysis, and then by a shared spatial data infrastructure.

Message extraction including a conceptual approach is carried out with different textual analysis such as lexical, syntactic and semantic analysis.

The present paper identifies four conceptual domains included in a message shared during disaster response events: needs, spatial location, actors, timing.

Each of these concepts requires an in-depth analysis for the construction of linguistic patterns that take into account knowledge and common sense related to the places where the event takes place. The use of natural language regarding the spatial location is of particular concern to understand local knowledge. Natural languages use terms and combinations of terms that are often unknown outside certain local/spatial contexts.

The existence of a natural language which creates information and supports local knowledge in text analysis is one of the focal points of this work. The sharing and understanding of local knowledge is the primary requirement of an information system at a global level (e.g. when responding to humanitarian crises). Based on these assumptions, local knowledge should require and deal with ontological models.

Knowledge Discovery in Text (KDT) aims at detecting and dismissing data (noise) which is not useful to the purposes

of the platform. It provides 'extraction' of latent knowledge (Swanson,1991).

Methodologies and Results

Figure 4 shows the methodological framework of the present work.

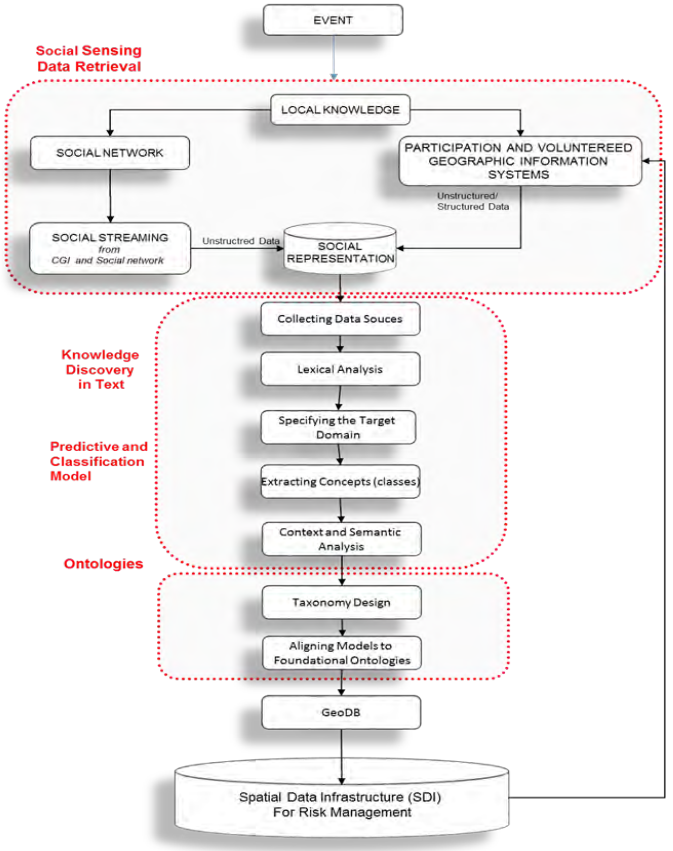


Figure 4 - Methodological framework

In the framework, 3 sections may be highlighted. Each section comprises a definition of risk and its declinations and of a non-structured dataset. The latter serves to study local knowledge, which provides for decision support systems in risk domains.

Social Sensing Data Retrieval

The understanding of local knowledge in disaster risk is based on a combination of social sensing and machine learning approaches. The former includes both structured information from public participation (participation and volunteered geographic information system) and unstructured data from social networks (Facebook, Twitter and others). These form the social representation containing useful information from people's perception about type, extent, intensity, impacts and emergencies in disaster response. The latter includes a machine learning approach which is based on information extraction to obtain the final dataset and compute the predictive model. The results obtained by the predictive model feed back into the social sensing context to form the spatial data infrastructure and enrich both the knowledge of the public and that of the expert. Next, a detailed description of the conceptual model is offered.

Information retrieved form social media can be stored in a database. However, some limitations exist because information is stored as text with no input constraints. A further limitation of the social representation is that users should be aware of the application and be willing to install it on their mobile devices. To solve this problem, several platforms add new modules and link these to social network, to capture further information and data. This process is

attainable through application programming interface (API)[6] which are dedicated libraries between the platform and the social media (e.g. Twitter, Facebook). The social streaming captures, saves and stores text messages containing keywords, such as 'earthquake', with the corresponding indication of location.

The present work assumes that the user is accustomed to at least one of the most common social media to exchange information, including requests for, and offers of, help in disaster response. However, ethical issues arising from social network streaming processing should not be overlooked: Users may not want, or may not be aware, that their messages can undergo a streaming process and be stored in databases. In disaster events, users are willing to share their text messages with as many people as possible.

Social streaming can be considered the latest development to data and information retrieval. Should this be suitably contextualized, it would open new research opportunities to public participation.

How to treat data with no input constraints from social streaming? The next section will deal with specific methodologies to retrieve structured knowledge from unstructured data.

To understand latent knowledge it is useful to shed light on Text Mining (TM), Text Data Mining (TDM) and KDT.

KDT o TM is applied to any corpus of documents and is mainly designed to:

- Identify thematic groups
- Extract concepts for taxonomies and ontologies
- perform classifications

[6] In Computer Science, an API is a set of available procedures and tools to execute a function or a set of functions.

- Discover hidden associations
- Extract specific information (i.e. addresses)

Usually, it implies four main phases like shown in Figure 5:

1. Information Retrieval (IR),
2. Information Extraction (IE),
3. Information Mining (IM),
4. Interpretation (I).

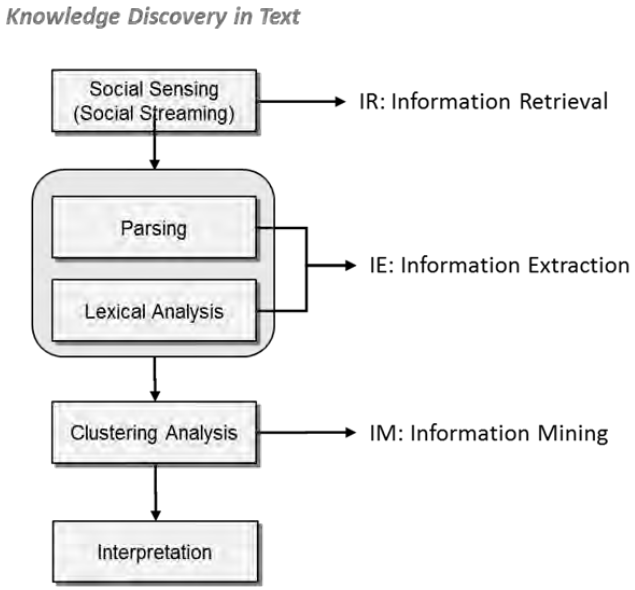


Figure 5 - Text mining phases

Information Retrieval is the first phase those texts are identified which it is possible to extract information from.
During Information Extraction, information is extracted from a text and encoded into vectors or matrices to be processed for further analysis.
Several different methods are employed in Information Mining to extract knowledge from texts.

A simple operation in the disaster response domain that can save lives is extracting high priority posts while deferring, to a second stage, other messages concerning minor emergencies. To do so, structured and unstructured knowledge is retrieved from social networks and the Ushahidi platform.

Ontological Analysis and Spatial Location

Within the disaster response domain, the contents related to the 'Why' field answer the question of 'Why did the event happen?'. The present work does not consider the reasons why an event happened or why a message is exchanged, as it exclusively deals with post disasters texts.
The lexical and syntactic forms obtained from dataset text processing underline the existence of recurrent forms. These forms establish the rules of belonging to the fields of 'What', 'Where', 'Who', 'When' and 'How'.
Therefore, Figure 6 shows only the elements attributable to this fields, above all the instances of type "where" which represents the main element of study.

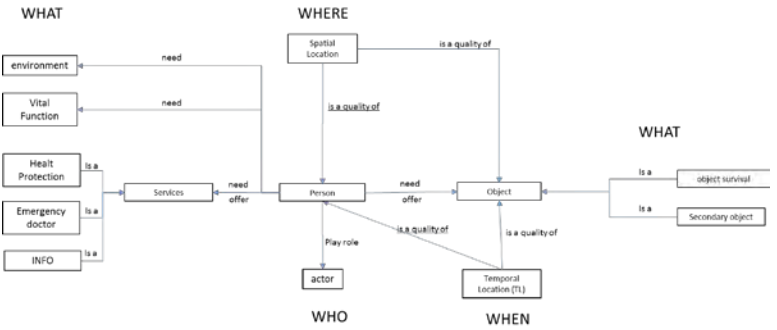


Figure 6 - Taxonomy of the Disaster Response Model

Taxonomies and Spatial locations

By examining the many messages sent in risk situations collected in some datasets during some events (Earthquakes in Haiti and in Italy), we have identified the different ways used by which everyone can communicate, using natural language, their geographical position in an urban space.
Figure 7 shows an ontological model that describes all the possible ways identified. Spatial locations are defined according to a dual approach: the first one identifies the elements of a location with respect to a reference system; the second one, shows a location (e.g. adress, landmark, meeting places), both based on natural language. The above-mentioned details will be addressed in the sub-sequent sections.

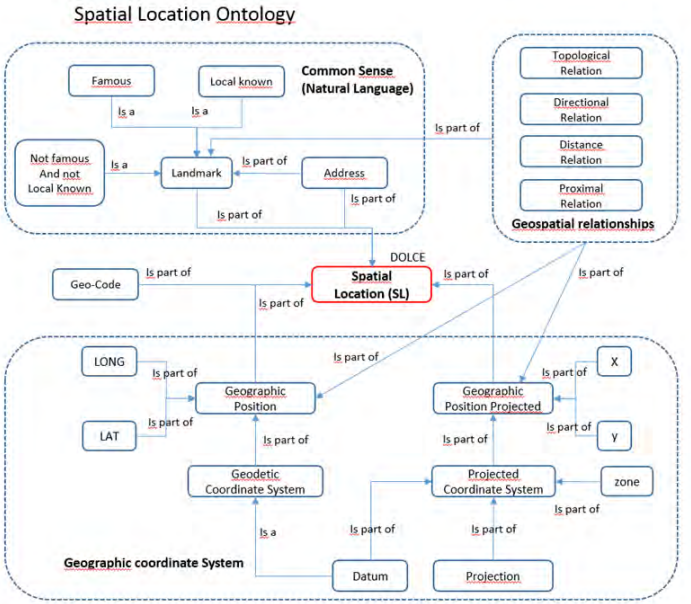


Figure 7 - Spatial Location taxonomy

Spatial Location represents the location of an object, an event, or an agent.
Figure 7 shows two ways, labeled with "Common Sense" and "Geographic Coordinate System" in which an agent uses a message to communicate his / her own location

1 *Geographic Coordinate System* includes two scenarios:
A spatial location can be obtained through absolute and relative coordinate systems. These can use different reference systems.

- The Geographic Position through a *Geodetic Coordinate System* (identified by a specific *Datum* with Latitude and Longitude)
- The *Geographic Position Projected* through a Projected Coordinate System (identified by a specific type of *Datum* and a Projection with its relative *Zone*) with X (East) and Y(North) coordinates.

The spatial location can automatically be detected by the system if the application allows to do so, or if the GPS is turned on and records the location of the user.

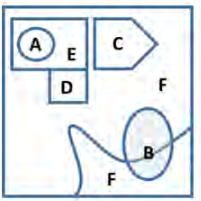
2 Common Sense. This is achieved by writing a text message in a *Natural Language*. The user supplies as much information as possible about his/her own location as follows:

- *Landmark. The user refers to and describes a generic place* (e.g., 'red building'). He/she also supplies further elements such as an address (should the location contain one) useful to determine his/her location.

- *Address*. The user shows the address. This alone is an *instance of Spatial Location.*

Another framework for spatial location is the "Geospatial RelationShip". It contains information of a spatial location according to Geographic Position, Geographic Position Projected, Landmark and Address. Using Geospatial

RelationShip enriches actual information with further spatial elements (Longley et al. 2011, Xu, 2014).
Table 1 shows Geospatial RelationShip such as Topological, Directional, Distance, Proximal.



Topological	Directional	Distance	Proximal
A inside E	C north of F	C at 100 m from E	C near E
D connected To E	A east C		F far from A
C disjoint E			
B overlaps E			

Table 1 - Geospatial RelationShip example

Topological, Directional, Distance, Proximal express spatial relations between geometric primitives (points, polylines and polygons). A regional space can be modeled by the use of these geometries. A spatial location can be represented by a polygon (e.g. a plaza), by a point (e.g. bus stop) and by a line (e.g. a street). The relationships occurring between these objects identifies useful information on spatial location between two or more objects. Therefore, expressions like 'I am outside the train station' is similar to 'C disjoint E' in Tab. 4.16; 'I am nearby the church' is 'C near E'; 'I am at 500 m from the University' is 'C at 500 m from E' or also 'We moved to North compared to the point 723000, 4523000 – WGS84 UTM 33N'.

Discussion and Conclusion

The resulting, integrated, modeling approach that has been investigated and put forward in the present paper mixes text

mining and ontologies, and seems to be promising in disaster response management.

This research added to the evidence in favor of ontologies as being an adequate approach to disaster response. In such framework, the effective interpretation of text messages was attempted at by building a shared conceptualization of risk. To this purpose, a separate taxonomy was developed (regarding Spatial Location), being linked to a terminal entity in DOLCE foundational ontology (Masolo et al., 2002): "SpatialLocation', for localizations and spatial relationships. Thus, the ontological framework was aligned to that of DOLCE's foundational ontology. This internationally-renowned ontology may represent the coordination apparatus among locally-differentiated knowledge information systems, with a view to enhancing knowledge sharing. Such efforts should however be complemented by the development at international level of shared disaster- and risk-related ontologies – in finer-grained details, so as to refine the linkages between the ontological entities and the concepts embodied in the natural language forms extracted from text messages.

This research work is not without limitations. First, the machine learning and ontological models have only partly been integrated with each other. While machine learning is an application-oriented approach, the ontological framework is a higher-level conceptual construct. Although disaster response interactions have been studied through an integrated approach, the integration was only tested at a conceptual level. The integration of an ontological framework in actual web platforms falls outside the scope of this study.

An important improvement that may be made to the present work in the near future is to consider an empirical integration between the ontological and machine learning approaches in

VGI/PPGIS technologies. In other words, future research could focus on the design and implementation of integrated platforms to collect, retrieve and analyze unstructured data, and communicate structured knowledge to policy makers and citizens.

Based on the above considerations, it may be concluded that the use of natural language should be explored case-by-case, with due consideration of the specific place-based, socio-cultural settings where disaster events occur. On a parallel track, special attention should be paid to sharing advances in the foundational cognitive structures that underpin sense-making and speech acts in disaster response.

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Diary extract of five research experiences in the XXXIV Italian doctoral cycle. Sharing common research questions on environment-oriented planning

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Abstract

In a time of renewal of the themes, interests, and applications of urban planning disciplines, is it possible to read continuity between the ongoing doctoral research? Despite Italian universities focused on project-making and urban planning, they often appear as closed groups, impermeable to external influences and synergies: still, examples of interdisciplinary syncretism and academic contamination could be found both in past research and emerging practices. Through the presentation of 5 research questions, developed by doctoral students from Italian universities, the paper is aimed to recognize a *fil*

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rouge made up of common interests. The proposal is oriented to recognize, through analogies and common traits, the potential of interdisciplinary comparison and research networks. The opportunity for concertation among PhD students arises from the fruitful participation in urban studies training activities and workshops tailored to doctoral studies, and from a two-year exchange of ideas and perspectives. The dissertation themes include the identification of the wickedness of some crucial problems that contemporary environment-oriented planning is called upon to address. They relate specifically to the issues of climate-proof planning, resilience, action research processes, regeneration of peri-urban areas. After a theoretical definition of wickedness to which the authors refer, five Diary Extracts are presented and compared by highlighting: 1) the existing interconnections between research questions, objectives and methodologies, 2) the implications for research and practice in the field of environment-oriented planning. Finally, the essay provides further remarks on the learning opportunities grounded on sharing and contamination among young scholar researchers.

Keywords

Doctoral Research; Environment-Oriented Planning; Wickedness; Networking; Innovative Contamination

Wicked problems and their implications in the environment-oriented planning: finding a compass in young scholars researches

The early decades of the twenty-first century brought to light a series of unique problems in the way the planning disciplines studied and designed the territory. New social conflicts, cutting-edge technologies, climate changes, the crisis of economic paradigms combine to define an unprecedented scenario both from an urban and a social point of view. As sometimes happens, research can predict future crises. An example is a definition given in 1973 by Rittel and Webber about planning problems. The authors of the essay "Dilemmas in a general theory of planning" (Rittel and Webber, 1973, p.160) define that "planning problems are inherently wicked".
From nowadays point of view, the increased awareness of global problems, not only local ones, and the resolution of spatial information can only lead to an agreement with the wickedness definition of territorial-making. Human interactions with the habitat (and with the different issues to it connected) are proactive. Unlike many other species, the approach of homo sapiens is to modify and alter the *status quo* to expand its ecological niche. This optimization of the anthropic space, as well as the interaction with other individuals, the complex functions linked to the construct and social conventions, generate problems. Therefore, the management of these problems requires different strategies with different and uncontrollable performances and side effects. Generally, it is possible to divide the problems into two main paradigms (Kreuter et al., 2004): tame problems, which are the ones for which there are scientifically based protocols that guide the choice of

solution(s), and wicked problems, whose solution(s) is (are) based on 'judgments' of multiple stakeholders. Wicked problems are the ones usually managed by urban planners. The planner figure is that person who seeks, through a discipline, to develop strategies to manage a vast set of issues linked to spatial and interactive life. The definition of this figure is generally referred to as the wideness of the territory-making processes. In a tame problem the definition of the problem itself unveils part of the solution, the causes of a problem can be determined by experts using scientific data and the task is completed when the problem is solved. By opposite, a wicked problem has different characteristics. For instance, it cannot be definitively formulated, it has no 'stopping rule' and it is not always unique (and so is its solution). A solution to a wicked problem is not 'true-or-false' but tends to be 'good-or-bad'. Besides, a wicked problem can be considered as a symptom of another problem, and this typology of problems cannot be solved, at best it can be only re-solved – over and over again. An example of a wicked problem can be represented by climate change management (Musco, 2016). In this case, the global warming phenomenon can be interpreted in its causes and solutions as a social, cultural, economic, environmental, urban, and political problem (Levin et al., 2012), that embeds a wicked problem since it is illusory or difficult to pin down and influenced by a constellation of complex social and political factors, evolving during the different phases of problem treating. Reflections on how to manage contemporary complexity have questioned modern epistemology. An example is a post-normal science highlighting how facing complex problems with high levels of uncertainty leads to the wavering of confidence in the integrity of science and its ability to respond

adequately to modernity challenges (Funtowicz and Ravetz, 1990). For this reason, post-normal science aspires not to ascertain a truth due to its uncertain nature but to gather as much information as possible to make wise decisions that take into account all legitimate perspectives, produce consensus, and be inspired by the principle of precaution. This epistemological trend wishes for an extended peer community, justifying the theme of participation in decision-making processes and in the co-production of knowledge at the basis of the "open science movement" (Elliot, 2019; Levin et al., 2016) and of the citizen science practices (Irwin, 1995; Bonney et al., 2009; Cavalier and Kennedy, 2016).

What emerges is a question: how is it possible to manage wicked problems within the discipline of urban planning both considering present and future challenges?

Notwithstanding the disciplines linked to planning seek to find both complex and punctual solutions to the increasing socio-environmental problems, however, the current scenarios require the implementation of trans-disciplinary research and actions, that are hindered by - among other factors- the isolation and the lack of contamination between Academies and between the Academia and territories.

The absence of spaces of horizontal discussion and peer learning moments has a negative effect, in particular on young researchers that are starting to explore their research path and who would benefit from further, deeper debates. Despite at international levels such niches of development of critical thinking exist (for instance, see the Young Academic Network),, they don't within the Italian context, with few exceptions, such as a previous experience called *Rete Nazionale Interdottorato in Urbanistica e Pianificazione Territoriale e Ambiental*e, already stopped, and

some workshops and seminars, still providing mostly unidirectional teaching. It was during one of these few training activities that the authors have met and felt the call for filling such gaps by also carrying out a common reflection.

The present essay enshrines the first results of such confrontations. It attempts to scrutinize and enhance synergy among five ongoing Italian doctoral research to demonstrate how a syncretic approach in addressing real wicked planning problems can have innovative implications on research practices and environment-oriented planning. Formal and informal meetings have allowed the authors to systematize their research questions, objectives, and methodologies into PhD Research Diaries presented in the next section, and to recognize a *fil rouge* among their research themes developed during the XXXIV Italian PhD Cycle (2018-2021).

Generally, the contributions extracted relate to climate change impacts and the urban environment, considering the strategies for mitigation and adaptation (I. Diary Extract), the complexity and uncertainty issues including disaster risk management and assessment (II. Diary Extract), sustainable management of urban and energy resources and stocks (V. Diary Extract), decision making, knowledge interaction & public participation in environmental modelling, planning and governance (III. & IV. Diary Extracts).

The subsequent section highlights the existing interconnections between research questions, objectives and methodologies and assesses and their implications for research practice in environment-oriented planning.

In conclusion, how to possibly trace and read a mutual learning approach in the authors' experience is the

question to which the authors try to answer. The next sections offer a systematic presentation and an integrated reading of these topics to recognize common issues and to have mutual input by addressing research questions from new perspectives.

Diary Extract of research experiences

The authors first met at the YoungerSIU 2019 (Italian Society of Urban Planners) workshop for young scholars in Ruvo di Puglia. During this initiative, they were called to face the planning of inner areas affected by environmental issues. Here they discovered commonalities between their research fields and started discussing the various ways to deal with issues and their planning, such as disaster management, climate change, resource wastefulness, anthropic footprint, and socio-economic spatial injustice (Figure 1).

Beyond the different backgrounds and academic stances, the authors tried to trace a common interpretation of their work aimed at finding collaboration opportunities and scientific growth. An extract of each research is reported in the following tables, presenting the same elements to achieve a multilevel comparison.

Each Diary Extract (DE) is a partial illustration of the main features of each PhD, that are: the title of the research, research question(s), keywords, the wickedness of the topic, objectives, methodology, limitations, ambition, and main references. All the authors are currently in the process of completing doctoral research; as such their research projects are ongoing.

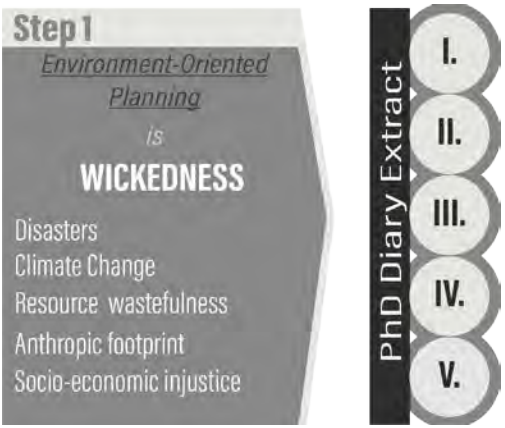

Figure 1 - Five PhD Diary Extracts to deal with the wicked problems of the environment. Source: authors' elaboration.

I. Diary Extract: Towards a Landscape Climate Adaptation Approach for Mediterranean Coastal Areas. Integrating strategies Land-Sea Contexts.
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Research Question(s): Can landscape planning be the approach to finalize the integration between climate resilience principles and the territorial regulation framework? Can this approach be the core of the effective and systematic implementation of adaptation strategies in complex areas such as the Mediterranean basin?
Keywords: Mediterranean basin, climate change adaptation, territorial planning, coastal management

The wickedness of the topic:
The Mediterranean Basin is characterized by a strong connection between the maritime space, water, and coastal settlements. These characters forged its history and are the base of the future of the region. Med coasts are facing huge environmental and social challenges, due to the scarcity of water, unsustainable agricultural practices, over-exploitation of natural resources and the rapid increase of climate change impacts on urban areas and the environment (Maragno et al., 2020). Understanding the present and the future complexity of this interconnected scenario is the key element to undertake strategies and actions. The representation of Land-Sea Interactions over Med coastal areas highlighted the wickedness of a holistic planning approach.

Objectives:
The research aims to prove that the integration between Landscape Planning and Coastal Zone Management can generate an effective tool for the implementation of the principles of climate adaptation in territorial governance. The goal is to develop the concept of Land Sea Landscapes Transect (LSLT) through the comparative study of Mediterranean coastal areas from a climatic, landscape and management point of view. The LSLT can be a territorial unit which can merge coastal and the sea-space needs and strategies, supporting transboundary Landscape Planning (Abbunasr et al., 2018). The assessment phase strengthens the research ambition to overcome the limits imposed by the cultural, economic, and geographical features and to produce a shared tool for the Med area.

Methodology:
The methodology is based on two investigation axes: the study of the main Landscape and Maritime planning tools for the Mediterranean basin, the study of local climate impacts exposures and the adaptive capacity of a case study set. Therefore, the integrated description of the main territorial dynamics advances through the study of the physical and administrative characteristics of each specific area. The comparative analysis of these results is a process aimed at supporting specific guidelines which can define the process replicability. The guidelines aim at presenting an open Landscape planning approach which understands present

territorial pressures and considers the climate exposure of strategic elements.

Limitations:
One limiting factor for the implementation of the integrated Landscape planning approach is the fragmentation of existing databases and information sources. The territorial knowledge framework is generally divided into different information repositories, which sometimes are not publicly accessible, and may cause a fragmented interpretation of the real territorial condition. Another crucial element which limits the implementation effectiveness of this possible approach is the public body's lack of determination. Different international bodies promoted initiatives aimed at a better and sustainable future in recent decades, nonetheless, these initiatives failed against the unwillingness of public decision-makers and the lack of interest in private stakeholders. Adaptation and mitigation planning or sustainable development principles still have not become mandatory in territorial planning. Existing Landscape Planning tools have characteristics capable of triggering a retrofit in territorial governance tools and can play a central role to overcome their limits. The research may encounter a lack of collaboration from public bodies. Nevertheless, local authority support is necessary to fully understand the technical organization of existing planning tools and to develop an effective guideline.

Ambitions:
The research seeks to develop a model capable of overcoming the differences among the cultures, territorial morphologies, religions, and planning approaches with the purpose of a sustainable Med coastal growth. Basing on the acceptance of the emancipatory catastrophism concept, the goal of the thesis is to define a Mediterranean knowledge and planning integration approaches to cope with future challenges. Reading territories and adapting landscapes constitutes a holistic approach to effectively transform regional governance. The ambition is to implement this concept in local planning tools through a transboundary interpretation of Land Sea Landscapes Transects. One first test could be the integration between Climate Adaptation Planning and Maritime Spatial Planning in Land-Sea Interaction contexts, retrofitting

regional governance frames. The combination aims at giving support to local authorities in managing wicked and overlapping issues, providing a single interpretative and strategic approach. The interpretation of the territory seeks that natural bond between the coastal habitat and water in its broadest sense. Land-Sea Landscape is the centre of this interpretation and has the aim of regenerating Mediterranean planning approaches and sustainable growth. The water cycle, the influence that the climate has on urban systems and the bio-regions, the perception and desires of landscape inhabitants compose the same knowledge framework to produce a shared approach for the basin of the Mediterranean.

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- Pietrapertosa et al. (2019)

II. Diary Extract: Environmental Risks and Metropolitan Areas: Smart Approaches and Tools for Enhancing Urban Resilience

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XXXIV PhD Cycle

Research Question(s):
Can risk-knowledge be more effective? Is it possible to better support risk-informed spatial planning by updating, shearing, giving a spatial dimension and integrating knowledge-risk frameworks? Can this lead to an open and evolving learning process?

Keywords: vulnerability, multi-risk assessment, disaster risk knowledge, resilience

The wickedness of the topic

The growing vulnerability of urban areas to hazardous events is due to numerous factors: the unpredictability of some flash climate-related events, the complex dynamics of urban growth and the ineffectiveness of the urban policies in providing adequate responses to the need of reducing risks. The issue of urban vulnerability to disasters has gained over the years a growing relevance in the planning debate, also thanks to the evolution of the sustainability paradigm and to the increasing relevance of the concept of resilience in guiding urban dynamics (Cutter et al., 2008; Alexander, 2013). Despite numerous advances in risk knowledge, disaster losses continue to grow even more (White 2001). The complex chain between natural hazards and urban growth configures one of the main wickedness of our time. The main international documents in the field of Sustainable development and Disaster Risk Reduction (2030 Agenda, Sendai Framework for DRR 2015-2030, 2015 Paris Agreement on Climate Change) and scientific literature emphasize the relevance of learning capacity of urban systems, intended as a constantly evolving process aimed to combine experience and knowledge for facing current multiple risks.

Objectives:

The research aims at developing an integrated frame capable of providing effective knowledge of the numerous and sometimes interrelated risks threatening urban areas, constantly updatable, open to different stakeholders and specifically tailored to the needs of planning processes at the metropolitan scale.

Methodology:

The methodological path starts from the systematization of the methodologies proposed by several European projects that have addressed over the years the aspects of the vulnerability of urban systems and the complexity of disaster risk chains. This allows the building of the knowledge-frame step by step: from the systematization and spatialization of the available data to the identification of the interactions among hazards and vulnerabilities

and the development of spatial-based multi-risk knowledge; the definition of multi-layers accessibility to facilitate shares and updates of the knowledge-base.

Limitations:
Despite the already complex challenge related to sudden-onset hazards and the complex interrelations among multiple hazards and vulnerabilities, comprehensive knowledge of risks also includes slow-onset hazards, such as human footprints on the environment as well as many long-term effects of climate change.

Ambitions:
The guiding principles for strengthening disaster risk management, starting from a better knowledge of existing and emerging risks, can be summarized as follows: a) from sectoral to cross-sectoral knowledge; b) from technical approaches to participatory processes, c) from "static" to "dynamic" knowledge, supporting a continuous learning process.
Cross-sectoral knowledge (a) allows overcoming the still prevailing assessment of risks in a sectoral way in favour of a comprehensive multi-risk assessment, capable of taking into account both the mutual influences among different hazard factors and the potential interactions between hazards and exposed vulnerable assets.
Evolving learning processes (b,c) allow increasing knowledge and perception of all risks, provide a framework for disaster risk management by combining communities experience and technical knowledge, by integrating the memory of past events and updating information on risk features; by outlining the likely risk scenarios.

Main References

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III. Diary Extract: Toward a Street-Small-Slow approach to research on risk landscapes. Diffused knowledge, toxic autobiographies and small data from a Sicilian petrochemical town

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XXXIV Ph.D. Cycle

Research Questions:
Assuming that ours is a transition era, which can be the role of urban planning in supporting inclusive transitions towards environmental justice in urban contexts? In addition to the quantitative approaches, which methodologies can fit with current issues, such as the impacts of climate change and of contamination? In risk landscapes due to the slow contamination can an insatiable high-tech growth ideology be enough? Or maybe planners could propose a slower, smaller, and more community-based planning?

Keywords:
Environmental injustice, storytelling, risk landscapes, contamination, citizen science.

The wickedness of the topic:
Since 1992 Ulrich Beck defined our society as a risk society in which no-one is exempted from the risk provoked by itself. Given that the possibility to avoid risk depends largely on socioeconomic status, dealing with risk means dealing with socio-economic injustices. In this respect, various fields of knowledge, e.g. the political ecology and the environmental justice studies (Agyeman, 2005; Pellow, 2007), have already widely scrutinized the link between health hazards-environment-socioeconomic disparities and its effects on the right to the city of powerless communities). In the meanwhile, many community movements are struggling for a city with more justice: they represent those "sub-political actors" (Beck, 1992) with the potential to challenge the agents that generate risks. While the civic society reacted and organized itself, during the years official documents (WHO, 2010, 2017; Sendai

Framework, 2015;) have wished for a multidimensional approach to the risk assessment that is inseparable from the enhancement of democratic processes and the involvement of citizens in paths of public participation (Aarhus Convention, 1998) and co-production of knowledge. Despite the rich aforesaid debate, both the mainstream planning and the Italian law on industrial risk mainly miss all these nuances and adopt quantitative approaches to the risk landscapes based on high-tech innovation and big data. Many current challenges are concentrated in industrialized areas: from the human footprint on the environment to the job blackmail, from the public health issues to the lack of democratic governance. The deterministic approach -for which from a cause there is a consequent and linear effect- does not work with the contaminated landscapes. While understanding the causes is already a very complex issue, to define which exactly are the effects into human and not human components coming from the causes is something almost impossible. Uncertainties are a limit and weakness, as well as a strength if they are already included from the beginning of the comprehension path. Another wickedness aspect regards the role of both public institutions and local communities and the tension between them. Since landscapes are the fruit of the long-term interaction between humans and the environment, to talk about the physical aspects of landscapes means talking about the socio-economic and human ones underlying the landscapes. This adds a further variable of complexity in treating the topic of planning of risk landscapes.

Objectives:
With my research, I aspire to propose a Street-Small-Slow planning approach to the risk landscapes in the "extreme case" of Gela, a Sicilian town converted by a multinational oil company into one of the main Italian petrochemical poles in the '60s. Nowadays, Gela is a shrinking city having a contaminated ecosystem and one of the highest rates of sickness and unemployment in Italy. By applying such approach, I seek to show the value of a slow, street and slow way to plan places

Methodology:
The Street-Small-Slow planning approach is "street" because it occurs in the fieldwork with people living in it; "small" because it

pays attention to the small, qualitative, partial and relational aspects of landscapes; "slow" because needs time (Stengers, 2018). Therefore, my research aims to frame theoretically and apply practically an "undisciplined" approach consisting of street science (Corburn, 2005), active listening and toxic autobiographies (Armiero et al., 2019) as relational tools that catch qualitative "small data" and map resistant and resilient practices and collective capabilities.

Limitations:
By having comparisons with other young scholars' research, some drawbacks have emerged. For instance, a street-small-slow approach needs much more time than the one provided by a Ph.D. path, consequently the results of such research will likewise be partial and less deep than I wished for. Besides, this work would benefit from a joint team having planners who use big data and other professional figures, whereas so far it has been done without any kind of comparison.

Ambitions:
This research has multi-layers ambition. First, it seeks to get into the theoretical debate by giving relevance and dignity to small data from both an epistemological and methodological point of view. Also, it has the ambition to affect the Italian law and practices regarding the planning of risk landscapes, Finally, it will attempt to support processes of community awareness and empowerment by giving voice to the unheard voices.

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IV. Diary Extract: Towards cyclical and regenerative planning: Methodologies and Decision Support Systems to regenerate abandoned landscapes

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XXXIV PhD Cycle

Research Question(s):
How can the geodesign approach make spatial planning processes regenerative, circular and participatory at the same time?

Keywords: geodesign, abandoned landscape, the impact on ecosystem services, circular economy

The wickedness of the topic
The phenomena of consumption and soil degradation continue to increase over the years, despite scientific, legislative and media attention. This uncontrolled phenomenon, with the passing of the years, has generated a new landscape, made up of interstices, middle territories, free strips along the main connecting arteries, areas waiting for development illegally built, spaces more and more fragmented and marginalized (Berger, 2007). A new urban fabric is born, made of voids between solids, where the contrast between natural areas, urban lots and infrastructures generates a mixture of areas that have taken on their own identity, generating new landscapes.
Among these landscapes, those resulting from the voids produced close to the infrastructure and left unused are united by the fact that they physically belong to the city but have been expelled from it for the end of their life cycle, for the incompatibility of their use with urban reality or the loss of their environmental and economic value. They represent a real rejection for society.
Talking about cyclical and more sustainable cities, these abandoned landscapes of infrastructure can be the cog in the wheel to trigger participatory processes of urban regeneration using innovative Decision Support System to think about the territories of the future.

Objectives:

The research aims to analyse the areas close to infrastructure, which can be interpreted in many cases as waste landscapes, to identify preferable regeneration scenarios, assessing the different types of impacts that such scenarios can have on the environment in general and on the loss of essential ecosystem services. The interaction between the Geodesign (Flaxman, 2010; Steinitz, 2010, 2012; Vargas- Moreno, 2010; Goodchild, 2010; Miller, 2012) approach and the spatial multi-criteria analysis represents the proposal to be tested to structure a decision support system that allows improving the system of relations between knowledge, evaluation and project, in coherence with Agenda 21 (chapters 31 and 40).

Methodology:

The evaluation of the benefits offered by this potential capital, through the identification of the ecosystems and services they produce in a regeneration phase, is one of the great challenges for scientific communities. Cities to meet sustainability requirements need cyclical planning processes, able to promote collaborative practices among all stakeholders, public, private, and social. These processes should be able to combine multidisciplinary knowledge, in which the assessment of impacts and effects of transformation is based on a methodological process in which different knowledge and skills and new technologies converge. The complexity of urban systems requires the activation of a constant dialogue between the different stakeholders involved in the transformations, integrating multidimensional approaches and plural points of view. In this perspective, decision support systems represent a useful tool to guide the construction of choices and compare possible transformation scenarios, intending to identify preferable and sustainable alternatives (Huang et al, 2019).

The attention to the different decision support systems that can support planning processes highlights the flexibility and adaptability of tools to the specificities of the decision-making context. Among the different approaches analyzed in literature and tested in numerous practices, Geodesign is one of the methodological references used in this research, able to support planning and evaluation processes for more sustainable cities (Campagna, 2014; Campagna and Di Cesare, 2016). This approach integrates different knowledge using the tools of Geographic

Information Systems and social interaction techniques (Goodchild, 2010).

Limitations:
An open approach to comparison with other research in similar fields allowed to define some potentialities and criticalities. One of the limits is the impossibility to have an open database to analyze large territorial contexts. This could be overcome by integrating big data with small data. Analyzing the territory in its complexity means looking at it in different perspectives and therefore not only considering the impacts that can be determined on ecosystem services, but also what consequences they determine: climate change, environmental risks, and vulnerabilities. Moreover, talking about circular cities, it is also necessary to define its metabolism. The active comparison allows defining some considerations that normally cannot be reached.

Ambitions:
The biggest challenge is to define a methodological framework that looks at landscape planning from the perspective of circularity, in order not only to reduce the impacts on the environmental, social, economic system but also on the production of material and immaterial waste generated by uncontrolled and bad planning processes. This is an ambition that finds innovation in the tools used to practice urban regeneration that put in place different knowledge and techniques. Innovation can be found in the interaction between evaluation Decision Support Systems within the Geographic Information System.

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V. Diary Extract: toward eco-innovative urban regeneration practices. From construction and demolition waste to resources for the regenerative city design.

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XXXIV PhD Cycle

Research Question(s):
How urban metabolism approaches may innovate the process of urban regeneration, and how does the goal of reducing construction and demolition waste flows influence the project?

Keywords: urban metabolism, regenerative city, circular economy, construction and demolition waste

The wickedness of the topic
Cities are the main global cause for the consumption of resources and the production of waste: while covering only 3% of the earth's surface they consume 75% of natural resources (UN, 2019) that, due to the "take-make-dispose" linear economic and production system, soon run out of life and becomes waste. 50% of them is produced in cities (UN, 2015) that are called to face European policies identifying the transition to a circular economy model as the main strategy to achieve the objectives of limiting landfills by 2035 (only 10% of waste) moving towards sustainability goals (EU Directive 2018/850). EU's circularity objectives led to new production and business models of consumer goods and buildings but the transition to a circular city model cannot, however, go through the technological and sectoral innovation in products/buildings in the city as this is a complex and wicked problem that includes environmental, social, economic and also spatial issues and thus requires a multidisciplinary and systemic approach (Jackson *et al.*, 2014).

Objectives:
The aim is the design of eco-innovative solutions (Carrillo-Hermosilla *et al.*, 2009) able to transform this circular approach into a design principle for the city and landscape and to influence

technical/process innovations for planning urban and territorial regeneration (Russo *et al.*, 2018). The research focuses on Construction and demolition waste (CDW) as they are almost a third of the waste produced globally and are connected to the results of urban regeneration processes.

Methodology:
The research activity is structured through the methodology of "Research Living Labs" which conceives the research path as a "Living Lab" where the experts involved (UNINA, RINA Consulting, TU Delft) collaborate and cooperate in a co-design process of innovative solutions in a real context. "Realism is one of the principles that clearly distinguishes Living Labs from other types of open co-creation environments" (Bergvall-Kåreborn and Ståhlbröst, 2009) and is the condition for obtaining valid and transferable results to real situations, according to with the objectives of the industrial PhD Innovative solutions will be tested in a case study located in the Metropolitan Area of Naples.

Limitations:
In terms of theoretical and methodological frame, the concept of urban metabolism underlines the technical-technological aspect of the functioning of cities without managing to include, especially during the time of doctoral research, the social and value aspects of territories. In the same way, the concept of circular - city - and economy describes the economic benefits of circularity, which however also concerns fundamental issues such as the life of different communities and their work. In the specific theme of the CDW, the inertia of the legislative context as well as its fragmentation in Europe, undermine the practicability and replicability of eco-innovative solutions. Currently, for example in Italy, CDW has not yet reached the end-of-Waste status (Silvestre et al., 2014) which would allow for simpler reuse and therefore the growth of the sector market.

Ambitions:
Applying the concept of circularity to cities and territories means, furthermore, asserting the need to overcome the concept of

sustainable development (Thomson & Newman, 2018), which aims to reduce environmental impacts of cities, to build a reparative relationship towards the ecosystems on which they depend, a regenerative approach able to positively affect the ecosystem (Girardet, 2014) and to drive space construction processes in order to generate not waste but resources to contribute to the regeneration of urban metabolism.

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- Crowther P. (2005)
- Secchi B. (2006)
- Mc Gregor D., Simon D., Thompson D. (2006)
- Kennedy C., Pincetl S., Bunje P. (2011)
- Girardet H. (2014)
- Russo M. et al. (2018)

Weaving meaningful links through a proactive research comparison

To design the connection between Ph.Ds researches on different levels, the path follows three main steps:
Step 1, identifying the wicked dimension of environment-oriented planning (Figure 1);
Step 2, tracing research questions to address wicked problems (top of Figure 2);
Step 3, comparing the identified wicked problems through methods and objectives (bottom of Figure 2);
Step 4, discussing the adopted approach and new research-network perspectives.
Starting from the definition of wicked problems and the relationship with environment-oriented planning (first section), this paper has used the DEs to stress on the possible multilevel interpretation of contemporary cities

and societies and the need for more open planning approaches.
Each DE (second section) illustrates the deployed methodologies and seeks objectives aiming at composing a sample of an Italian kaleidoscopic view of young planners' approaches and visions.
By digging into the key-features of each research, two considerations emerge:
1) the complexity and wickedness referred to the contents and topics of the five pieces of research unveil the multiple existing links between them;
2) the debate behind this experience reveals the limits of the single approaches and allows the authors to rethink their way of researching young scholars.
Even if the research design might lead to the conclusion of an obvious overlapping of interests, however, it is hard to trigger proactive cooperation among distinct academic perspectives.
Figure 2 provides an interpretative tool and compass to interconnect viewpoints, confirming the need for a holistic approach to environment-oriented planning.
More in detail, Figure 2 explains how tracing the research questions to address wicked problems has led the authors to recognize common features and interpretative criticalities, as well as the opportunity for contamination between researches. Also, the bottom part of the picture tells that methods and objectives can be enmeshed and compared with each other. For instance, the authors have found potential interactions between quantitative methods and qualitative ones, theories and practices, high-tech and digital tools and street and 'personal' ones. The various nature of the identified wicked problems (Figure 2) gradually blurs the boundaries of all research allowing authors to intertwine topics, problems, theoretical

approaches, and methodological processes. The research keywords which at the beginning of the discussion belonged to the individual researchers, becomes the base for deconstructing and reinterpreting all contents and methods.

More in detail, the meaningful links between each keyword referred to the **methods** are the following:

a) the prominence of climate change in transforming disaster risks in different ways (Glasser 2020) requires complex analysis models, such as multi-hazard and multi-risk assessment models. They may need integrated approaches and practices toward learning processes involving multiple actors (technicians, politicians, stakeholders, and civil society);

b) co-production of knowledge needs fieldwork and active listening by researchers and planners. It can be pursued by counterbalancing the big data use challenge with complementary tools such as toxic autobiographies and small data;

c) regeneration practices to face current urban challenges transform environmental fragilities of growing urbanization (e.g. contaminated sites, abandoned areas and waste) into opportunities and resources. They should require innovative tools (e.g. Geodesign) and approaches (e.g. urban metabolism) to maximize the effectiveness of processes and to seize the opportunities given by multiple drivers (social, economic, climatic, etc.);

d) the awareness of dealing with complex territorial dynamics through multi-level governance models can lead to finding a way to implement this systemic integration within the current regulation frame of cities, territories, and landscapes also from a legislative point of view.

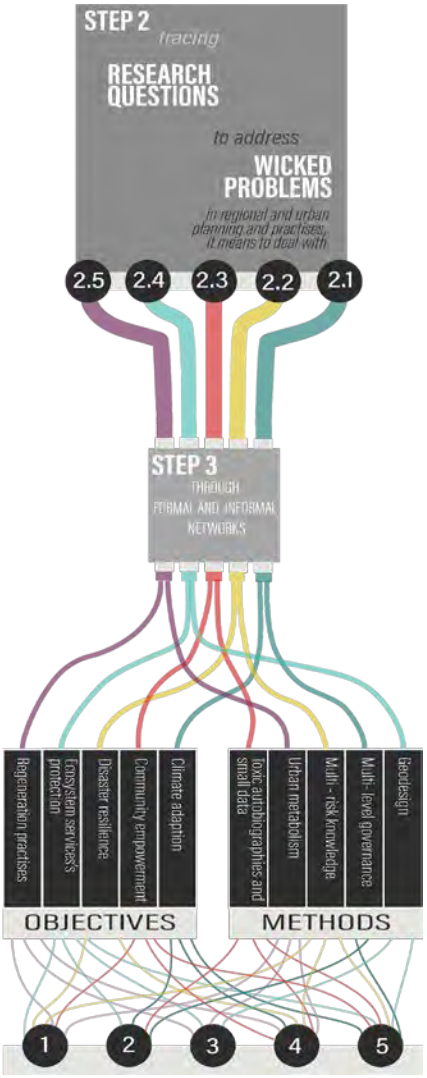

Figure 2 - Overcoming research limits through contaminations between objectives and methods of the 5 pieces of research. Source: authors' elaboration.

In terms of **objectives**, considering that each research is addressed to better understand different aspects of the wicked problem of environment-oriented planning, each research contributes to pursuing the others:
a) **climate adaptation** measures are frequently integrated with urban **regeneration practices** and contribute to strengthening ecosystem service in counterbalancing anthropic footprints;
b) increasing **disaster resilience** means also implementing effective mitigation and adaptation activities possibly included in urban plans and policies, and enhancing **community empowerment** to strengthen their learning and coping capacities;
c) **regeneration practices** can positively act on for the **ecosystem services' protection** by driving a transition towards new transformation models of cities.
The collaboration between authors and the attempt of merging each diary goal highlighted the different aspects of the wicked problem of environment-oriented planning and allowed to recognize the limit of sectoral approaches supporting territorial governance and planning. Therefore a holistic and conscious awareness can be the common ground on which researches can base exchange of energy and contribute to a proper sheared growth of the scientific community. As a result, is it possible to recognize a kind of process innovation also in the ways of doing research? Can this contamination experiment be useful for the authors as well as for young scholars in urban and territorial practices?
It is worth noting how wicked problems have pushed our research to a multi-scalar and multidisciplinary confrontation approach to face problems that have relations with social-economics and environmental disciplines. For sure, each research follows a different

research methodology and after this proactive comparison, the opportunity of approaching them from an enriched perspective emerged.
As the opportunity for this study arises from the involvement of authors in urban studies training activities and workshops tailored to doctoral students, and from an ensued two-year informal exchange of ideas and perspectives, these positive experiences represent the starting point for the construction of a research process - and network - able to overcome its nature of impromptu event and to orient, from the first steps, the increasingly heterogeneous doctoral paths. Through this experience, the authors recognize five key-attributes to build a common dialogue and to better cope with their researches addressing as urban and territorial issues. The attributes are (Figure 3):

- Open
- Collaborative
- Meta-disciplinary
- Stable
- Evolving

Opening the boundaries of on-going research towards new challenges allows young academics to better understand the context in which they are framed, recognizing both new connections and potential limitations of the adopted approach, as well as set objectives. **Collaborative** research helps in enriching different backgrounds and knowledge bases, as well as technical and technological skills. In this way, the innovative approach is **meta-disciplinary** not only multidisciplinary - defining an inclusive debate capable of

involving various perspectives of that same subject, whose need emerged in the previous chapters. To contaminate and fruitfully effect on research paths, this collaboration - and process - can only be lasting and **stable** in the research pathways among young academics and that it is a constantly **evolving** path leading to the formation of always innovative contributions to solve wicked problems, rather than an individual attempt to deal with complex problems.

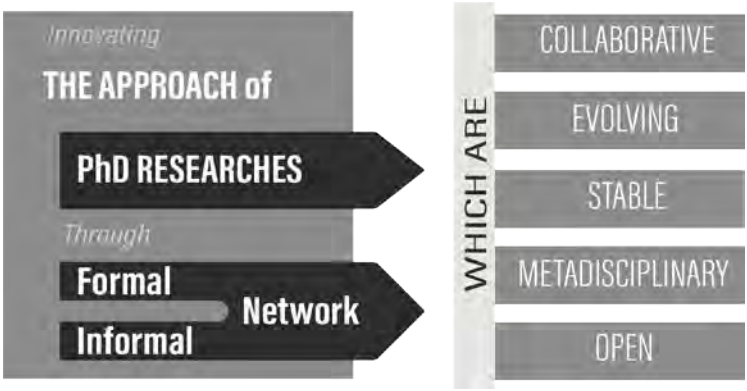

Figure 3 - Five keywords to define an innovative approach to PhD urban research. Source: authors' elaboration.

Conclusive remarks

By stemming from the definition of planning problems as inherently wicked, the authors have then tried to go through the wicked problems within the discipline of urban planning by adopting their ongoing PhD researches as emblematic cases of study. Considering that planning is even more wicked due to the lack of contamination and

exchange between the several schools and currents of thoughts, this essay seeks to provide a contribution in this sense bridging the existing dialogical gaps. The advances of this essay consist precisely in proposing an increase and implementation of occasions and spaces of peer discussion among young scholars within the Italian planning academia. Through the comparison of the five PhD pieces of research in urban planning, many issues emerged. The wickedness of environment-oriented planning, as a whole, comes from criticalities and challenges: the key challenge of climate change (I. DE) and the role assumed by planning processes in increasing the effectiveness of adaptation measures; the assessment of vulnerability in urban systems threatened by the impacts of multiple hazards to drive planning processes in already compromised systems (II. DE); the need for exploring the complex, polysemic, and conflictual links between natural and human factors, by adopting more innovative tools - such as toxic autobiographies, small data (III. DE), and Decision Support Systems (IV. DE) - and approaches - such as urban metabolism (V. DE). The informal comparison held within the present article redaction and the formal attempt of reporting its output, lead authors to a set of general considerations approaching researches which have the aim of assessing the wicked problem of territorial planning.

What limits an effective democratic and widespread advancement of local knowledge, as it emerged within DEs comparative assessment, is the lack of theoretical synergies between the different souls of the same research field. Therefore this cannot lead to a possible simplification of wicked territorial problems. A possible solution could be, for instance, a holistic approach in developing a sheared background for research which

assesses and copes with territories, in particular, considering the Italian context.
Based on the awareness of the wicked concept, the authors tried to provide an innovative approach to cope with this kind of problem and to give a methodological contribution to the research on territorial governance through their PhD paths. Despite annual meetings and congresses are structural opportunities to share experiences, researches, and approaches on the wickedness of planning problems, further interaction among young scholars is necessary. Nevertheless, this is a silent work that always lays beyond more evident and sponsored academic activities.
By grounding in this experience of a collective and collaborative research journey, we believe that despite planning is a wicked problem, employing the creation of space of peer discussion and mutual learning for young scholars, planning may become, perhaps, at least a bit less wicked.

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New challenges for hydrogeological risk, among established and emerging paths. The case of 'Timpa di Acireale'

Venera Pavone [*]

Abstract

Hydrogeological risk is one of the major challenges that a community must face to be resilient to water-related disasters. Italy is highly vulnerable to hydrogeological risk and for this reason the issue has assumed ever greater importance in planning and has involved the need for implementing measures to make the territory safer. Generally, planning tools and action for adapting to hydrogeological risk are based on technical paradigm, that seems to be insufficient and inadequate. The era of Anthropocene, the sudden changes taking place and their unpredictability put us in the conditions to plan in ever-increasing uncertainty. This has led more and more scholars to talk about resilience as a new 'strategy' to redefine the ways of adaptation. In this paper I intend to reflect on the traditional approach to risk management and the new challenges, starting from the need to strengthen the relationship between technical-scientific knowledge and common knowledge for a real integration of resilience approach in local governance practices. The case reflects on the initial work led by a local environmental organisation, in a natural protected area La Timpa di Acireale (Sicily), in

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which different actors are implementing different approaches to face the problem.

Keywords

Hydrogeological risk, Resilience, Participation, Collective learning, Protected Area

Introduction

Hydrogeological risk is one of the most complex challenges that communities have to face in the time of the Anthropocene. The level of gravity of a flood is affected by many factors: quantity of precipitated water, land use, geomorphological characteristics of the watershed. The occurrence of a disastrous flood is also characterized by anthropogenic factors: the ability of the population to be prepared and the ability to build a path that can prevent the occurrence of social, environmental and economic damages (Rossi and Benedini, 2020). Italy is a country highly vulnerable to hydrogeological risk and in recent decades we have seen the increase in frequency and intensity of events proved disastrous. For this reason, the issue of flood risk management has become increasingly important in planning and has led to the need to take measures for a safer territory. The planning approach to hydrogeological risk is still mainly based on a linear relationship of knowledge and action, which is expressed through measures, forecasts, zoning, the requirements and identification of actions necessary to increase the factors for securing the territory. So, today, the reduction of hydrogeological risk is mainly in two directions, either in the implementation of an

existing defence system or with the construction of new one (Vitale et al., 2020).

There is an attempt in some fields of the social sciences to build a counterpart to this approach. Research in this area has focused mainly on the perception of risk, developing through two main independent directions. The first one is oriented to the deepening of the elements of descriptive nature and to the analysis of the social behaviour in front of the occurrence of natural risks. The second one focuses on understanding how communities perceive technological advancement to reduce the risk rate (Saitta, 2009).

However, these approaches have not explored a topic of practice relevance, which looks at how to integrate these forms of knowledge with technical-scientific ones.

To look at literature, therefore, it is evident that the goal of some approaches in social sciences was to typify and classify individuals and their behaviours. On the other hand, hard sciences are limited to transforming the reality into mathematical variables, in an attempt to develop increasingly complex models capable of making predictions useful for designing safety measures and infrastructures. In both cases we see a simplification of reality in which the sentimental and experiential components of the value system are not taken into account together with purely technical factors.

This paper aims to reflect on the need to strengthen the relationship between technical-scientific knowledge and common knowledge for a real integration of resilient action in local planning practices. The paper presents some preliminary results of an ongoing research carried out on the case of La Timpa, in Acireale (Sicily), in which researchers from the fields of environmental planning and hydrology are working closely with non-profit associations, community, schools, adopting a transdisciplinary and action-research approach (Saija, 2017). The objective is to identify specific

community learning strategies for building resilience to hydrogeological risk.

The current planning tools for risk mitigation in Italy

In planning, the traditional tools used to manage hydrogeological risk are tied to ways of thinking typical of hard sciences and the concerning unidirectional nature of knowledge production that exists between the "expert" and the "plan".
In planning this means that the action and choices of planners or designers are based on the expert knowledge that they are able to produce, it is the result of a rational intuition able to translate stable and universal values in the form of utopia or model (rationalism) or the result of rigorous analyses and codified procedures capable of indicating what the necessary conditions are for a given pre-constituted objective to be achieved. This paradigm can also be found in the main planning tools that has been produced in recent decades in Italy.
The frequent combination of floods and landslides has led to develop a normative and planning apparatus that looked at the defence of the soil in a comprehensive way and Law 183/1989 is its expression. Law 183/89 introduces elements to start a rational, planned and overall management of the water resource. One of the principles on which it is based is to operate on the scale of the river basins, with the aim of overcoming the difficulties of planning the water resource, caused by the fragmentation in territorial areas defined by purely administrative boundaries. In order to plan the management and use of water, Law 183/89 introduces the River Basin Plan tool that is conceived as a tool to collect relevant information and to identify the needed actions for

(1) flood defence and soil conservation, (2) water supply for different uses and (3) pollution control of water bodies (rivers, lakes and aquifers) (Rossi and Benedini, 2020). The Basin Plan, which is binding and over-ordered to other planning tools, contains comprehensive plan, articulated in "structural and mandatory" decisions, with low degrees of flexibility and legitimized by the highly technical-scientific profile of the Basin Authority (Bobbio, 2006). The Basin Plan, in its implementation, has found multiple difficulties due to the wide cognitive activity necessary, the complexity of its approval procedure and facing the difficulties moving among different scales, where often the choices taken at a regional scale collide with emerging interests at a local level. In the specific topic of hydrogeological risk, this stalemate was overcome with the drafting of the Hydrogeological Asset Planning (PAI). The PAI is oriented to the identification and classification of the main hydraulic hazard and risk areas and existing infrastructures and to identify the new ones to reduce risk. The contents are divided into structural measures and non-structural measures (land use rules and behaviour norms).
In short, the Basin Plan and the PAI are, essentially, technocratic plans, designed to prevail over any other plan, inspired by the logic of the hierarchy of interests.
At urban scale, the flooding issue is getting more and more attention, due to the presence in urban context of a high number of people and property exposed to hazard. So, in order to adapt to hydrogeological risk, technological solutions have been developed, consisting in the construction of green or blue infrastructures (BGI), in addition or for replacing the traditional drainage system already existing. Green and blue infrastructures are a way for creating sustainable drainage systems (SuDS) aiming at restoring the water cycle and increasing the levels of

hydraulic invariance through the provision of high infiltration capacity infrastructure, which aim to combine the needs of water disposal with the possibility of increasing green and/or blue surfaces (Dieperink et al., 2018; Moccia and Sgobbo, 2013). All this is part of actions that should be carried out mainly by the hands of the public sector or through building regulation instruments and incentive mechanisms that give to the private individuals the opportunity to act in order to improve the invariance hydraulics in the field of private property. However, even in this case it is possible to see a gap between theory and practice. In Italy, the issue of planning for urban adaptation to flooding risk is not yet a priority for many local administrators (De Gregorio Hurtado et al., 2015; Gobattoni et al., 2017). This seems to confirm what Innes and Booher had claimed back in 1994, that the choices of planning and public policy are based on systems of social cognition of problems that are often distant from scientific knowledge and strongly conditioned by common sense and structures of power (Innes and Booher, 1994). In summary, therefore, we can observe that despite innovations in terms of objectives and tools, the paradigm with which risk is faced today is purely technical, with a strong propensity for structural solutions, in obedience to a vision defined "hydraulic paradigm" (Barbanente and Monno, 2005), that inclines more to the continuous promotion of public infrastructure (Becchi, 1990). In the meantime, victims, damage and, not least, investments (albeit limited) for infrastructures that seem ineffective *per se*, would be avoidable, implementing prevention and planning strategies that do not relate only to traditional planning approaches, but which also look at planning practices that relate to new paradigms, capable of adopting new rationalities and methods (Dyckman, 2019).

A shift of paradigm: Anthropocene and evolutionary resilience

The Anthropocene era (Crutzen, 2002) we live in, in which it is certain that human is no longer separable from nature. The sudden changes taking place and their unpredictability puts us in the conditions to plan in ever-increasing uncertainty. Anthropocene uncertainties and climate change are now endogenous factors of human history that individuals, communities, governments, must deal with when putting down choices of future planning. It is not possible to predict the effects of this status, both in the medium and long term, neither the changes that climate change will determine. The imperative of uncertainty has led more and more scholars to talk about resilience as a new "strategy" to redefine the ways of adaptation. Strategies are intended as a process by which consolidated practices are questioned. The concept of resilience is originally used in the field of physics and engineering to describe a material ability to return to its original characteristics, after an alteration of its balance. The same concept will be then introduced in the field of ecology, in the 70s of the twentieth century by Holling that defines resilience as "Measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (1973, p. 14). The initial scope of Holling's work is very important because he first sets a breaking point between the engineering resilience paradigm, as a condition of balance and stability of components, and the new idea of resilience, influenced by the theory of complexity (Bateson, 1973; Bocchi and Cerruti, 1985), which is no longer linked to a static and unique equilibrium concept of the system, but focuses more on

what is unpredictable and on the study of factors that are contingent and non-deterministic (Davoudi et al., 2012).
A few decades later, the concept of resilience is further expanded and influenced by the theory of complex adaptive systems (Levin, 1998), so the ecological interpretation of resilience takes on additional characteristics, also applied to Socio-Ecological Systems (SES) (Gunderson and Holling, 2001), to describe the relations between human community and non human, biotic/abiotic communities. Holling himself and the Resilience Alliance group define resilience through these three features:
1 - The amount of change that a given system can endure while maintaining the same control
2 - the capacity of the system to increase its ability to learn and adapt to change.
3 - the capacity of the system to self-organize and transform.
In this theoretical framework, the concept of resilience does not imply a return to an initial state but is rather related to the ability of the system not only to receive stress, but also to change and transform, opening up to new opportunities.
Since Holling's work, the concept of resilience has involved multiple disciplines, becoming an increasingly broader and unclear concept. In the literature we find the concept of resilience in many other fields, from social disciplines (Adger, 2000) to economic disciplines (Rose, 2004) and also in planning resilience is now a buzzword (Davoudi 2012). Although its fluidity has facilitated the transition and a growing familiarity with this term (Brand and Jax, 2007), the application of the concept of resilience to planning shows problematic nodes and implications, especially when it comes to environmental issues, in particular issues that have to do with environmental risks and climate change and the adoption of strategies to adapt to them (Pizzo, 2015). There is criticisms about the ambiguity in the use of that concept,

that holds together things that are also very different from each other: in this sense it risks losing meaning and have a mere evocative value, a "empty signifier" (Weichselgartner and Kelman, 2015). This means that when we talk about resilience, it is necessary to contextualise it.

This paper looks at resilience in its evolutionary meaning (Davoudì, 2013). Being resilient, an adaptive process doesn't bring us back to how we were before, but to a change of perspective. A SES, that can be considered resilient, has not only transformed its physical environment to respond to external disturbances. It is a system where activated processes led to an higher level of awareness, with the aim of understanding the reasons and the modalities underlying the desired transformation and, therefore, it is able to develop new strategies of transformation needed in a highly mutable world.

In line with what Adger (2003) wrote, adaptive capacity is the ability of a community to cooperate in order to deploy climate change adaptation actions taking advantage of potential opportunities, thus becoming the path of adaptation in the attempt to use changes and uncertainties as an opportunity to bet on a new desired future framework. This means that the evolutionary approach to adaptation, defined in assonance with the evolutionary resilience of Davoudi (2013), is not a way of being, but the trigger to start transformative actions.

In the specific case of a process in which the objective is to be resilient to hydrogeological risk, we move from the paradigm of protection and security from flood risk to one that, in a complex way, uses the necessity of having a territory safer for triggering transformative actions that can be opportunities also in other fields. In this sense, the attribution of roles, knowledge and responsibilities are fundamental factors in the success of the adaptive capacity

process. To this end, many scholars (Armitage et al, 2008; Pelling, 2010) see in the mechanisms of collective learning a key to start a path of resilience that leads to the maturation of new values, ideas, rules, choices that constitute a new basis for social life.
First of all, we are all embedded in a SES, this means that each one has its own role and no single person can face the deep understanding of system issues, so it is auspicial to get different sources of knowledge that allow to better navigate SES (Shava et al., 2010). For decades it has been assumed that for environmental problems learning produces a linear effect in changing people behaviours and ways of thinking, but it has been suggested that it is not. Namely, a continuous collective learning permits to reflects on political and social aspects of environmental issues and develops a value framework for orienting actions of evolutionary resilience. Continuously-changing features of complex SES need a continuous updating of information and knowledge, with the aim of refining and transforming people behaviours, institution or management practices (Shultz and Lundholm, 2010).

Community learning as a way to building resilience

Learning is one of the topics of planning, a long planning tradition has been based on the idea that planning tools are devices with which people learn new ways of life, guided by the design logic that underlies the production of the plan. This has been manifested in the risk field, through unidirectional information transmission with the aim to ensure that the citizen acquires behaviours capable of making her/him safe in the extreme event or with the aim of building consensus for one technical solution rather than

another. In the case of this paper we look at those forms of learning that consider the process for which the construction of the community value system (Friedman, 1989; Healey 2006) will be placed at the base of questions related to future transformations (Douglas et al., 2018; Saija, 2012). The idea collective learning refers to is not passive learning that arises from having undergone external action, but is an active type of learning capable of triggering a process through which the community learns to recognize and tries to fill the gap that exists between the triggering causes of imbalance alteration and the ability of the system to respond to such alteration.
In literature we found Double Loop Learning (Argyris and Shon, 1978). At a first level, the concept of learning implies the acquisition of knowledge or skills and implies the achievement of two possible different moments:
a) the acquisition of skills or know-how, which implies the ability to perform some action;
b) the acquisition of awareness or know-why, which is inherent in the ability to develop a conceptual understanding of lived experience.
Beyond this first level, second level or autopoietic processes can be initiated, in which the system not only learns to respond to external stresses but is also able to transform, through an autopoietic process of re-organization of the system itself (Maturana and Varela, 1980).
In this light, the learning process is such that all those who are part of it have the opportunity to meet, confront and "learn collectively:
a) what is important/right/good to do to address a given problem (first level learning)
b) learning to learn, or developing the ability to deal with possible future problems (second-level learning or deutero-learning)" (Saija, 2017, p. 46, transl).

A process of collective learning has also the goal of enhancing various perspectives and forms of knowledge and also allows common knowledge to take a cognitive value.
In line with Funtowicz and Ravetz (1993) an approach based on extended peer communities is proposed, in which values are no longer kept out of the analysis or data collection but are made explicit in a mutual respect between the various perspectives and forms of knowledge, which complement each other. Community involvement is a very important factor in risk management for many reasons. When assessing the risk itself, the technical approach looks at numbers, experimental evidence, forecasts that have a value as objective and predictive as possible, and they influence the policy choices for addressing the risk problem. However, as mentioned above, the risk also depends on factors very different from those used to extrapolate the numbers of prevention. The citizens, and in general, the "non-experts" influence their perception of risk with psychological and cultural factors, conditioned overall by direct experiences and asymmetric received information. If scientific analyses describe risk as exact and measurable fact, social sciences suggest that actually the psychological and cultural dimension of risk is strongly influenced by contextual factors (Renn, 1998). Last but not least, the widespread lack of capacity to address environmental issues encourages citizens to rely on experts and institutions for risk management, limiting themselves to the behaviour dictated by alarm systems and to exclude themselves from the problem. As a result, social sciences also show how this attitude of trust also leads to an excessive sense of security and to underestimating the real problems to which one is exposed (Felletti et al., 2017). These factors are too often considered optional, compared to the normal course of hydrogeological risk management strategies (Vitale et al., 2020) Instead, it

should become structuring factors of decision-making processes, rejecting the idea that the planning act is only the prerogative of experts, rather it is the result of a path made by a collective subject.

The case of the Timpa of Acireale

The case presented here refers to the protected natural area Timpa of Acireale, located in Sicily and the initial ideas related to MIPAT project, inevitably slowed down by the global pandemic of COVID-19. The choice to talk about this case is significant because allows to reflect on a tendency by the institutions to intervene for the safety of the territory, even in those portions that have particular natural value, with a predominance tendence on expert knowledge production, finalized to build new infrastructure, without actually looking at the problem in a complex way, both in terms of the extent of the phenomenon, or in terms of process. In contrast, a partnership that brings together universities, the third-sector world and citizens is experimenting a process that looks at risk as a manifestation of a territorial process (Magnaghi, 2012), with the aim of addressing the problem through multifaceted strategies.
The Timpa (Figure 1) is a narrow strip of territory, about 8 km long, that from the sea rises steeply up to about 180 m

Figure 1 - The extention of the Timpa (light and dark green area)

of altitude, formed as a result of Etna volcanic system movement.

From a geomorphological profile the Timpa represents a structure subject to the normal evolutionary dynamics of slope, that include repeated failures and/or more or less localized collapses of stone material, caused mainly by erosion by atmospheric agents and by surface runoff and infiltration water. In the case of the geological escarpment of the Timpa, the close presence of the town of Acireale, together with the dense road network that connects the numerous smaller towns located in the urban area, means that important quantities of rainwater, conveyed along these widespread waterproof surfaces, reach the edge of the Timpa from which they fall in a disorderly manner. In this context, the lack of an efficient urban drainage system and the high amount of runoff means that rainwater can affect the stability of the scarp. An efficient form of control over this type of disruption was in the past exercised through the assiduous practice of agricultural activity along the escarpment. In fact, agricultural terracing was an active form of defence, since any falling blocks stopped by sinking into the horizontal surface formed by the agricultural land contained in the terracing. Their continuous maintenance ensured over time an effective barrier against the danger of collapses and detachments of rocky material. The current state of neglect of agricultural terraces is a considerable danger, because it allows the effects of many small collapses to be added, with the accumulation along the slope of large quantities of rocky blocks in precarious equilibrium conditions, destined to landslide giving rise to larger disturbances than the initial small collapses. A similar argument can be made for the waters circulating on the ridge, which were once regulated for agricultural purposes, while currently flow freely along the slope.

The institutional perspective

In this already complex framework, the latest PAI update many areas of the reserve, like the areas of hazard P3 and P4 and with risk R3 and R4, from "high" to "very high" rate of risk. Following this classification Ordinance No.07 of 26 April 2019 of the Regional Office of Territory and Environment prohibits the use of the areas below the escarpment. In response to this problem and in order to plan risk mitigation actions, the municipal administration has recently commissioned a study to geotechnical researchers team, with the aim of assessing the 'state of health' of existing flood infrastructures that have been built in the Timpa and planning new ones with the aim of reducing the risk classes of the PAI.

However, there are some limitations that need to be stressed here. Existing retain structures (retain walls, micro-piles, etc.) or active defensive interventions, such as adhesion nets reinforced with steel wire and/or high-strength mesh panels, have been the result of an emergency action that lacks an overall and programmatic vision of the hydrological risk management of the area. In addition, over the years, the continuous landslides caused by torrential rains have shown that these works are not entirely effective and, in many cases, have had negative effects on the protection of biodiversity and the landscape. At last, the attention of the city administration continues to look at portions of territory defined by legal and administrative limits, the reserve one. In the specific case it looks at the reserve taking into account only what happens within its perimeter without looking in a complex way to the causes of risk that must be resolved upstream of the reserve itself, in urban context.

In the adaptation processes, as in this case, the institutions mainly adopt a rational approach in which they are guided

by predefined objectives, for which knowledge is gathered in order to model and predict future scenarios and on the basis of these, a strategy is implemented to minimise the flooding risks. To act in such a way implies a strengthening, more and more over time, of established values, norms and cumulative consolidated knowledge base, limiting in fact the possibilities of future choice. It takes place what Krasner (1988) has defined path-dependency organizational room, where adaptive capacity is reduced to linear forms of knowledge and action that limit the range of possible choices on adaptation measures. In the contingency of events, decision-makers could implement alternative strategies, but the same options are chosen as used in past events because they constitute institutional practices that are accepted by common sense (Parson et al., 2019). Such choices are culturally specific practices that respect both formal rules and norms, as well as cognitive structures and worldviews that influence the understandings and actions of decision makers. Maintaining the institutional *status quo* often requires the constant maintenance of coalitions of stakeholders and interest groups in support of institutions (whose values and knowledge reflect those of the social hegemonic group) to ensure the defence of the continuation of existing policy responses (Johnson et al., 2005).

The community perspective

A paradigm change in risk management implies to produce forms of knowledge that are based on the ability to cooperate of various actors, leading not only to increasing the amount of knowledge but to a reorganization of those values, those rules and objectives that permit to make an effective change of perspective. The opportunity for the Circolo Legambiente (an environmental organisation) to

experiment a more complex path was the publication of the call for project by Foundation for the South, – Environment 2018 call, that promotes adaptation activities to environmental risks, but with a multifaceted vision, as reported on the call text:

"Effective reduction of environmental risks cannot, therefore, be achieved without the development of widespread local networks, which promote public policies with environmental protection objectives, that active citizenship paths that contribute to the maintenance and enhancement of virtuous behaviour and good practices. It is therefore essential to actively involve communities living in protected areas and in the surrounding areas, through the promotion of initiatives and mechanisms that are able to encourage the spread of behaviour aimed at the care and protection of the environment" (Fondazione con il Sud, 2018).

The need to think about such a project has given rise to many questions about the best approach to handle the vastness of the information, data, cultures, permanencies, emergencies that are parts of a territory telling and starting point for a project that can become a transformation path (Adger, 2003). The will was to go beyond the mere environmental issue and give voice to a story able to describe the socio-ecological dynamics that over the centuries have given shape and structure to the territory. A starting point was the desire to adopt a multi-disciplinary approach that offers different reading layers for the interpretation of this portion of the territory so rich in diversity. The elements of natural preservation become unique with the factors of cultural enhancement (Gambino, 2010). The relationship between permanence and change is the fulcrum around which the instances of the project revolve. The attention to what has been seen and still is possible to see, is closely

linked to the theme of the identity of the territory, factors of stability that have given meaning to places (Decandia, 2000). The project 'M.I.P.A.T. (Hydrological Mitigation Landscape Environment Territory) starts from an integrated concept of territorial heritage, treating the territory as a subject open to continuous relations, activating interactions and exchange between different actions and disciplines (Magnaghi, 2012) and interpreting risk as a manifestation of suffering of a complex system. The project is supported by a diversified partnership: University of Catania (Department of Agriculture, Food and Environment and Department of Civil Engineering and Architecture), Ecoscience (Biologists association), Circolo Arci Babilonia, Fondazione Città del Fanciullo (training centre), Acireale Municipality and Sicily Region Department of Rural and Territorial Development. The collaboration of the partners within the project has allowed the development of a multidisciplinary approach, which draws resources from the world of research, institutions and active citizenship. Cultural, social and scientific competences have the aim of creating a network of people and put in action all the goals written below. To do this, attention has been paid to how multiple sources of knowledge put into cooperation can contribute to building complex knowledge frameworks (Funtowicz and Ravetz, 1993) on adaptive and resilient capacities of the territory to face the challenges of hydrological risk. One of the key points is to rediscover traditional construction techniques of agricultural infrastructures and agriculture activities, which in the past have ensured the daily care of a delicate ecosystem such as La Timpa. It is planned to empower the resumption of citrus cultivation and traditional infrastructure with courses of agro-ecology and traditional building aimed at training young people. The goal is to build a base of operators able to promote a path that restarts

agricultural activities, now suffering, with the aim of bringing agriculture to the role of sentinel and care of the territory. To this economic dimension, educational demonstration of bio-engineering site (Petrone and Preti, 2010) is programmed in order to start a debate about the possibility to intervene for hydro-geological risk adaptation with techniques that are able to integrate with the ecosystem cycles. In addition, the workshop of territorial animation and environmental education laboratories are a further contribution to the prevention and adaptation of risk. The next step will be the realization of a community map (Saija and Pappalardo, 2018), conceived as a transformative tool for developing a framework of shared values in a climate of collaboration, trying to turn each mapping subject into a member of a "investigating community" (Sclavi, 2004). The overall strategy of the project is therefore based on a direct approach to the critical issues highlighted in La Timpa, placing as a central element the local community and the network of operators and experts who support it. In this sense, the proposal focuses on *community learning*. Implemented direct actions on and with the territory and sharing the urgency and importance of prevention are aimed to creating a path of active citizenship to reclaim the right to be part of a democratic governance, as an institutions-community mechanism, inspired in general by the value of participation and in particular by the studies of Ostrom (1990) and the so-called Landscape Agreements (Pizziolo, 2009).

Conclusions

Hydrogeological risk is a complex challenge that we all face. Despite events tell us that we are in a highly mutable

world, the ways followed by decision-makers tackles hydrogeological risk continuing to foster consolidated engineering approaches (Lawrence et al., 2015; Vitale et al., 2020). The guiding principles and cognitive processes that underlie the choices of securing the territory are mainly oriented to the development of a type of incremental knowledge rather than paradigmatic changes. A real and feasible process of 'prevention' and 'preparation' to hydrogeological risk, however, does not depend only on the ability to make the territory safer, rather it depends on a paradigm shift for which planning aims to build a path of resilience and adaptation. In order to ensure that hydrogeological risk is not only a problem but also an opportunity for change for socio-ecological systems, it is necessary to strengthen the relationship between technical-scientific knowledge and common knowledge, through collective learning processes. Elaborating risk-awareness frameworks and to creating a collective subject, capable of initiating a process of transformation, can have an effect in the medium and long term, not only on the problem of risk, but also to multi-purpose goals that can improve the condition of economic and social well-being. A complex adaptive pathway, as described above, requires an innovative and integrated approach to risk planning and management, based on an open and flexible learning process involving citizens, associations, experts and institutions in order to reach a socio-ecological revitalization, able to change the current established way of dealing with the risk and represents an opportunity for the future, putting the roots for a "new alliance" between human and nature (Prigogine and Stengers 1984). They are processes where social practices are integrated with the institutional ones for changing the physical spaces, the economic and social mechanisms in which they are emerging. From this point of

view, there is a need for research efforts that investigate the relationship between scientific knowledge and social cognitive systems.

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Landscape policies, urban and territorial planning to support SNSVS and SNAC

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Abstract

The article is part of the broader debate concerning the processes of transposition, on a local scale, of the national strategies of socio-economic and environmental interest.
Specifically, the focus will be on the integration of the objectives of two specific Strategies: National Strategy for Adaptation to Climate Change (hereinafter SNAC) and National Strategy for Sustainable Development (hereinafter SNSVS), in territorial government policies, and among territorial planning tools.
From a doctrinal point of view, these Strategies can be registered in the category of Soft Laws; this particular juridical "nature" involves some administrative weaknesses for which the SNAC and the SNSVS need tools and institutes dedicated to their transposition on a local scale.
Landscape, urban and territorial planning represent the suitable tools through which to implement the aims of these Strategies while favouring, at the same time, greater participation of local institutions in decision-making

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processes, in compliance with the principles of multilevel governance desired by the European Landscape Convention.

Keywords

Sustainable Development; Climate Change; Landscape policies; Urban and territorial planning; Multilevel governance

Introduction

The issues concerning a new global model of sustainable development and the adoption of measures to mitigate and adapt to climate change are now at the centre of the scientific and institutional debate at the international level.
Both the United Nations and the European institutions have put in place strategies and programs to achieve these objectives; the strategic framework is defined by the 2030 Agenda and by the documents drawn up by the Intergovernmental Panel on Climate Change (IPCC).
In the EU framework, the regulatory reference on the topic of sustainable development is COM-739 (European Commission, 2016) "Next steps for a sustainable European future. European action for sustainability". However, as regards climate change, the legal framework is provided by COM-35 (European Commission, 2005) "Winning the Battle Against Global Climate Change" and in the subsequent COM-216 (European Commission, 2013) "The EU Strategy on adaptation to climate change".
These programs and strategies define guidelines that require national and local implementation plans. Italy has both a

National Strategy for Sustainable Development (ME, 2017a) and a National Strategy for Adaptation to Climate Change (ME, 2017b) but the fundamental role in implementation is to be attributed to local institutions. This poses the need to put in place suitable tools - the responsibility of which is borne by territorial administrations - for the execution of the objectives set at the national level.

The principles and purposes set out in the SNSVS and in the SNAC are immediately related to issues related to territorial governance, landscape policies, and urban and territorial planning tools. Therefore, it is desirable to evaluate the functionality of these tools in achieving the set of the objectives.

Therefore, in this article, the authors intend to start a reflection on this theme, proceeding through a path of analysis that will investigate some specific aspects deemed exemplary of the key focus of the paper: the functionality of the Landscape Plan to provide, on a regional scale, some tools necessary for the implementation of the SNSVS; the role of urban planning in implementing the SNAC in relation to the issue of urban welfare and the resilience of urban contexts to the impacts of Climate change.

Starting from a reading of the critical issues from the legal-administrative point of view in the SNSVS and SNAC, the authors will move on to the analysis of: (i) the new dynamics of socio-economic development of the territory; (ii) how to respond, with integrated actions, to the direct and indirect effects of Climate Change through integrated actions for the transformation of urban welfare models.

In addition, the ways in which landscape policies and urban and territorial planning would be able to make concrete some strategic objectives set in the SNSVS and SNAC will be highlighted.

The contribution is the result of a shared reflection of the authors. However, the second and third sections are attributed to Stefano Damiano, while the fourth section is attributed to Marsia Marino. The remaining sections, including the introduction and conclusion, are shared by both authors.

SNSVS and SNAC. Comparative analysis

The choice to analyse the functionality of landscape policies and urban and territorial planning tools in relation to two specific strategies - SNSVS and SNAC - is due to the need to find an implementation of the principles highlighted by the latter at the local scale, through prescriptions able to guarantee their implementation.
The National Strategy for Adaptation to Climate Change is solely dedicated to the specific theme, while the National Strategy for Sustainable Development - as well as the 2030 Agenda at the international level - has a wider sphere of action which includes the actions to adapt and mitigate the effects of climate change.

Similarities: vision and purpuses

In the two strategies it is possible to trace a common mission and vision, as also highlighted by an important document of the European Commission, the Green New Deal, which highlights how "Climate change and environmental degradation are an existential threat to Europe and the world. To overcome these challenges, Europe needs a new growth strategy that transforms the Union into a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases by 2050 economic

growth is decoupled from resource use no person and no place is left behind The European Green Deal is our roadmap for making the EU's economy sustainable" (European Commission, 2019).
Therefore, there is a cause-effect link between processes aimed at sustainable development and actions to adapt to climate change. In fact, Sustainable Development is based on three dimensions - environmental, economic, and social - proposing a vision of a more harmonious society, respectful of one another, and of the resources of the Planet. All the sustainability challenges, including, first of all, the issue of climate change, is not only related to the environmental sector but also have serious repercussions on the economic and social system. The latter, in fact, strictly depends both on the availability and fair distribution of natural resources, and on the ability of ecosystems to absorb the impact of human activities on the environment. Artificial capital (production systems) and natural capital (natural resources) are fundamentally complementary (Italia Nostra, 2019).
In this regard, the same National Strategy for Adaptation to Climate Change highlights the relationship between its objectives and those of the SNSVS, underlining that in the literature there is a growing ability to understand the possibilities of choosing and implementing climate response options in different sectors to achieve synergies and avoid conflicts with other dimensions of sustainable development (IPCC, 2007; IPCC, 2014). Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (WCED, 1987) The latter is possible through integration between:
- micro and macroeconomic dynamics;

- multilevel governance processes preceded by a strengthening of capacity building in the different stages of decision making;
- environmental protection and sustainability actions and programs;
- safeguarding of social cohesion processes also through the empowerment of people in environmental matters (Aarhus Convention: UNECE, 1998).

Only the integration of these different dynamics and processes would guarantee, at the same time, the achievement of multiple objectives, including those of sustainable development and mitigation and adaptation to climate change. A slogan can be used: there is no development without sustainability; there is no sustainability without actions to combat Climate Change.

As highlighted in the SNSVS, the impacts of climate change can seriously hinder development in essential sectors (for example, the increased risk of natural disasters and water stress will have to be counted in planning for public health); development choices, in turn, will affect the ability to mitigate and adapt to climate change (for example, forest conservation and renewable energy policies, if properly designed and implemented, can increase the resilience of communities and therefore reduce their vulnerability). There are other examples of synergies:

- Policies related to energy efficiency and renewable energies are often cost-effective, improve energy security, and reduce local polluting emissions.
- Measures to reduce natural habitat loss and deforestation can have a variety of significant benefits in terms of biodiversity, soil and water conservation, and can be implemented in a socially and economically sustainable way.
- Forestry and plantation measures for bioenergy can help restore degraded land, manage water runoff, store carbon in

the soil and benefit rural economies, but they also risk creating competition in land use with food production and be negative for biodiversity if not properly designed (ME, 2017a).

Similarities: critical issues

In addition to the characteristics of commonality, from the reading of the two strategic documents, similar criticalities also emerge, which led the authors to propose this reflection on the points of union between the strategic lines highlighted by the two strategies and national government instruments. The SNSVS and SNAC, in fact, in order to achieve their goals at the local level, need dedicated tools that are not exclusively of a planning type, but also of a managerial-territorial type. In compliance with current legislation, this function could - and should - be performed through landscape policies and urban and territorial planning. Yet, although the two strategies repeatedly highlight the importance of landscape, resilience, and urban regeneration, the tools dedicated to territorial governance are never expressly referred to.

For example, among the transversal vectors of the SNSVS, as regards the "Monitoring and evaluation of plans and projects policies", there is talk of ensuring the definition, implementation and supply of integrated systems for the monitoring and evaluation of policies, plans, and projects, but without talking directly about the Landscape Plan or the Local Urban Plan.

Even concerning the vector "Institutions, participation and partnerships", the instruments of government and territorial planning are not expressly mentioned, although there is a need to guarantee the creation of effective mechanisms for institutional interaction and the implementation and

evaluation of the SNSVS and it is specified that the areas will be deepened and defined in line with the strategic guidelines of the governance system for the implementation and evaluation of the SNSVS, which will identify the ways, times and spaces functional to the interaction with the institutions (horizontal and vertical integration mechanisms), taking into consideration the existing guidelines at national and EU levels (ME, 2017a).

Instead, it is the Legislative Decree 152/2004 - which according to the principle of cogency also concerns urban planning tools - to highlight the relationship between landscape policies and planning with the processes of sustainable development and resilience to the effects of climate change - even if only indirectly, recalling the need for actions to protect and safeguard the environmental and landscape heritage.

Article. 135, section 2 "Landscape planning", for example, establishes that the landscape plan defines, with particular reference to the assets referred to in Article 134, the transformations compatible with the landscape values, the recovery and redevelopment actions of buildings and areas subject to protection, as well as landscape enhancement interventions, also about sustainable development prospects (Legislative Decree 42/2004).

Furthermore, also in "Chapter III - Landscape planning", art. 143 ("Landscape Plan") identifies the measures necessary for the correct insertion of the transformation interventions of the territory in the landscape context, to which the actions and investments aimed at the sustainable development of the areas concerned must refer (D .lgs 42/2004).

Finally, art. 145 "Coordination of landscape planning with other planning tools" highlights that landscape plans provide for coordination measures with territorial and sector

planning tools, as well as with national and regional economic development tools.
The Code of Cultural Heritage and Landscape, therefore, would compensate for the *vacatio* existing in the SNSVS about the relationship between sustainable development and territorial planning.
On the side of mitigation and adaptation actions, urban planning tools - thanks to their greater ability to influence, from an executive and administrative point of view, the actions of the government of the territory - are fundamental to make the cities and the territory resilient to the effects of climate change.
However, to date, the strategic documents at the national level, while providing for implementation and adaptation processes on a local scale, have not yet defined the tools dedicated to achieving the set objectives, while, by reinforcing and integrating with new skills the Landscape Plan and Urban Plans, it may be possible to start the necessary implementation processes. In support of this line of research, in the following two sections the authors want to define some aspects, linked to sustainable development and to the contrast of the effects of climate change, exemplifying how the PP and urban plans could give immediate answers to the strategic objectives outlined at the national level.

Landscape policies and planning tools to support a new socio-economic development model of the territory

As expressed up to now, the SNSVS claims that sustainable development does not mean economic stagnation or renounce to economic growth for the sake of the environment; rather, it should involve the promotion of

economic development as a condition for maintaining environmental quality.
Economic development leads to a greater ability to deal with environmental and social problems. In turn, maintaining environmental quality is essential for sustainable development. Therefore, climate change and the strategies to counter, and adapt to, it can be understood as part of the greatest challenge of sustainable development (ME, 2017a).
Development and sustainability are not "forcibly linked" concepts but represent different types of relational processes between human and the environment. However, to make these two types integrated it is necessary to define a new paradigm of territorial development, where sustainability represents a growth factor and not a "brake". Moreover, as previously highlighted, the issue of mitigation and adaptation to the effects of climate change could represent an "accelerator" of this new model of socio-economic development of the territory.
This concept is further underlined in the premise of the SNSVS which highlights how sustainable development means a new circular economic model, with low CO2 emissions, resilient to climate change and other global changes due to local crises such as, for example, the loss of biodiversity, modification of fundamental biogeochemical cycles (carbon, nitrogen, phosphorus) and changes in land use (ME, 2017a).
Talking about sustainable development also includes an overall vision of growth for the whole territory, starting from urban areas up to the so-called internal areas - subject to a dedicated strategy: the National Strategy for Internal Areas (SNAI).
The contents reported up to now in this section have the aim of bringing out a specific element, a keyword that is at the

basis of all the assumptions of the SNSVS and SNAC: the territory.

Landscape planning for sustainable development

This term is also part of the definition that the European Landscape Convention gives of landscape: "a certain part of the territory, as perceived by the populations, whose character derives from the action of natural and/or human factors and their interrelations" (European Council, 2004).
Moreover, continuing to read art. 1 of the ELC, it is highlighted that: "Landscape management" indicates the actions aimed, from a sustainable development perspective, at guaranteeing the governance of the landscape to guide and harmonize its transformations caused by social, economic and environmental development processes.
Therefore, landscape policies are fundamental in achieving a sustainable development model from a social, economic and environmental point of view. Landscape planning tools can be functional to the objectives envisaged in the SNSVS and their implementation on a local scale.
For example, it should be noted that the landscape plan is responsible, among the various skills, to identify the risk factors and the elements of the vulnerability.
Even from reading these few paragraphs of the *Urbani Code*, it is clear how much the Landscape Plan, as a tool for implementing landscape policies at a territorial level, can be functional to the simultaneous achievement of the objectives of the National Strategy for Sustainable Development. Landscape planning, in the light of current legislation, represents the main tool of competence of the local institutions - even if in agreement with the central institutions on some aspects including landscape protection - and this guarantees the principle of subsidiarity, of

multilevel governance and greater participation of citizens and stakeholders in decision-making processes.
Moreover, in the drafting of the Landscape Plan, the Ministry of the Environment and the Protection of the Territory and the Sea can also make its contribution of expertise, strengthening the actions of environmental protection and mitigation adaptation to the effects of Climate change.
At the end of the present section, the authors want to highlight the role of urban planning tools in support of innovative economic-environmental models.
Starting from the UN data concerning the processes of progressive population increase in the urban environment (a topic further developed in the third section) it is clear how cities are the centre from which to start developing a new model of sustainability in which economic, employment and production sectors growth is sustainable from an environmental, landscape, ecosystem and health point of view.
Given the relevance of the issue, public institutions at different scales, starting from municipal administrations, should be committed to the front line according to the principles of the Aalborg Charter (European Commission, 1994).
The scientific literature highlights how a correctly planned urban fabric is the prerogative of a city that tends towards urban resilience to the effects of climate change and can implement sustainable development processes capable of driving even a large area such as the one established with the so-called "Del Rio Reform".
If local institutions are committed to implementing landscape policies, planning tools and socio-economic programs in support of the objectives defined by the SNSVS and SNAC, in this section the authors want to highlight the

extent to which urban planning tools can favour the participation of private subjects in the processes of redefining the city also through ecological-environmental interventions.
In vast and complex contexts, the "Urban Project" tool is required to adopt specific and innovative implementation rules, whether it is new interventions, or whether they are the recovery of parts of the existing city.
The tool guarantees, with a single solution, the technical and economic feasibility, the finding of financial resources with the active involvement of private individuals, certain phases and times of realization. The basic urban planning choices of urban projects are agreed upon and shared through specific forms of participation (Rome Department of Urban Planning, 2008).
Therefore, the Urban Project favours the participation of private individuals, and especially business women and men, in public-private partnership actions for the construction of city transformation works, also to make them resilient to the effects of Climate change.
Therefore, companies can play a fundamental role in the dynamics of promoting and strengthening sustainable development models and adaptation and mitigation to climate change through the sustainability of the production of goods and services and their consumption.
For example, 'impact finance' represents an extremely interesting socio-economic model, as also indicated in the second Eurosif report (2017) which highlighted how the sustainable and responsible investment strategy (SRI) has proved extremely effective in achieving the objectives for sustainable development while promoting territorial adaptation processes.
This is an interesting model to follow, which could be further implemented through forms of public-private,

private-private, and even private-third sector partnerships, to create the conditions for a new form of sharing economy in which:

- the company is configured according to new micro and macroeconomic models including that of shared value and benefits corporations;
- the citizen directly or indirectly participates in the creation of a circular economy model whose benefits can be used;
- the public entity, while maintaining its role as a "decision-maker", finds interlocutors ready to support, in a participatory way, transformation processes of cities aimed at improving resilience and sustainability (Damiano, Marino, 2020).

A new welfare model for resilient cities

According to the World Urbanization Prospects (UN, 2018), more than 50% of people currently live in urban areas and the increase in settlement in cities could increase by 2.5 billion people.

This issue has absolute relevance in the international political agenda, requiring institutions to start a profound reflection on the social, economic and environmental repercussions that this phenomenon will entail in the long run, to guarantee the well-being of the inhabitants of the city, intended in its social and relational dimensions linked to daily life, with the material endowment of services for the community through its different spatial articulations (Cognetti, 2012).

SNAC also highlights how urban settlements host the majority of the Italian population (94% in 2001) and are at the same time the main culprits and the main "victims" of climate change. Being predominantly artificial systems, their

resilience must be ensured almost exclusively by human action. This is an unprecedented challenge for the government of the territory since it is necessary to combine short-term interventions with interventions that will produce effects in the medium and long term (ME, 2017b).
The progressive massive migration towards large urban centres involves, in addition to the effects in terms of welfare, also the explosion of some phenomena including gentrification. This is a physical, social and economic tendency for which historically popular neighbourhoods are repopulated by the middle class, thus determining a substantial change in the social composition due to the endogenous factors mentioned above which have the effect of increasing the price of housing and essential services (Secchi, 2013).
This phenomenon triggers extremely delicate social processes, as the most fragile segment of the population is forced to move to the marginal areas of the city, with the dual effect of causing urban sprawl phenomena (with significant environmental accidents such as the consumption of soil), and an increase in the gap of disparity between residents in terms of access to primary and essential services; therefore, a substantial disarticulation of spaces is generated, even more discontinuous both in morphological terms and in terms of social equity (Mariano, 2011).
Therefore, there is a theme of contrasting inequalities understood as the right to the city and to an accessible and homogeneous urban welfare system for all segments of the population and throughout the territory.
This strategic objective takes on a central role in the Green New Deal which "will provide targeted support to regions and sectors that are most affected by the transition towards the green economy" (Euroepan Commission, 2020). Infact, the European Union is aware that many states and regions

could have difficulties, in economic terms, in implementing a sustainable transition; thus the EU has foreseen an investment plan that can support the just transition mechanism according to the principle that "no person and no place is left behind". At the local level and in terms of territorial governance instruments, the objectives of the Green New Deal presupposes a new vision of the urban design to be implemented through an integration of the objectives of the SNSVS and SNAC in the planning tools provided for by current legislation.

It seems necessary to emphasize how the theme of "inequalities" has particular relevance within the strategic document for sustainable development. In this concern, a further innovative aspect of the 2030 Agenda is the attention paid to the phenomenon of inequalities, exacerbated by the economic crisis of the last decade, which risks slowing down the path aimed at pursuing sustainable development. In the absence of an adequate intervention strategy, various factors, including globalization, technological changes, transformations in the labour market, demographic trends, and migration, can feed a polarization between 'winners' and 'losers'. Therefore, it appears essential to identify and share policies that can relaunch growth and make it sustainable in the long term (ME, 2017a).

Even the National Strategy for Adaptation to Climate Change clearly refers to the concept of "inequalities", albeit indirectly, and the relationship existing between SNSVS and SNAC on this issue is evident in a passage of the National Strategy for Sustainable Development which states that the fight against inequalities is increasingly an inescapable goal for governments, since growth without inclusion limits social mobility, damages growth and creates political instability (ME, 2017a).

Inequalities in changing cities

The concept of inequality, in relation to urban design, is highlighted, above all, in the marginal areas which, from a social point of view, represent areas in which forms of "degradation" and social marginalization are easier to take place, while from the institutional point of view, according to Gilles Clemant, represent those places where the carelessness of the political decision-maker often generates a state of dereliction.

It is precisely on this aspect that action must be taken, accepting the challenge of a social and ecological reconversion of the city, and the actions to be taken are those of strengthening the urban welfare system.

In relation to the SNSVS, the concept of margins is highlighted in the strategic area "People", which highlights how sustainable development also passes through the fight against poverty and social exclusion by eliminating territorial gaps (ME, 2017a).

For example, among the key tools for "Tackling poverty and social exclusion by eliminating territorial gaps", the Plan for the redevelopment of the suburbs is reported.

In addition, the following objectives are reported in the "Planet" area of the National Strategy for Sustainable Development:

- Create resilient communities and territories, safeguard landscapes and cultural heritage;
- Prevent natural and anthropogenic risks and strengthen the resilience capacities of communities and territories;
- Ensure the high environmental performance of buildings, infrastructures and open spaces;
- Regenerate cities, ensure accessibility and ensure the sustainability of connections;

- Ensure the restoration and defragmentation of ecosystems and promote urban/rural ecological connections;
- Ensure the development of potentials, the sustainable management and care of territories, landscapes, and cultural heritage (ME, 2017a).

To achieve these objectives, one of the key tools is the Italian National Report on sustainable urban development, a document supporting Italian participation in the United Nations International Conference HABITAT III.

However, as regards the issue of Climate Change, it is above all in the "margins" that the so-called "Critical infrastructures" are present, according to the definition of the SNAC: they are areas that will be most affected by the effects of the CC.

The SNSVS, in "Promoting health and well-being", underlines the importance of acting in order to reduce the "exposure of the population to environmental and anthropogenic risk factors" (ME, 2017a).

It is evident how necessary it is to create strategies capable of guiding the sustainable urban development of the territories, as indicated by the European Environment Agency (EEA, 2016) in the report "Climate change, impacts and vulnerability in Europe 2016".

Therefore, the figure of the urban and territorial planner emerges, who, "as a leader of Change, is committed to [...] promoting strategies, policies, and programs for greater 'Regional Resilience' to combat the vulnerability of cities and regions (territories) to the effects of rapid urbanization, climate change, poverty and growing inequality" (ECTP-CEU, 2013).

Designing for change means predicting the effects of what may happen in the future, of how climate change will continue to affect our environment and how it will change

our lifestyle and our new needs. Anticipating change will mean establishing planning strategies and actions, which are capable of making our cities resistant to changes in environmental conditions, which are at least capable of adapting and responding to changes in the climate in progress and defining places, spaces and buildings capable of mitigating their effects (Bassolino, 2016).

Concluding remarks

Sustainable development and actions to mitigate and adapt to climate change are inextricably linked and require joint actions in order to achieve the global goals highlighted in the 2030 Agenda.
The strategies through which the institutions tend to achieve these goals require implementation tools, especially at the local level.
To date, this aspect is still little dealt with, yet it is clear how necessary it is to set up tools capable of achieving the purposes set by the SNSVS and SNAC.
In this paper, the authors wanted to open a reflection regarding the functionality of landscape policies and urban and territorial planning in the actions of implementation and adaptation at the local level of national strategies of economic and environmental interest.

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