

TeMA

Journal of
Land Use, Mobility and Environment

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

Tema is the Journal of Land use, Mobility and Environment and offers papers with a unified approach to planning and mobility. TeMA Journal has also received the Sparc Europe Seal of Open Access Journals released by Scholarly Publishing and Academic Resources Coalition (SPARC Europe) and the Directory of Open Access Journals (DOAJ).

INPUT 2014

papers selected

Smart City

planning for energy, transportation
and sustainability of the urban system

SMART CITY

PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

Special Issue, June 2014

Published by

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

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

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

Editorial correspondence

Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"
Piazzale Tecchio, 80
80125 Naples
web: www.tema.unina.it
e-mail: redazione.tema@unina.it

TeMA

Journal of
Land Use, Mobility and
Environment

TeMA. Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science, and complex systems.

The Italian National Agency for the Evaluation of Universities and Research Institutes (ANVUR) classified TeMA as scientific journals in the Areas 08. TeMA has also received the Sparc Europe Seal for Open Access Journals released by Scholarly Publishing and Academic Resources Coalition (SPARC Europe) and the Directory of Open Access Journals (DOAJ). TeMA is published under a Creative Commons Attribution 3.0 License and is blind peer reviewed at least by two referees selected among high-profile scientists by their competences. TeMA has been published since 2007 and is indexed in the main bibliographical databases and it is present in the catalogues of hundreds of academic and research libraries worldwide.

EDITOR- IN-CHIEF

Rocco Papa, Università degli Studi di Napoli Federico II, Italy

EDITORIAL ADVISORY BOARD

Luca Bertolini, Universiteit van Amsterdam, Netherlands
Virgilio Bettini, Università luav di Venezia, Italy
Dino Borri, Politecnico di Bari, Italy
Enrique Calderon, Universidad Politécnica de Madrid, Spain
Roberto Camagni, Politecnico di Milano, Italy
Robert Leonardi, London School of Economics and Political Science, United Kingdom
Raffaella Nanetti, College of Urban Planning and Public Affairs, United States
Agostino Nuzzolo, Università degli Studi di Roma Tor Vergata, Italy
Rocco Papa, Università degli Studi di Napoli Federico II, Italy

EDITORS

Agostino Nuzzolo, Università degli Studi di Roma Tor Vergata, Italy
Enrique Calderon, Universidad Politécnica de Madrid, Spain
Luca Bertolini, Universiteit van Amsterdam, Netherlands
Romano Fistola, Dept. of Engineering - University of Sannio - Italy, Italy
Adriana Galderisi, Università degli Studi di Napoli Federico II, Italy
Carmela Gargiulo, Università degli Studi di Napoli Federico II, Italy
Giuseppe Mazzeo, CNR - Istituto per gli Studi sulle Società del Mediterraneo, Italy

EDITORIAL SECRETARY

Rosaria Battarra, CNR - Istituto per gli Studi sulle Società del Mediterraneo, Italy
Andrea Ceudech, TeMALab, Università degli Studi di Napoli Federico II, Italy
Rosa Anna La Rocca, TeMALab, Università degli Studi di Napoli Federico II, Italy
Enrica Papa, University of Amsterdam, Netherlands

TeMA

Journal of
Land Use, Mobility and
Environment

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



CONFERENCE COMMITTEE

Dino Borri, Polytechnic University of Bari, Italy
Arnaldo Cecchini, University of Sassari, Italy
Romano Fistola, University of Sannio, Italy
Lilli Gargiulo, University of Naples Federico II, Italy
Giuseppe B. Las Casas, University of Basilicata, Italy
Agostino Nuzzolo, University of Rome, Italy
Rocco Papa, University of Naples Federico II, Italy
Giovanni Rabino, Polytechnic University of Milan, Italy
Maurizio Tira, University of Brescia, Italy
Corrado Zoppi, University of Cagliari, Italy

SCIENTIFIC COMMITTEE

Emanuela Abis, University of Cagliari, Italy
Nicola Bellini, Institute of Management, Scuola Superiore Sant'Anna Pisa, Italy
Mariolina Besio Dominici, University of Genoa, Italy
Ivan Blečić, University of Sassari, Italy
Dino Borri, Polytechnic University of Bari, Italy
Grazia Brunetta, Polytechnic University of Turin, Italy
Roberto Busi, University of Brescia, Italy
Domenico Camarda, Polytechnic University of Bari, Italy
Michele Campagna, University of Cagliari, Italy
Arnaldo Cecchini, University of Sassari, Italy
Donatella Cialdea, University of Molise, Italy
Valerio Cutini, University of Pisa, Italy, Italy
Luciano De Bonis, University of Molise, Italy
Andrea De Montis, University of Sassari, Italy
Filippo de Rossi, University of Sannio (Dean of the University of Sannio), Italy
Lidia Diappi, Polytechnic University of Milan, Italy
Isidoro Fasolino, University of Salerno, Italy
Mariano Gallo, University of Sannio, Italy
Lilli Gargiulo, University of Naples Federico II, Italy
Roberto Gerundo, University of Salerno, Italy
Paolo La Greca, University of Catania, Italy
Giuseppe B. Las Casas, University of Basilicata, Italy
Robert Laurini, University of Lyon, France
Antonio Leone, Tuscia University, Italy
Anna Loffredo, Institute of Management, Scuola Superiore Sant'Anna Pisa, Italy
Silvana Lombardo, University of Pisa, Italy
Giovanni Maciocco, University of Sassari, Italy
Giulio Maternini, University of Brescia, Italy

Francesco Domenico Moccia, University of Naples Federico II, Italy
Bruno Montella, University of Naples "Federico II" (Director of DICEA), Italy
Beniamino Murgante, University of Basilicata, Italy
Agostino Nuzzolo, University of Rome, Italy
Sylvie Occelli, IRES Turin, Italy
Rocco Papa, University of Naples Federico II, Italy
Maria Paradiso, University of Sannio, Italy
Domenico Patassini, IUAV, Venice, Italy
Michele Pezzagno, University of Brescia, Italy
Fulvia Pinto, Polytechnic University of Milan, Italy
Giovanni Rabino, Polytechnic University of Milan, Italy
Giuseppe Roccasalva, Polytechnic University of Turin, Italy
Bernardino Romano, University of L'Aquila, Italy
Francesco Russo, Mediterranean University Reggio Calabria, Italy
Michelangelo Russo, University of Naples Federico II, Italy
Ferdinando Semboloni, University of Firenze, Italy
Agata Spaziante, Polytechnic University of Turin, Italy
Michela Tiboni, University of Brescia, Italy
Maurizio Tira, University of Brescia, Italy
Simona Tondelli, University of Bologna, Italy
Umberto Villano, University of Sannio (Director of DING), Italy
Ignazio Vinci, University of Palermo, Italy
Corrado Zoppi, University of Cagliari, Italy

LOCAL SCIENTIFIC COMMITTEE

Rosaria Battarra, ISSM, National Research Council, Italy
Romano Fistola, DING, University of Sannio, Italy
Lilli Gargiulo, DICEA, University of Naples Federico II, Italy
Adriana Galderisi, DICEA, University of Naples Federico II, Italy
Rosa Anna La Rocca, DICEA, University of Naples Federico II, Italy
Giuseppe Mazzeo, ISSM, National Research Council, Italy
Enrica Papa, University of Amsterdam, Netherlands

LOCAL ADMINISTRATIVE TEAM

Gennaro Angiello, TeMA Lab, University of Naples Federico II, Italy
Gerardo Carpentieri, TeMA Lab, University of Naples Federico II, Italy
Stefano Franco, TeMA Lab, University of Naples Federico II, Italy
Laura Russo, TeMA Lab, University of Naples Federico II, Italy
Floriana Zucaro, TeMA Lab, University of Naples Federico II, Italy

EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

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

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

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

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

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

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

SMART CITY PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM Special Issue, June 2014

Contents

- 1. The Plan in Addressing the Post Shock Conflicts 2009-2014.
A First Balance Sheet of the Reconstruction of L'Aquila** 1-13
Fabio Andreassi, Pierluigi Properzi
- 2. Assessment on the Expansion of Basic Sanitation Infrastructure.
In the Metropolitan Area of Belo Horizonte - 2000/2010** 15-26
Grazielle Anjos Carvalho
- 3. Temporary Dwelling of Social Housing in Turin.
New Responses to Housing Discomfort** 27-37
Giulia Baù, Luisa Ingaramo
- 4. Smart Communities. Social Innovation at the Service of the Smart Cities** 39-51
Massimiliano Bencardino, Ilaria Greco
- 5. Online Citizen Reporting on Urban Maintenance:
A Collection, Evaluation and Decision Support System** 53-63
Ivan Blečić, Dario Canu, Arnaldo Cecchini, Giuseppe Andrea Trunfio
- 6. Walkability Explorer. An Evaluation and Design Support Tool for Walkability** 65-76
Ivan Blečić, Arnaldo Cecchini, Tanja Congiu, Giovanna Fancello, Giuseppe Andrea Trunfio
- 7. Diachronic Analysis of Parking Usage: The Case Study of Brescia** 77-85
Riccardo Bonotti, Silvia Rossetti, Michela Tiboni, Maurizio Tira
- 8. Crowdsourcing. A Citizen Participation Challenge** 87-96
Júnia Borges, Camila Zyngier
- 9. Spatial Perception and Cognition Review.
Considering Geotechnologies as Urban Planning Strategy** 97-108
Júnia Borges, Camila Zyngier, Karen Lourenço, Jonatha Santos

- 10. Dilemmas in the Analysis of Technological Change. A Cognitive Approach to Understand Innovation and Change in the Water Sector** 109-127
Dino Borri, Laura Grassini
- 11. Learning and Sharing Technology in Informal Contexts. A Multiagent-Based Ontological Approach** 129-140
Dino Borri, Domenico Camarda, Laura Grassini, Mauro Patano
- 12. Smartness and Italian Cities. A Cluster Analysis** 141-152
Flavio Boscacci, Ila Maltese, Ilaria Mariotti
- 13. Beyond Defining the Smart City. Meeting Top-Down and Bottom-Up Approaches in the Middle** 153-164
Jonas Breuer, Nils Walravens, Pieter Ballon
- 14. Resilience Through Ecological Network** 165-173
Grazia Brunetta, Angioletta Voghera
- 15. ITS System to Manage Parking Supply: Considerations on Application to the “Ring” in the City of Brescia** 175-186
Susanna Bulferetti, Francesca Ferrari, Stefano Riccardi
- 16. Formal Ontologies and Uncertainty. In Geographical Knowledge** 187-198
Matteo Caglioni, Giovanni Fusco
- 17. Geodesign From Theory to Practice: In the Search for Geodesign Principles in Italian Planning Regulations** 199-210
Michele Campagna, Elisabetta Anna Di Cesare
- 18. Geodesign from Theory to Practice: From Metaplanning to 2nd Generation of Planning Support Systems** 211-221
Michele Campagna
- 19. The Energy Networks Landscape. Impacts on Rural Land in the Molise Region** 223-234
Donatella Cialdea, Alessandra Maccarone
- 20. Marginality Phenomena and New Uses on the Agricultural Land. Diachronic and Spatial Analyses of the Molise Coastal Area** 235-245
Donatella Cialdea, Luigi Mastronardi
- 21. Spatial Analysis of Urban Squares. ‘Siccome Umbellico al corpo dell’uomo’** 247-258
Valerio Cutini

- 22. Co-Creative, Re-Generative Smart Cities.
Smart Cities and Planning in a Living Lab Perspective 2** **259-270**
Luciano De Bonis, Grazia Concilio, Eugenio Leanza, Jesse Marsh, Ferdinando Trapani
- 23. The Model of Voronoi's Polygons and Density:
Diagnosis of Spatial Distribution of Education Services of EJA
in Divinópolis, Minas Gerais, Brazil** **271-283**
Diogo De Castro Guadalupe, Ana Clara Mourão Moura
- 24. Rural Architectural Intensification: A Multidisciplinary Planning Tool** **285-295**
Roberto De Lotto, Tiziano Cattaneo, Cecilia Morelli Di Popolo, Sara Morettini,
Susanna Sturla, Elisabetta Venco
- 25. Landscape Planning and Ecological Networks.
Part A. A Rural System in Nuoro, Sardinia** **297-307**
Andrea De Montis, Maria Antonietta Bardi, Amedeo Ganciu, Antonio Ledda,
Simone Caschili, Maurizio Mulas, Leonarda Dessena, Giuseppe Modica,
Luigi Laudari, Carmelo Riccardo Fichera
- 26. Landscape Planning and Ecological Networks.
Part B. A Rural System in Nuoro, Sardinia** **309-320**
Andrea De Montis, Maria Antonietta Bardi, Amedeo Ganciu, Antonio Ledda,
Simone Caschili, Maurizio Mulas, Leonarda Dessena, Giuseppe Modica,
Luigi Laudari, Carmelo Riccardo Fichera
- 27. Sea Guidelines. A Comparative Analysis: First Outcomes** **321-330**
Andrea De Montis, Antonio Ledda, Simone Caschili, Amedeo Ganciu, Mario Barra,
Gianluca Cocco, Agnese Marcus
- 28. Energy And Environment in Urban Regeneration.
Studies for a Method of Analysis of Urban Periphery** **331-339**
Paolo De Pascali, Valentina Alberti, Daniela De Ioris, Michele Reginaldi
- 29. Achieving Smart Energy Planning Objectives.
The Approach of the Transform Project** **341-351**
Ilaria Delponte
- 30. From a Smart City to a Smart Up-Country.
The New City-Territory of L'Aquila** **353-364**
Donato Di Ludovico, Pierluigi Properzi, Fabio Graziosi
- 31. Geovisualization Tool on Urban Quality.
Interactive Tool for Urban Planning** **365-375**
Enrico Eynard, Marco Santangelo, Matteo Tabasso

- 32. Visual Impact in the Urban Environment.
The Case of Out-of-Scale Buildings** 377-388
Enrico Fabrizio, Gabriele Garnerò
- 33. Smart Dialogue for Smart Citizens:
Assertive Approaches for Strategic Planning** 389-401
Isidoro Fasolino, Maria Veronica Izzo
- 34. Digital Social Networks and Urban Spaces** 403-415
Pablo Vieira Florentino, Maria Célia Furtado Rocha, Gilberto Corso Pereira
- 35. Social Media Geographic Information in Tourism Planning** 417-430
Roberta Floris, Michele Campagna
- 36. Re-Use/Re-Cycle Territories:
A Retroactive Conceptualisation for East Naples** 431-440
Enrico Formato, Michelangelo Russo
- 37. Urban Land Uses and Smart Mobility** 441-452
Mauro Francini, Annunziata Palermo, Maria Francesca Viapiana
- 38. The Design of Signalised Intersections at Area Level.
Models and Methods** 453-464
Mariano Gallo, Giuseppina De Luca, Luca D'acierno
- 39. Piano dei Servizi. Proposal for Contents and Guidelines** 465-476
Roberto Gerundo, Gabriella Graziuso
- 40. Social Housing in Urban Regeneration.
Regeneration Heritage Existing Building: Methods and Strategies** 477-486
Maria Antonia Giannino, Ferdinando Orabona
- 41. Using GIS to Record and Analyse Historical Urban Areas** 487-497
Maria Giannopoulou, Athanasios P. Vavatsikos,
Konstantinos Lykostratis, Anastasia Roukouni
- 42. Network Screening for Smarter Road Sites: A Regional Case** 499-509
Attila Grieco, Chiara Montaldo, Sylvie Ocelli, Silvia Tarditi
- 43. Li-Fi for a Digital Urban Infrastructure:
A Novel Technology for the Smart City** 511-522
Corrado Iannucci, Fabrizio Pini
- 44. Open Spaces and Urban Ecosystem Services.
Cooling Effect towards Urban Planning in South American Cities** 523-534
Luis Inostroza

- 45. From RLP to SLP: Two Different Approaches to Landscape Planning** 535-543
Federica Isola, Cheti Pira
- 46. Revitalization and its Impact on Public. Space Organization A Case Study of Manchester in UK, Lyon in France and Łódź in Poland** 545-556
Jaroslaw Kazimierzczak
- 47. Geodesign for Urban Ecosystem Services** 557-565
Daniele La Rosa
- 48. An Ontology of Implementation Plans of Historic Centers: A Case Study Concerning Sardinia, Italy** 567-579
Sabrina Lai, Corrado Zoppi
- 49. Open Data for Territorial Specialization Assessment. Territorial Specialization in Attracting Local Development Funds: an Assessment. Procedure Based on Open Data and Open Tools** 581-595
Giuseppe Las Casas, Silvana Lombardo, Beniamino Murgante, Piergiuseppe Pontrandolfi, Francesco Scorza
- 50. Sustainability And Planning. Thinking and Acting According to Thermodynamics Laws** 597-606
Antonio Leone, Federica Gobattoni, Raffaele Pelorosso
- 51. Strategic Planning of Municipal Historic Centers. A Case Study Concerning Sardinia, Italy** 607-619
Federica Leone, Corrado Zoppi
- 52. A GIS Approach to Supporting Nightlife Impact Management: The Case of Milan** 621-632
Giorgio Limonta
- 53. Dealing with Resilience Conceptualisation. Formal Ontologies as a Tool for Implementation of Intelligent Geographic Information Systems** 633-644
Giampiero Lombardini
- 54. Social Media Geographic Information: Recent Findings and Opportunities for Smart Spatial Planning** 645-658
Pierangelo Massa, Michele Campagna
- 55. Zero Emission Mobility Systems in Cities. Inductive Recharge System Planning in Urban Areas** 659-669
Giulio Maternini, Stefano Riccardi, Margherita Cadei

- 56. Urban Labelling: Resilience and Vulnerability as Key Concepts for a Sustainable Planning** 671-682
Giuseppe Mazzeo
- 57. Defining Smart City. A Conceptual Framework Based on Keyword Analysis** 683-694
Farnaz Mosannenzadeh, Daniele Vettorato
- 58. Parametric Modeling of Urban Landscape: Decoding the Brasilia of Lucio Costa from Modernism to Present Days** 695-708
Ana Clara Moura, Suellen Ribeiro, Isadora Correa, Bruno Braga
- 59. Smart Mediterranean Logics. Old-New Dimensions and Transformations of Territories and Cites-Ports in Mediterranean** 709-718
Emanuela Nan
- 60. Mapping Smart Regions. An Exploratory Approach** 719-728
Sylvie Occelli, Alessandro Sciuolo
- 61. Planning Un-Sustainable Development of Mezzogiorno. Methods and Strategies for Planning Human Sustainable Development** 729-736
Ferdinando Orabona, Maria Antonia Giannino
- 62. The Factors Influencing Transport Energy Consumption in Urban Areas: a Review** 737-747
Rocco Papa, Carmela Gargiulo, Gennaro Angiello
- 63. Integrated Urban System and Energy Consumption Model: Residential Buildings** 749-758
Rocco Papa, Carmela Gargiulo, Gerardo Carpentieri
- 64. Integrated Urban System and Energy Consumption Model: Public and Singular Buildings** 759-770
Rocco Papa, Carmela Gargiulo, Mario Cristiano
- 65. Urban Smartness Vs Urban Competitiveness: A Comparison of Italian Cities Rankings** 771-782
Rocco Papa, Carmela Gargiulo, Stefano Franco, Laura Russo
- 66. Urban Systems and Energy Consumptions: A Critical Approach** 783-792
Rocco Papa, Carmela Gargiulo, Floriana Zucaro
- 67. Climate Change and Energy Sustainability. Which Innovations in European Strategies and Plans** 793-804
Rocco Papa, Carmela Gargiulo, Floriana Zucaro

- 68. Bio-Energy Connectivity And Ecosystem Services.
An Assessment by Pandora 3.0 Model for Land Use Decision Making** 805-816
Raffaele Pelorosso, Federica Gobattoni, Francesco Geri,
Roberto Monaco, Antonio Leone
- 69. Entropy and the City. GHG Emissions Inventory:
a Common Baseline for the Design of Urban and Industrial Ecologies** 817-828
Michele Pezzagno, Marco Rosini
- 70. Urban Planning and Climate Change: Adaptation and Mitigation Strategies** 829-840
Fulvia Pinto
- 71. Urban Gaming Simulation for Enhancing Disaster Resilience.
A Social Learning Tool for Modern Disaster Risk Management** 841-851
Sarunwit Promsaka Na Sakonnakron, Pongpisit Huyakorn, Paola Rizzi
- 72. Visualisation as a Model. Overview on Communication Techniques
in Transport and Urban Planning** 853-862
Giovanni Rabino, Elena Masala
- 73. Ontologies and Methods of Qualitative Research in Urban Planning** 863-869
Giovanni Rabino
- 74. City/Sea Searching for a New Connection.
Regeneration Proposal for Naples Waterfront Like an Harbourscape:
Comparing Three Case Studies** 871-882
Michelangelo Russo, Enrico Formato
- 75. Sensitivity Assessment. Localization of Road Transport Infrastructures
in the Province of Lucca** 883-895
Luisa Santini, Serena Pecori
- 76. Creating Smart Urban Landscapes.
A Multimedia Platform for Placemaking** 897-907
Marichela Sepe
- 77. Virtual Power Plant. Environmental Technology Management Tools
of The Settlement Processes** 909-920
Maurizio Sibilla
- 78. Ecosystem Services and Border Regions.
Case Study from Czech – Polish Borderland** 921-932
Marcin Spyra
- 79. The Creative Side of the Reflective Planner. Updating the Schön's Findings** 933-940
Maria Rosaria Stufano Melone, Giovanni Rabino

- 80. Achieving People Friendly Accessibility.
Key Concepts and a Case Study Overview** 941-951
Michela Tiboni, Silvia Rossetti
- 81. Planning Pharmacies: An Operational Method to Find the Best Location** 953-963
Simona Tondelli, Stefano Fatone
- 82. Transportation Infrastructure Impacts Evaluation:
The Case of Egnatia Motorway in Greece** 965-975
Athanasios P. Vavatsikos, Maria Giannopoulou
- 83. Designing Mobility in a City in Transition.
Challenges from the Case of Palermo** 977-988
Ignazio Vinci, Salvatore Di Dio
- 84. Considerations on the Use of Visual Tools in Planning Processes:
A Brazilian Experience** 989-998
Camila Zyngier, Stefano Pensa, Elena Masala

TeMA

Journal of
Land Use, Mobility and Environment

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

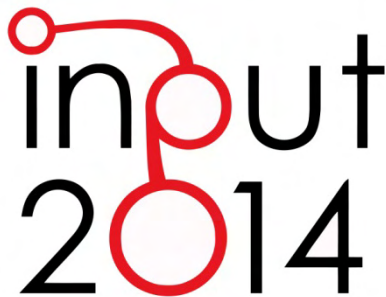
DOI available on the online version

Licensed under the Creative Commons Attribution
Non Commercial License 3.0
www.tema.unina.it

SPECIAL ISSUE

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

Naples, 4-6 June 2014



RURAL ARCHITECTURAL INTENSIFICATION A MULTIDISCIPLINAR PLANNING TOOL

ROBERTO DE LOTTO^a, TIZIANO CATTANEO^b, CECILIA MORELLI DI POPOLO^c,
SARA MORETTINI^d, SUSANNA STURLA^e, ELISABETTA VENCO^f

^a Department of Civil engineering and Architecture, University of Pavia
e-mail: roberto.delotto@unipv.it
URL: www.unipv.it/rdelotto

^b Department of Civil engineering and Architecture, University of Pavia
e-mail: tiziano.cattaneo@unipv.it
URL: www.raintensification.com

^{c,d,e,f} Department of Civil engineering and Architecture, University of Pavia
e-mail: uplab@unipv.it
URL: <http://uplab1.wix.com/uplab>

ABSTRACT

When approaching a composite territorial problem that involves different scales and disciplines, it is necessary to establish a precise logical framework. Every planning or design activity is an iterative process applied to a complex system; not linear relations among the entities that compose the system are numerous and it is problematic to spell out them.

Authors developed a framework that has a hybrid structure in which different classical tool such as Spatial Decision Support Systems, Knowledge Discovery and Data Mining (KDD), and Expert Systems (ES) converge.

The method is not completely automatic and there is a continuous interaction between user and system.

The main aim of the entire research group who participated to a national research (PRIN 2009) was to define an informed methodology for decision makers, stakeholders and public bureaus who have to (or want to) face the problem of improving and intensifying insediative activities in minor centers located in rural-urban context.

In particular authors defined Rural Architectural Intensification (RAI) as a way to improve territorial features throughout a serie of interventions in small settlements and buildings.

The explanation of the relations among different disciplines, different scales and different related methodologies is the key point of the paper.

After an introduction and the description of RAI, authors introduce the main methodological structure; then each passage is detailed and specified considering the elements involved and the technical operations.

KEYWORDS

Rural Architectural Intensification; Multidisciplinar approach; planning tool; methodology explanation.

1 INTRODUCTION

The paper describes methodology and results of a branch of a PRIN 2009 research (relevant research at Italian national level) aimed to define theoretical and practical solutions for rural context. Authors expose a Spatial Decision Support System with a specific application to Rural Architectural Intensification (RAI).

The whole process involves different scales (at least: territorial and architectural) and different disciplinary fields such as: regional planning, landscape and environmental planning, architecture, social sciences, economy (Blaschke 2006).

Within this methodological process many basic concepts of Smart Growth are taken into account. They are: Land Preservation; Preventing urban sprawl; Development Best Practices; Preservation Development; Mix land uses; Take advantage of compact building design; Create a range of housing opportunities and choices; Preserve open space, farmland, natural beauty, and critical environmental areas; Make development decisions predictable, fair, and cost effective; Encourage community and stakeholder collaboration in development decisions.

The entire research bases on a general procedure (quite similar to classical planning ones) in which the main aim is RAI. Applications depend on possible specific aims that put into effect this principal objective.

For each of these two main phases themes, techniques and tools are defined.

2 RURAL ARCHITECTURAL INTENSIFICATION

Rural Architectural Intensification (<http://www.raintensification.com/#!/home-english/ceab>) has been defined by the local research unit of the University of Pavia (coordinated by Prof. Tiziano Cattaneo) inside a general framework (coordinated by University of Ancona) "Architecture as Heritage: innovative instruments for the tutelage and the improvement of the local border systems". Authors from University of Pavia participated with the research theme: "Regeneration and renewal of rural landscape. Building strategies in the surroundings of new urban centers" (Frampton 1991; Carboz 1998; Thompson, Sorving 2000; Jongam 2002).

Rural Architectural Intensification is an innovative design action for architecture and urban design. This operative action is applicable for regenerate and transforms the contemporary city-landscape into uses that are suitable for contemporary ways of living through the construction of a new paradigm that will shape an architectural and urban project committed to sustainability. Rural Architectural Intensification has three keywords: Rural as environment with richness of history, values, memory and high quality; Architecture as a process and construction product, which can create social, cultural, economic and technological innovation; Intensification as a strategy to create sustainable density of activities and spaces for people in which the natural environment and the rural-urban environment coexist harmoniously.

This issue aims to the regeneration of the rural landscape as cultural heritage (Van der Vaart, 2005; Spaziante, Murano 2009; Fuentes 2013). The crisis in rural areas is essentially a European problem: depopulation and ageing of the population, abandonment and decay of small town centers, difficulty in keeping existing businesses and/or in launching new start-ups, intensive agricultural practices to the detriment of biodiversity, pollution, a lack of infrastructures and services for tourism, as well as a shortage of job opportunities for the population, etc.

Enhancing rural architecture, small towns, farmsteads and ancient relics is one of the main components for the regeneration of the countryside. It is a strategy with a positive outcome, even only if it has been supported simultaneously by the possibility of creating more business (also working from this architectural

heritage), but which nevertheless is planned taking into account the improvement of the perceived aesthetic structure of the countryside.

The main methodological approach here presented, previously defined as a Decision Support System, is a hybrid solution among Spatial Decision Support System (SDSS), Knowledge Discovery and Data Mining (KDD) e Expert System (ES) (Densham 1991; Wang, Feng 1992; Fayyad, Piatetsky-Shapiro, Smyth 1996; Keenan 2003).

3 MAIN PROCEDURE AND TERRITORIAL APPLICATION

The following flow diagram (Fig. 1) represents the entire planning method. Authors consider it is essential to specify the sequence of the phases that characterize the whole process because it combines various approaches that can be referred to the different scales and disciplines involved.

The aims are defined by decision makers, stakeholders, public bureaus, developers or private associations and the procedure is addressed to planners and to professional figures that may ease the decision process.

The process starts with the identification of a “main aim”, that is the final goal of the whole planning procedure; in this case it is RAI.

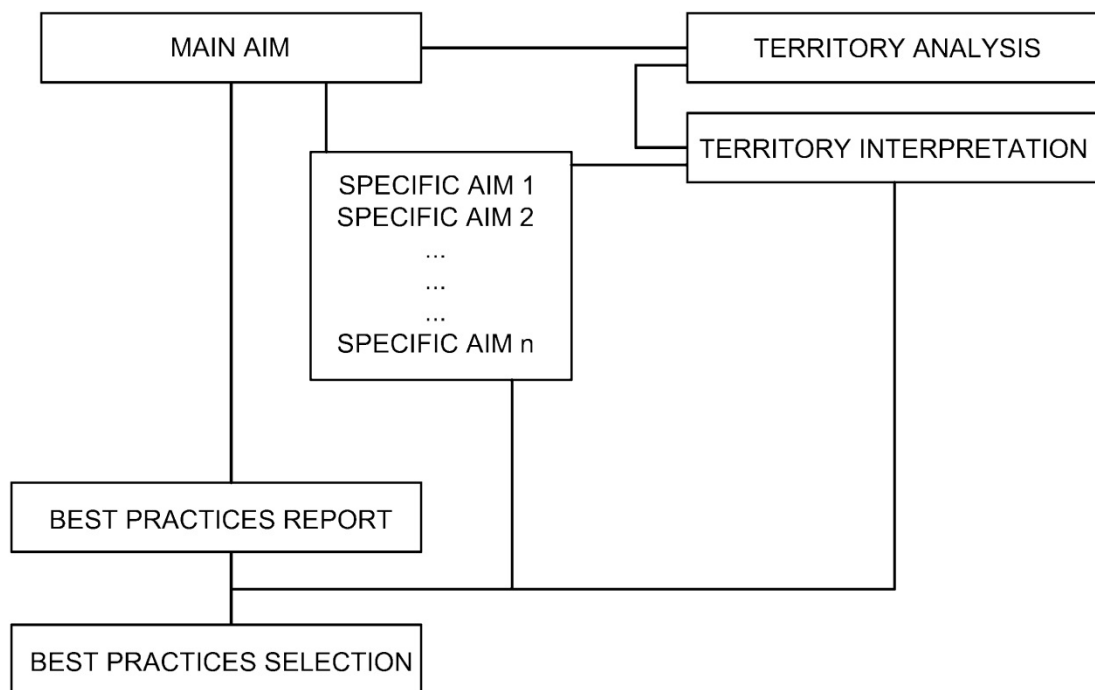


Fig. 1 Logical framework

Considering that RAI application depends on the characteristics of the territory in which it should work, once the main aim is defined, planners analyze the territory starting from available net information (such as Regional and local webgis, DUSAF, CORINE, etc.).

A Best Practices Report was built during the RAI research and it is a basic thematic reference in which many experiences from all over the world are classified and assessed depending on specific criteria.

Considering the characteristics of the analyzed territory, decision makers and stakeholders define specific aims; these are in example: concentration of new commercial activities in existing small centers, creation of a system of mixed use small centers, creation of a decentralized hotel, definition of territorial facilities, distribution of residential settlements in existing underused buildings, renewal of existing rural settlements, etc.

Obviously, territorial interpretation depends on certain specific aims: in fact different spatial or economic factors may have particular relevance for each precise objective. At the same time the entire Best Practice database can be consulted and appropriate examples may be selected.

Lastly a compatibility assessment among the territorial interpretation and the selected case studies carries to possible scenarios that decision makers and stakeholders should consider.

In the following schemes, two phases are singularly analyzed.

The first phase consists on the Territorial Analysis and on the creation of the Best Practices Report (Fig. 2a and 2b).

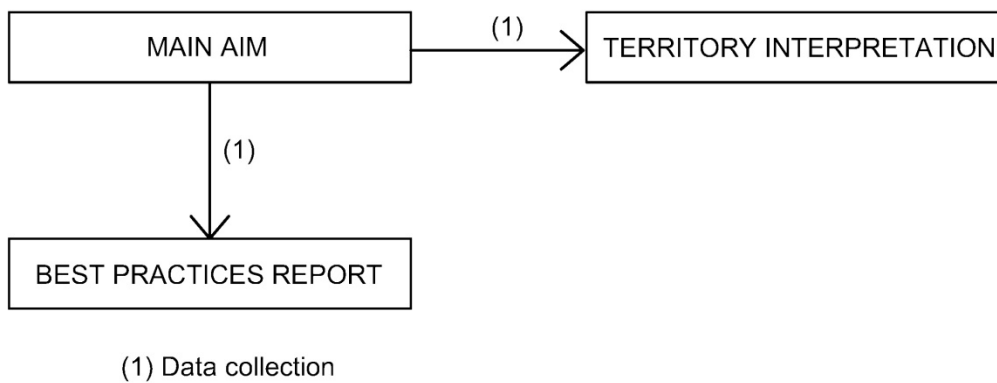


Fig. 2 a First Phase

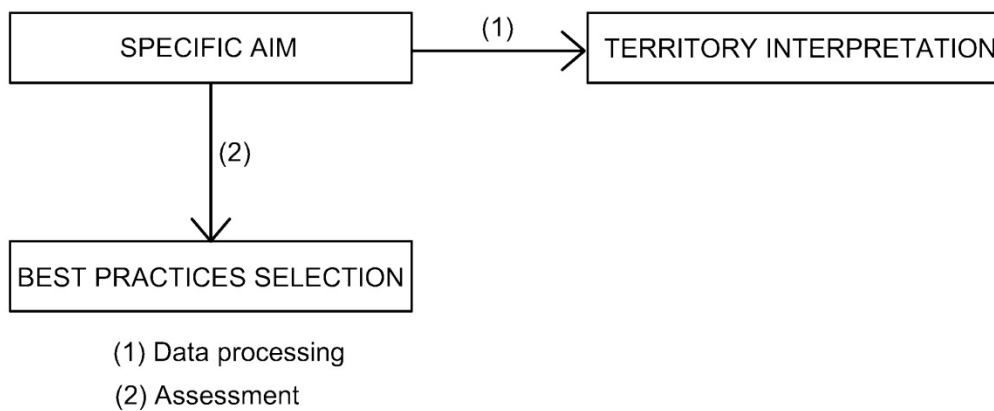


Fig. 2 b First phase

In this phase two actions are developed simultaneously: one is driven mainly by planners (Territorial Analysis) and the other mainly by architects (Best Practices Report). Different scales and disciplines are involved and they may work separately.

Territorial Analysis starts with the creation of a wide GIS-based database about all available information that may be useful for a comprehensive description of the territory under investigation (Cano, Garzón, Sánchez-Soto 2013). Together with all environmental and landscape information, in this database a particular attention must be paid to existing and underused architectural assets. In fact they represent the starting point for RAI strategies.

In RAI application a specific best practices database already exists: <http://www.raintensification.com/#!/case-report/c1zi1>. It reports carried out and successful projects related to urban, rural and fringe contexts from all over the world.

In the Best Practice Report built for the main aim RAI, each project is catalogued by four parameters:

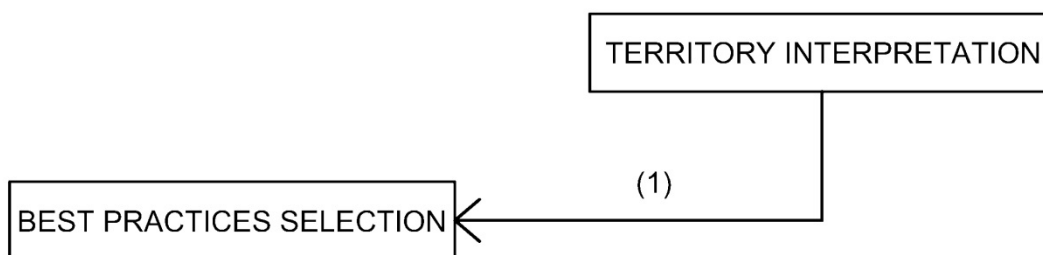
- a. development of local business capability;
- b. development of cultural and tourist activities;
- c. environment preserving;
- d. facilities for population.

With more details:

- a. development of local business capability: business and tourism, diversification into non-agricultural activities, diversification and innovation in agriculture, cultivate the landscape, cooperation and short chain, growth of the bio-economy, business and infrastructure;
- b. development of cultural and tourist activities: tourism and architectural heritage, tourism and environment, small-scale tourism services, countryside vs sea and mountain, tourism and water, tourism and infrastructure, tourism in less-favorable areas;
- c. environment preserving: environment and biodiversity protection , environment as heritage, environment and water, soil and environment, environment and animals, environmentally sustainable operations, limit consumption of the environment, bioenergy, environmental reservoirs, environment and urban space, environment and infrastructure, environment and waste, environmental risk, environment in disadvantaged areas, diversified environmental redevelopment;
- d. facilities for population: population and employment: tourism, population and employment: diversification of agricultural activities, essential services to the population, country-city, population: energy saving, young population, population: infrastructure, cooperation in development, safe population, population and environment.

The characteristics of the specific aim (that decision makers or stakeholders select) guide the data processing that aims to acquire knowledge from the information layers.

At the same time, basing on the thematisms of each example that compose the Best Practices Report, decision makers or professionals circumscribe a coherent selection with the specific aims.



(1) Assessment and compatibility check

Fig. 3 Second phase

In the second phase (Fig. 3) the output of the Territorial Interpretation defines the boundaries wherein selected case studies have to stay. This assessment among the multiple possible solutions is a compatibility check between the opportunities and limits of the territorial context and the specific goals that each example is able to reach (goals that depend on the specific aim).

In the following scheme (Fig. 4) logical connectors link all the issues and elements involved in the two phases.

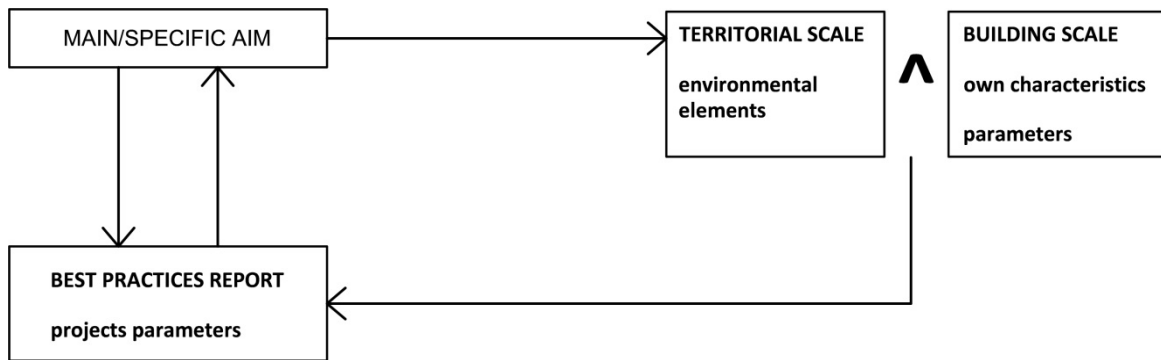


Fig. 4 Involved issues and elements

where:

- Environmental elements are: rows, plantings, hydro-net, land use, REN-regional ecological network, urbanized areas, infrastructures, restrictions;
- Own characteristic are: areas, year of building, state of preservation, state of use, function, restrictions;
- Parameters and projects parameters (a, b, c, d).

With reference to Fig. 4, Fig. 5 illustrates the techniques exploited in each passage.

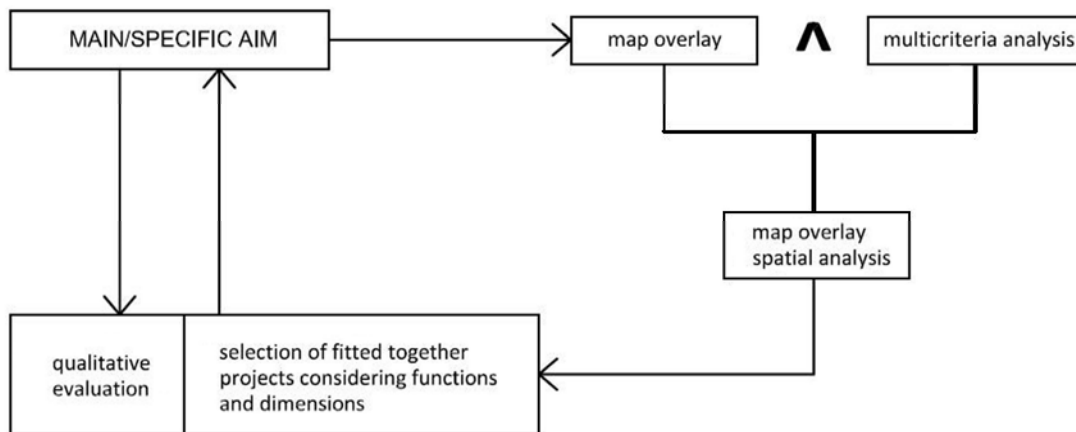


Fig. 5 Exploited techniques

Inside Territorial Scale box the technical operation is basically a map overlay; in Building Scale box the operations are based on a multicriteria analysis that uses the previous four criteria (Voogd 1983). In turn the crossroad of the two sets is assessed by map overlay and spatial analysis (Murgante, Borruso, Lapucci 2009; Murgante, Danese 2011): in this way the territorial interpretation guided by the specific aim is complete.

The qualitative evaluation is described in the next chapter. Once the territory is appropriately read, it is possible to choose the selected case study that fit with the territorial characteristics. In Tab. 1 there is a synthesis of the main considered elements and used techniques.

	TERRITORIAL SCALE	BUILDING SCALE
Data source and tools	Gis and cartography	Gis and cartography, hyperlink, bibliography, automatic survey
Data processing	Map overlay	Multicriteria evaluation
Elements	Water, soil and urban settlements	Casine: rural settlements

Tab.1 Synthesis of considered main elements and techniques

Fig. 6 reports an example (from ESRI ArcGIS) of an attribute table that contains all the information connected to a single rural settlement (specifically a so called “cascina”).

In addition to the physical parameters obtained by simple spatial interrogations, there is an evaluation of the previous four parameters (a, b, c, d) and the weights (a-Wn, b-Wn, c-Wn, d-Wn) assigned by planners or decision makers considering the specific aim.

OBJECTID	AREA	PERIMETER	STRA	DISTRATO	B development of cultural and tourist activities	w1	B-w1	C environment preserving	w2	C-w2	A development of local bust
1293	12771.8875	492.87014	CS	Cascina	10	0.85	8.5	10	1	10	
2106	21289.03125	703.5378	CS	Cascina	3	0.85	2.55	2	1	2	
459	16904.875	594.2498	CS	Cascina	9	0.85	7.65	5	1	5	
462	14373.59375	513.96254	CS	Cascina	6	0.85	5.1	3	1	3	
467	24695.21875	890.16105	CS	Cascina	2	0.85	1.7	1	1	1	
533	13477.84375	513.05709	CS	Cascina	7	0.85	5.95	5	1	5	
1164	23151.25	710.06556	CS	Cascina	7	0.85	5.95	8	1	8	
1206	13786.71875	545.21053	CS	Cascina	10	0.85	8.5	5	1	5	
1222	28407.15625	797.48959	CS	Cascina	5	0.85	4.25	3	1	3	
2564	26913.28125	953.88605	CS	Cascina	1	0.85	0.85	9	1	9	
2597	8951.3125	389.19354	CS	Cascina	2	0.85	1.7	2	1	2	
2651	17596.46875	535.45859	CS	Cascina	9	0.85	7.65	3	1	3	
2657	14634.90625	512.12111	CS	Cascina	3	0.85	2.55	8	1	8	
2743	25124.53125	837.55614	CS	Cascina	4	0.85	3.4	3	1	3	
2777	15246.53125	502.39371	CS	Cascina	6	0.85	5.1	8	1	8	
2801	20550.9	530.46959	CS	Cascina	5	0.85	4.25	3	1	3	
2854	21601.8125	637.72409	CS	Cascina	2	0.85	1.7	7	1	7	
2866	21204.40625	696.62402	CS	Cascina	8	0.85	6.8	5	1	5	

Fig. 6 A single rural settlement attributes table (software: ESRI ArcGIS)

4 QUANTITATIVE AND QUALITATIVE ASSESSMENT

It is necessary to specify in which way each project of the Best Practices Report can be assessed in a qualitative and in a quantitative way.

Following what previously mentioned, there are four main criteria that guided the cataloguing procedure. For each specific aim, criteria assume different relevance (or, in other words, each project may have marked performances for certain criteria).

In Fig. 7 there is an example of a qualitative assessment of a certain project. Each criteria is divided in sub-criteria that the project may satisfy or not.



Fig. 7 Example of qualitative assessment

In a quantitative assessment the cited relevance can be synthesized with a weight. The weights are assigned by decision makers, or experts such as planners and architects or also common people if the specific aim demands social involvement. A pairwise comparison is a diffuse methodology that is applied also in this case (Fig. 8).

Specific Aim				
	Local business	Culture + Tourism	Environment	Population
Local business				
Culture + Tourism				
Environment				
Population				

Evaluation	
Local business	x
Culture + Tourism	y
Environment	z
Population	t

Fig. 8 Example of quantitative assessment

In the compatibility check phase (the final phase of the entire procedure) decision maker compares real information about the minimum built units such as small rural settlements or “cascine” (described using the same parameters a,b,c,d) with the result derived from the qualitative or quantitative assessment of the case report.

Decision maker will select the projects that have performances similar to the studied minimum units.

Qualitative assessment could be transformed into a quantitative one throughout:

- A weighted sum of elements considering how many sub-criteria are satisfied. In Fig. 7 example “Local business” is 1 on 7, “Cultural + Tourism” is 1 on 7, “Environment” is 3 on 15 and “Population” is 1 on 7. These values may become fractions. Once a weight is associated to each parameter decision maker obtains a numerical value ($W_a \times 1/7 + W_b \times 1/7 + W_c \times 3/15 + W_d \times 1/7$). The value itself is not meaningful but it is useful to build a ranking among the selected case studies;
- The well known “Fuzzy logic” (Terai, Asano, Sugeno 1992; Borri, Concilio, Conte 1998) can be used to transform such qualitative evaluations (in fact, even if it is possible to define how many sub-criteria a project satisfies, this decision is always highly subjective). With Fuzzy Logic it is also possible to synthesized more complex evaluations derived from non expert judgments. Moreover Fuzzy is also useful in the final phase of compatibility check because the compatibility has often wide ranges of doubts and shades.

4 CONCLUSIONS

The research aimed to focus on methodological aspects that regard (and come from) different disciplines. Multidisciplinary is a keyword in recent times but it is not easy to define procedures that can put together quantitative and qualitative, and subjective and objective evaluations into a unique decision process.

The methodology is sufficiently general to be applied to very different contexts and some real applications are needed to test it.

Authors implemented quite all the passages in an automatic tool but some passages need a deeper review.

In example, a semantic indexation of the case study could furnish a more clear (and fast, once well tested) evaluation of the multitude of projects that may respond with more or less coherence to specific needs.

The complete computerization of the process is the main aim that authors would like to reach but the resulting system will always be a DSS in which decision maker interact in all the steps and can control each weight basing on specific aim or personal considerations.

The last passage that still must be faced is the GUI. The interface depends on the typology of users that the system is addressed to and at the moment no specific profile has been defined. Surely authors will start with expert users.

REFERENCES

- AA.VV. (2009), I centri minori: recupero e valorizzazione: atti della XV conferenza internazionale Vivere e camminare in città 2008, EGAF Edizioni, Forlì.
- AA.VV. (1998), Il paesaggio lombardo. Identità, conservazione e sviluppo, (ed. by) Benetti D., Langé S., Cooperativa Editoriale Quaderni Valtellinesi, Sondrio.
- Anderberg M.R. (1973), Cluster Analysis for applications, Academic Press, INC., New York.
- Blaschke T. (2006), "The role of the spatial dimension within the framework of sustainable landscape and natural capital" In: *Landscape and Urban Planning*, Volume 75, Issue 3-4, 198-226.
- Borri D., Concilio G., Conte E. (1998), A fuzzy approach for modelling knowledge in environmental system evaluation, *Comp. Environm. and Urban System*, vol. 22, n. 3, 299-313.
- Camiz S. (2004), Analisi esplorative di dati multidimensionali, tutorial per corso universitario presso Università di Roma "La Sapienza".
- Cano M., Garzon E., Sanchez-Soto P.J. (2013), "Historic preservation, GIS, & rural development: the case study of Almeria province, Spain" In: *Applied Geography*, n. 42, 34-47.
- Carboz A. (1998), Ordine sparso. Saggi sull'arte, il metodo, la città e il territorio, (ed. by) P. Viganò, Franco Angeli, Milano.
- Densham, P.J. (1991), "Spatial Decision Support Systems" In: McGuire, D.J., Goodchild, M.S., Rhind, D.W. (eds.) *Geographical Information Systems: principle and application*, Longman, England.
- Fayyad U., Piatetsky-Shapiro G., Smyth P. (1996), "From Data Mining to Knowledge Discovery: An Overview" In: Fayyad U., Piatetsky-Shapiro G., Smyth P., Uthurusamy R. (eds.) *Advances in Knowledge Discovery and Data Mining*, AAAI Press/The MIT Press.
- Frampton K. (1991), "In search of the Modern Landscape" In: AA.VV., *Denatured visions. Landscape and culture in the Twentieth century*, Published by The Museum of Modern Art, New York.
- Fuentes, J.M. (2013), "Methodological bases for documenting and reusing vernacular farm architecture" In: *Journal of Cultural Heritage*, Volume 11, Issue 1, 119-129.
- Getis A., Ord J.K. (1992), "The analysis of spatial association by use of distance statistics" In: *Geo-graphical analysis*, Volume 24, Issue 3, 189-206.
- Jambu M., Lebeaux M.O. (1983), Cluster Analysis and data analysis, North Holland Publishing Company, Amsterdam.
- Jongam R.H.G. (2002), Landscape Planning for Biological Diversity in Europe, (Eds.) Routledge, Oxford UK.
- Keenan, P. B. (2003), "Spatial Decision Support Systems" In: Mora M., Forgionne G., and J. N. D. Gupta J.N.D. (Eds.) *Decision Making Support Systems: Achievements and challenges for the New Decade* Idea Group, 28-39.
- Malczewski J. (1999), GIS and Multicriteria Decision Analysis, John Wiley & Sons Inc., New York.
- Multiplicity.lab, Centro Studi PIM, Comune di Milano (2009), Le cascine di Milano verso ed oltre Expo 2015; un sistema di luoghi dedicati all'agricolture, all'alimentazione, all'abitare e alla cura.

Murgante B., Borruso G., Lapucci A. (2009), "Geocomputation and urban planning" In: Murgante, B., Borruso, G., Lapucci, A. (Eds.), *Geocomputation and Urban Planning Studies in Computational Intelligence*, vol.176. Springer-Verlag, Berlin, 1-18.

Murgante B., Danese M. (2011), "Urban versus Rural: the decrease of agricultural areas and the development of urban zones analyzed with spatial statistics" In *Special Issue on Environmental and agricultural data processing for water and territory management*, International Journal of Agricultural and Environmental Information Systems (IJAEIS), Volume 2, Issue 2, 16-28.

Murgante B., Danese M., Las Casas G. (2012), Analyzing Neighbourhoods Suitable for Urban Renewal Programs with Autocorrelation Techniques, *Advances in Spatial Planning*, (Eds.) Dr Jaroslav Burian InTech.

Seddon G. (1986), "Landscape planning: a conceptual perspective" In: *Landscape and Urban Planning*, Volume 13, 335-347.

Spaziante A., Murano, C. (2009), "Rural development programs and strategic environmental assessment: towards a sustainable rural territory" In: *International Journal of Agricultural Resources, Governance and Ecology*, Volume 8, Issue 2, 205-223.

Terano T., Asai K., Sugeno M. (1992), *Fuzzy system theory and its applications*, Academic Press, San Diego, California.

Thompson W.J., Sorving K. (2000), *Sustainable landscape construction*, Island Press, Washington DC.

Spath H. (1980), *Cluster Analysis Algorithms for data reduction and classification of objects*, Ellis Horwood Limited, Chichester UK.

Van der Vaart J.H.P. (2005), "Towards a new rural landscape: consequences of non-agricultural re-use of redundant farm buildings in Friesland" In *Landscape and Urban Planning*, n.70, Issue 1, 143-152.

Voogd H. (1983), *Multicriteria evaluation for urban and regional planning*, Pion, London.

Wang Z.J., Feng S. (1992) Expert system – based decision support system, workshop on Support Systems for Decision and Negotiation Processes.

IMAGES SOURCES

Fig. 7: <http://www.raintensification.com/#!home-english/ceab>

AUTHORS' PROFILE

Roberto De Lotto

Associate Professor in Urban Planning, DICAR/Department of Civil Engineering and Architecture, University of Pavia.

Tiziano Cattaneo

Assistant Professor in Architectural Composition, DICAR/Department of Civil Engineering and Architecture, University of Pavia.

Cecilia Morelli di Popolo

PhD student in Building Engineering/Architecture XXVI cycle, DICAR/Department of Civil Engineering and Architecture, University of Pavia.

Elisabetta Maria Venco

PhD student in Building Engineering/Architecture XXIX cycle, DICAR/Department of Civil Engineering and Architecture, University of Pavia.

Sara Morettini

Scholarship holder in Urban Planning, UPLab (Urban Planning Laboratory), DICAR/Department of Civil Engineering and Architecture.

Susanna Sturla

Scholarship holder in Urban Planning, UPLab (Urban Planning Laboratory), DICAR/Department of Civil Engineering and Architecture.