

Antonio Leone Carmela Gargiulo
Editors

Environmental and territorial modelling for planning and design



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Smart City, Urban Planning for a Sustainable Future

4

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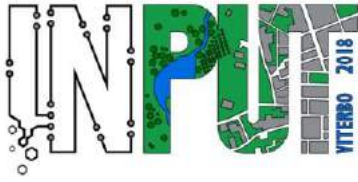
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This book collects the papers presented at the 10th International Conference INPUT 2018 which will take place in Viterbo from 5th to 8th September. The Conference pursues multiple objectives with a holistic, boundary-less character to face the complexity of today socio-ecological systems following a systemic approach aimed to problem solving. In particular, the Conference aims to present the state of art of modelling approaches employed in urban and territorial planning in national and international contexts.

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This book is the latest scientific contribution of the "Smart City, Urban Planning for a Sustainable Future" Book Series, dedicated to the collection of research e-books, published by FedOAPress - Federico II Open Access University Press. The volume contains the scientific contributions presented at the INPUT 2018 Conference and evaluated with a double peer review process by the Scientific Committee of the Conference. In detail, this publication, including 63 papers grouped in 11 sessions, for a total of 704 pages, has been edited by some members of the Editorial Staff of "TeMA Journal", here listed in alphabetical order:

- Rosaria Battarra;
- Gerardo Carpentieri;
- Federica Gaglione;
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- Rosa Morosini;
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The most heartfelt thanks go to these young and more experienced colleagues for the hard work done in these months. A final word of thanks goes to Professor Roberto Delle Donne, Director of the CAB - Center for Libraries "Roberto Pettorino" of the University of Naples Federico II, for his active availability and the constant support also shown in this last publication.

Rocco Papa

Editor of the Smart City, Urban Planning for a Sustainable Future" Book Series
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Table of contents

Introduction **13**

Session 1 - Territorial modelling: state-of-art and future development

An integrated evaluation model for shaping future resilient scenarios in multi-pole territorial systems **17**

Vanessa Assumma, Marta Bottero, Roberto Monaco, Ana Jacinta Soares

Features of agents' spatial knowledge in planning open spaces. A pilot study **25**

Domenico Camarda, Giulia Mastrodonato

Agent-based modelling and geographic information system for evaluation of eco-district's scenarios **35**

Caterina Caprioli, Marta Bottero

Land development support in marginal areas. An opportunity of environmental quality implementation **47**

Elena Cervelli, Stefania Pindozi, Donatella Cialdea

Landscape urbanism's interpretative models. A new vision for the Tiber river **57**

Donatella Cialdea, Chiara Pompei

The land of the border **69**

Silvia Dalzero

The territorial frames. A new integration model for local development **79**

Donato Di Ludovico, Federico d' Ascanio

Supporting retail planning with territorial models. Approaches, innovations and opportunities **87**

Giorgio Limonta, Mario Paris

Geosimulation methods for settlement morphologies analysis and territorial development cycles **105**

Giampiero Lombardini

Session: 2 - Environment, planning and design: the role of modelling

Climate change and coastal cities. A methodology for facing coastal flooding **115**

Carmela Gargiulo, Rosaria Battarra, Maria Rosa Tremiterra

Ecosystem Services for spatial planning. A remote-sensing-based mapping approach **127**

Davide Longato, Denis Maragno, Francesco Musco, Elena Gissi

Integrating participatory modelling in risk management **139**

Giulia Motta Zanin, Stefania Santoro

Surface temperature variation and urban heat island intensity in Antofagasta, Chile **147**

Massimo Palme, Francisco Flores, Leonardo Romero

The places and times in risk management. The case of the school system **159**

Francesca Pirlone, Ilenia Spadaro

Distributed delay models. A proposal of application in urban context to forecast pest insects' life cycle <i>Luca Rossini, Maurizio Severini, Mario Contarini, Stefano Speranza</i>	169
--	------------

Session 3 - Rural landscapes and well-being: towards a policy-making perspective

Spatial relations in the benefits from ecosystem services. The case study of Bratsigovo municipality <i>Angel Petrov Burov</i>	179
Historical land use change and landscape pattern evolution study <i>Elena Cervelli, Ester Scotto di Perta, Annalisa di Martino, Salvatore Faugno, Stefania Pindozi</i>	189
Landscape defragmentation policy and planning. An assessment of strengths and weaknesses <i>Andrea De Montis, Antonio Ledda, Vittorio Serra</i>	199
Governance and adaptation to climate change. An investigation in Sardinia <i>Andrea De Montis, Antonio Ledda, Elisabetta Anna Di Cesare, Daniele Trogu, Michele Campagna, Gianluca Cocco, Giovanni Satta</i>	207
Integrating climate change adaptation into SEA. An assessment for Sardinia, Italy <i>Andrea De Montis, Elisabetta Anna Di Cesare, Antonio Ledda, Daniele Trogu, Michele Campagna, Gianluca Cocco, Giovanni Satta, Agnese Marcus</i>	215
Modis data for detection of landscape changes by oil palm plantations in Borneo <i>Samuele De Petris, Piero Boccardo, Barbara Drusi, Enrico Borgogno Mondino</i>	223
Water technologies and rural landscapes in the Apulia region. Multi-sectoral and multi-functional approaches to analysis and planning <i>Laura Grassini</i>	231
Natural rural landscape perception and restorativeness <i>Giulio Senes, Luca Pernechele, Rita Berto, Natalia Fumagalli, Giuseppe Barbiero</i>	243
Evaluating ecological connectivity in cultivated and urbanized areas at landscape scale. A case study in the North-East plain area of Italy <i>Maurizia Sigura, Marco Vizzari, Francesco Boscutti</i>	257

Session 4 - Smart planning

Analysis of zoning plan changes in an urban regeneration area <i>Burcu Aslan, Cankut Dağdal Ince</i>	269
Italian metropolitan cities. A quantitative analysis aimed at the implementation of governance and innovation policies <i>Giuseppe Mazzeo</i>	281
Classifying railway station catchment areas. An application of node-place model to the Campania region <i>Rocco Papa, Gerardo Carpentieri</i>	299

Session 5 - Maintenance, upgrading and innovation in cultural heritage

Social construction of space in heritage conservation. Geo-mining Park in Sardinia <i>Nada Beretić, Arnaldo Cecchini, Zoran Đukanović</i>	323
Enhance the historical city with new technologies <i>Francesco Botticini, Michele Pezzagno, Michela Tiboni</i>	331
The chartreuse in Calci. Application of a multi criteria decision making method (MCDM) to its functional recovery <i>Ewa Karwacka, Luisa Santini, Denise Italia</i>	341
Spatial data infrastructure in historical contexts. The case study of Matera <i>Piergiuseppe Pontrandolfi, Antonello Azzato</i>	357
On restoring and reviving lost religious buildings. Multi criteria analysis techniques to address an increasingly underused patrimony <i>Elisabetta Pozzobon, Luisa Santini, Alessandro Santucci</i>	369

Session 6 - Urban and environmental planners: who is the client? The planners jobs in a new millennium

Gap Reduce. A research & development project aiming at developing a tool for promoting quality of urban life of people with autism spectrum disorder <i>Tanja Congiu, Francesco Lubrano, Luca Pilosu, Pietro Ruiu, Valentina Talu, Giulia Tola, Giuseppe Andrea Trunfio</i>	383
Biourbanism. The role of environmental systems in urban regeneration processes <i>Mauro Francini, Lucia Chieffallo, Annunziata Palermo, Maria Francesca Viapiana</i>	393
Environmental criteria. Consistency between the Minimum Environmental Criteria and the Itaca Protocol criteria concerning the quality of the intervention site <i>Mauro Francini, Giusi Mercurio, Annunziata Palermo, Maria Francesca Viapiana</i>	401
G3w-suite, publishing and managing cartographic Qgis projects on the web. The use in "Foreste Casentinesi, Monte Falterona e Campigna" National Park <i>Walter Lorenzetti, Francesco Boccacci, Leonardo Lami, Davide Alberti, Matteo Ruocco</i>	409

Session 7 - Big data and data mining

Tangible and intangible aspects in the promotion and fruition of the UNESCO sites. A case of sustainable innovation <i>Marichela Sepe</i>	417
--	------------

Session 8 - ICT & models: planning for communities

Toward clarification of meanings via ontological analysis method in environmental planning processes and actions <i>Domenico Camarda, Maria Rosaria Stifano Melone, Stefano Borgo, Dino Borri</i>	427
--	------------

Implementing GIS technology. A spatial decision support system tool to study the impacts of land uses <i>Tullia Valeria Di Giacomo</i>	437
Augmenting the Smart City. A "new view" for the urban planning <i>Romano Fistola, Rosa Anna La Rocca</i>	449
Regenerate, retrain, reuse. A GIS based on spatial multi criteria analysis for the redevelopment of abandoned military areas in Pisa <i>Anna Maria Miracco, Luisa Santini, Alessandro Santucci</i>	461
Opportunities for the use of collaborative 3D mapping in post-disaster situations <i>Camilla Pezzica, Valerio Cutini, Clarice Bleil de Souza</i>	475

Special session 1: Did we learn lessons? Following the paths of Giovanni Rabino

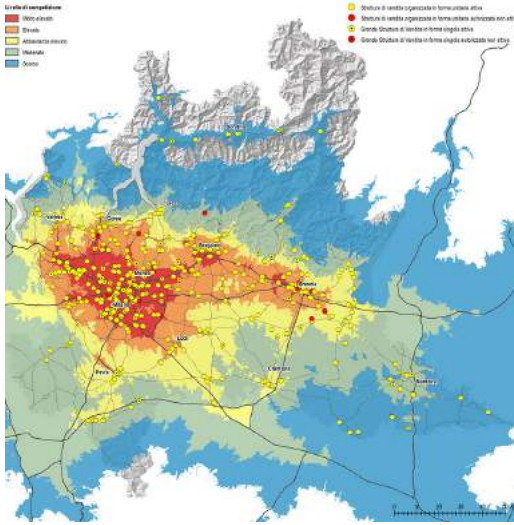
Models at the time of weak planning. Their role, if any <i>Valerio Cutini</i>	483
Informal settlements, complexity and urban models. Is there any order in autopoietic urban systems? <i>Valerio Cutini, Valerio Dipinto</i>	491
From the rules to the models and vice-versa for a new planning rationality <i>Giuseppe B. Las Casas, Beniamino Murgante, Francesco Scorza</i>	499
A meta-model of regional transportation planning: the case of Piedmont <i>Sylvie Occelli</i>	509

Special session 2: Ecosystem-based and performance-based approaches for spatial planning

Ecosystem services and ecological networks. A case study from Flanders <i>Ignazio Cannas, Daniela Ruggeri</i>	531
Resilient criteria for strategic road network <i>Mauro Francini, Sara Gaudio, Annunziata Palermo, Maria Francesca Viapiana</i>	543
Inclusion of ecosystem-based approaches in the regulations of marine protected areas. An experimental procedure developed in Sardinia. Part 1 <i>Federica Isola, Francesca Leccis</i>	551
Inclusion of ecosystem-based approaches in the regulations of marine protected areas. An experimental procedure developed in Sardinia. Part 2 <i>Maddalena Floris, Salvatore Pinna</i>	561
Spreading green infrastructure-related benefits a study concerning Sardinia, Italy <i>Sabrina Lai, Federica Leone, Corrado Zoppi</i>	569
What planning for facing global challenges? approaches, policies, strategies, tools, ongoing experiences in urban areas <i>Gabriella Pultrone</i>	577
Ecology-based planning. Italian and French experimentations <i>Angioletta Voghera, Benedetta Giudice</i>	589

Special session 3: Geodesign

The geological workshop of geodesign for landscape planning <i>Pedro Benedito Casagrande, Ana Clara Mourão Moura</i>	595
A hybrid decision-making process for wastescapes remediation. Geodesign, LCA, urban living lab interplay <i>Maria Cerreta, Pasquale Inglese, Chiara Mazzarella</i>	603
Towards a novel approach to geodesign analytics <i>Chiara Cocco, Michele Campagna</i>	611
Facing urban regeneration issues through geodesign approach. The case of Gravina in Puglia <i>Pietro Fiore, Angela Padula, Angela Pilogallo, Francesco Scorza</i>	619
A geodesign project on Post-Earthquake rehabilitation. Co-designing a strategy for Norcia <i>Francesco Fonzino, Emil Lanfranchi</i>	633
Complementary web-based geoinformation technology to geodesign practices. Strategic decision-making stages of co-creation in territorial planning <i>Ana Clara Mourão Moura, Simona Tondelli, Aurelio Muzzarelli</i>	643
Collaborative approach in strategic development planning for small municipalities. Applying geodesign methodology and tools for a new municipal strategy in Scanzano Jonico <i>Angela Padula, Pietro Fiore, Angela Pilogallo, Francesco Scorza</i>	665
The application of geodesign in a Brazilian illegal settlement. Participatory planning in Dandara occupation case study <i>Susanna Patata, Priscila Lisboa De Paula, Ana Clara Mourão Moura</i>	673
From the logic of desktop to web services applications in GIS. The construction of basic evaluation maps to support urban planning and co-design. <i>Nicole Andrade Rocha, Ana Clara Mourão Moura, Hrishikesh Ballal, Christian Rezende, Markus Neteler</i>	687



SUPPORTING RETAIL PLANNING WITH TERRITORIAL MODELS

APPROACHES, INNOVATIONS AND OPPORTUNITIES

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ABSTRACT

Over the last twenty years, Italy experimented a deep transformation of its socio-economic and technologic conditions, which influenced, among others, shopping habits and customers' consumption practices. In retail sectors these changes, overlay with an incremental deregulation process, that had a strong spatial impact related with the competitions of brands and formats, offer systems, etc. At regional scale, the evolution of national regulation produced multi-channel systems marked by a heterogeneous complexity. Policy community needs innovative tools able to support an effective governance for sectoral planning and its territorial impacts. The aim of this paper is discussing different territorial models that authors implemented within the recent activities of URB&COM Lab (PoliMI), analyzing Lombardy region and especially the network of "retail polarities" that currently shows specific development trends as new openings, refurbishments, re-location, crises and dismantling, demalling, etc. which have effects on the whole system, integrating – and often competing with – the offer of urban retail systems. We present two different approaches to the modeling using as a support to the public strategies, that take in consideration "static" and "dynamic" data. The integration of these two approaches produces usable descriptions of current regional market competition and of the attractiveness – and the performance – of the retail polarities. Therefore, we explored the potential combination of those models with specific focuses based on Google Places service, that allow reflections about consumption practices and their working profiles. The result is an updated, interactive and original knowledge, that supports sectoral and territorial planning, providing a new, integrated point of view about retail poles and their impact on regional scale.

KEYWORDS

Urban retail systems, Retail poles, Demalling, Spatial descriptions as usable knowledge

1 INTRODUCTION¹

Over the last twenty years, Italy, as many others European countries, experimented a deep transformation of its socio-economic and technologic conditions, which influenced, among others, shopping habits and customers' consumption practices (Pellegrini & Zanderighi, 2013). In retail sectors these changes, overlay with an incremental deregulation process, which follows an incremental business deregulation process (D.Lgs. 114/98, L. 248/2006 and the D.Lgs. 59/2010, the last one is the Italian declination of European regulation about competition EU Directive on services in the internal market 2006/123/EC, commonly referred as the Bolkestein Directive), had a strong spatial impact related with the competitions of brands, formats, offer systems, etc. At regional scale, the evolution of national regulation produced multi-channel systems marked by a heterogeneous complexity. Policy community needs innovative tools able to support an effective governance for sectoral planning and its territorial impacts.

The aim of this paper is discussing different territorial models that authors implemented within the recent activities of URB&COM Lab of the Politecnico di Milano, analyzing the Lombardy region and especially the network of "retail polarities" (Morandi & Paris, 2015) (Shopping mall, Big Boxes, etc.) that currently shows specific development trends as new openings, refurbishments, re-location, crises and dismantling, demalling, etc. (Cavoto & Limonta, 2015; Cavoto, 2014) which have effects on the whole system, integrating – and often competing with – the offer of urban retail systems (high streets, food hall, aggregates of traditional shops).

In the following section, we reflect about disciplinary tools and sectoral approaches, and the need to increase our knowledge about retail phenomena and their influences and opportunity in territorial governance (2.). Therefore, we present two different approaches to the modeling using as a support to the public strategies, that take in consideration "static" and "dynamic" data. Resulting maps show the spatial distribution of current retail system in the Region, and their attractive power.

The integration of these two approaches produces useful and effective descriptions of current regional market competition and defines several factors that influence the attractiveness – and the performance of footfall (visitors/year) – of the retail polarities. Therefore, we explored the potential combination of those models with specific focuses based on Google Places, a web service containing useful data about visitors' flows for a variety of relevant functions (3.).

The result is an updated, interactive and original knowledge about Lombardy region, that supports sectoral planning and territorial governance, providing a new, integrated point of view about retail poles and their impact on regional scale (4.).

2 LEARNING FROM LOMBARDY REGION: A MULTICHANNEL, INTEGRATED AND COMPETITIVE MARKET FOR RETAIL COMPANIES

Since 1998, Lombardy Region represents the most relevant market in Italy for retail companies in terms of number of local units and business, heterogeneity of brands, offers and innovation in concepts and formats.

¹ Although this paper should be considered a result of the common work of the two authors, M. Paris took primary responsibility for the section "2. Learning from Lombardy Region: a multichannel, integrated and competitive market for retail companies" and G. Limonta for the section "3. Supporting territorial governance through not-conventional readings of spatial distribution of retail poles" meanwhile the Introduction and Conclusions are a product of the shared reflections between the two authors.

Moreover, the spatial distribution of retail services is not homogeneous over the region and one of its key features is the interaction of planned retail poles (Brunetta and Morandi, 2009; Paris, 2014) – as large specialty stores (RICS, 2018), shopping malls, retail parks, etc. -, that have been developed between late 90s and the 2010 and existing urban systems. Due to the crisis of 2008, the development of this network slowed down but, in recent times and following European trends, it evolved in a new phase, marked by several trends that we will point out in the next section (2.1), that produced a need of new tools and approaches to support public actions (2.2).

2.1 THE EVOLUTION OF REGIONAL RETAIL MARKET

The evolution of Lombardy retail market shows a complexity that produced transformations, affecting the consolidate status of existing retail systems and producing new trends (Limonta and Paris, 2017a). These transformations depend on a set of different strategies implemented by operators – and sometime suggested by public policies – to face off structural and contingent crisis (2008-2016) after an expansive phase (1998-2008). The final result is an articulated multichannel system composed by different kinds of offer. Major two - planned retail poles and urban retail systems - show specific peculiarities, that increase the overall complexity of the regional scenario. The result of the interaction between different typologies produces an over-dimensioned offer of retail functions, that is changing due to selective processes of adaptation to new market conditions and consumption behaviors (Tamini, 2018; Tamini and Zanderighi, 2017).

Retail poles

Four main trends marked the evolution of planned retail poles:

- The opening and the development of new venues that aim to achieve a role of centrality in regional space, due to their larger and larger dimension and functional complexity, where the consumption of goods, services and experiences produces a strong attractiveness of these “poles” that serve catchment areas that exceed their close contexts (Morandi e Paris, 2015) and achieve provincial and regional dimensions;



Fig. 1 The stock of 327 existing shopping malls in Lombardy Region classified by the ratio Authorized Sales Area and GLA (URB&COM Lab., 2018)

- The refurbishment of existing shopping malls, that aims to reinforce their role in an increasingly competitive market;
- The integration of retail with other specialized functions related with entertainment and leisure, culture, sport and horeca activities;
- In parallel with the inertia of suburban poles, it appears an increasing decommissioning of consolidate stock. Those structures less innovative and attractive suffer a process of accelerated obsolescence, especially where the offer is sprawled and not attractive for users/customers. Therefore, operators of large retail companies and real-estate developers explore a variety of demalling strategies aimed at regenerating deadmalls and gothboxes (Cavoto and Limonta, 2015; Cavoto, 2014).



Fig. 2 Le Acciaierie in Cortenuova (BG) – exterior of an abandoned shopping mall, opened in 2005 closed in 2014 (URB&COM Lab., 2018)

Urban retail systems

In Lombardy, together with planned retail poles, a variety of spontaneous or "natural" retail systems located in urban contexts resists. In many cases, they show certain resilience and vitality, representing an alternative to suburban shopping malls. Urban retail aggregates are characterized by the agglomeration of economic activities on the ground floor, that configure high streets or vibrant squares, where retail functions (not only corner shop but also arcades, urban shopping malls, supermarket and superette) match and coexist with other commercial activities (craftsman, restaurant and café, creative and cultural industries, culture and entertainment, advanced services, etc.). In other cases, retail and commercial activities does not create those agglomerations and their fragmentary spatial distribution don't produce any synergy or added value in terms of attractiveness. In recent publication², we focused on municipal retail trends to describe the fragility of retail

² The article presents the outcome of their research agreement within Urb&Com Lab – DASTU, Politecnico di Milano and Polis-Lombardia, entitled "*Analisi delle criticità e delle opportunità di sviluppo del fenomeno della dismissione commerciale ai fini dell'attrattività urbana*" coordinated by Prof Luca Tamini, within the research project "*Attuazione strategie europee 2014/2020: individuazione priorità e linee di azione ed evento di confronto sulle tematiche del commercio tra le Regioni dei Quattro motori*" financed by Èupolis Lombardia (Decrete no. 2771 of 1 October 2014).

systems through a complex indicator (Limonta and Paris, 2017b)³. These focuses depict a rich variety of situations, with some municipalities under pressure due to the attractiveness of planned retail poles and other local retail systems. These maintain a vital economic presence and a potential local retail system that are not weakened by competition (as in major cities - as Milano, Bergamo, Brescia and Monza - and the municipalities along the Milan-Turin motorway), and in some instances they are improved by the compactness (as in Milan and some peripheral municipalities).

Together with these trends we should take in account other kind of factors that influence consumption practices of Lombardy Region, as the increasing role of ecommerce, or a progressive shift from a consumption economy to a sharing one, etc. that integrate - and sometime, compete - with traditional offers. Despite the relevance of these issues, in this contribution we will focus more in these aspects related with the physical retail network, leaving these digital or immaterial topics - and their material supports - as background. Therefore, in the next session we will point our reasons and opportunities for a change in the approach to retail system in policy community.

2.2 A NEED OF NEW TOOLS AND APPROACHES FOR POLICY COMMUNITY

In Lombardy, current conditions of retail system offer to customers the opportunity to differentiate their behaviors, choosing from time to time among a variety of different options. They develop their consumption habits, considering a variety of criteria (as easy access and proximity, low prices, products' quality and merchandising mix, opening time, but also quality of contexts and urban environment, richness of consumption experiences and functional mix, etc.).

This process produced a set of deep influences in retail companies, affecting their market strategies, their settlement behaviors and their branding and marketing policies. The result has been a progressive transformation of retail offer, in which we pointed out an incremental market saturation and an adaptive evolution of existing network, where co-exist different dynamics.

The co-action of these factors affects not only on retail field, but influences flows and infrastructural patterns, employment and social practices, local and regional economies, territorial attractiveness and urban vibrancy, safety and the quality of built environment, etc.

The result is a complex dimension, which cannot be explained only through sectorial logics and which must be considered in public policies, as a field which influences territorial growth and its sustainable development, and where a governance is needed. Therefore, it emerges a demand for new spatial descriptions, that exceed the conventional and over-simplified current narratives of retail phenomena.

This original, specific and orientated spatial knowledge could be used to comprehend current territorial realities and to define specific strategies and actions. Moreover, these new readings, based on data and interpretative keys, must be open, transcalar and interacting. They should allow a systemic view of the retail dynamics and framing them in their territorial and relational dimension.

³ Data was obtained from a regional observatory, in order to track the evolution of municipalities in the period 2008-2011 and understand the dynamics of local networks of stores (increasing, balance, decreasing). The was then cross referenced with ISTAT data from the Industry and Services Census 2001 and the Industry, Services, and Non-profit Institutions Census 2011, regarding all retail activities (horeca, services, handicrafts, etc.) that were usually part of the shopping experiences of users.

3 SUPPORTING TERRITORIAL GOVERNANCE THROUGH NOT-CONVENTIONAL READINGS OF SPATIAL DISTRIBUTION OF RETAIL POLES

In a recent research⁴, we explored an approach oriented to the description of Lombardy Region retail poles system, in which produced cartographies and elaborated data have supported the definition of new regulative tools for traffic assessment and infrastructure management.

The aim was providing to decision-makers and private operators an assessment tool for the attractiveness of retail poles able to estimate the footfall (and from this, the number of cars and generated trips) for each structure. Our aim was the definition of a protocol able to define flows distributed during the week and their succession during the day.

Our proposal uses different kind of materials, mixing "static" data (location, dimension, offered products, etc.) with "dynamic" information in which we take in account relative positions of poles, their interactions and the attractiveness of their formats (especially when they integrate more functions or propose specialized offers). Testing this approach, we integrated the reflection with an exploration on Google Places data, that could support with an on-time update these focuses.

This spatial description allowed us to:

- Identifying municipalities affected by a new opening (or refurbishment) taking in account its format, its dimension and the integrated functions offered within the retail pole. Therefore, we quantified the potential basin of a specific venue in terms of attracted inhabitants and, consequently, the number of families and vehicles potentially attracted by the structure (3.2);
- Quantifying the pole attractiveness through the involvement of original models⁵ that take in account the presence of competitors within the specific basin of each structure and the resulting competitive market (3.3);
- Focusing on directions and rates of visitors' flows, distributing them on infrastructure networks that serve any pole according to its ranking (motorway, state/provincial route or local one), its features (speed expected, existing traffic, etc.) and performance potentials (3.4).

3.1 STATIC DATA: DESCRIBING THE SPATIAL DISTRIBUTION OF RETAIL SYSTEMS

In the first focus, we represented the spatial distribution of poles according to the data provided by the Opendata services of Lombardy Region⁶ considering their dimensions and their typologies. Therefore, we provided a specific focus for those poles "organized in unitary form" (*Grandi Strutture di Vendita organizzate in forma unitaria*) and the large specialty stores (*Grandi Strutture di Vendita organizzate in forma singola*) as

⁴ Developed within the Research Agreement between Polis-Lombardia (I) and DASTU – PolIMI, titled "Valutazione del traffico generato/attratto da trasformazioni urbanistiche-insediative e da grandi strutture di vendita", coordinated by P. Beria and where authors took part as members of research team (headed by L. Tamini) in 2017-2018. Urb&Com Lab has been called to (a.) Defining the spatial distribution of retail poles (Shopping mall, big-boxes, FOC, etc.) in Lombardy, (b.) Interpreting the regional context, (c.) Focusing on rhythms and cycle of attractiveness through Google Places data, (iv.) Supporting the definition of the new regulative approach.

⁵ Gravitation model that the Lombardy regional authority implemented a gravitation model for the assessment of impacts on labour market of new openings of retail poles (DGR X/1193, cfr. 3.2.2). The base for those quantifications is our re-interpretation of this model, in which we applied the same variable of distance (measured in travel time) to identify the real attractive potential of each structure for visitors.

⁶ <https://dati.lombardia.it/>

defined in section 2 "*Definizioni e altre disposizioni comuni*" of D.G.R. X/1193 del 20 dicembre 2013, the regional law that provide a specific taxonomy for these structures.

Poles organized in unitary form

This channel comprehends: Shopping malls (with its declinations "Aggregated shopping mall" and "Multi-functional shopping mall"), Factory Outlet Centres (FOC) and Retail parks. Together with these elements, we took in consideration also the Entertainment centers (which are sometimes integrated by retail functions) and the cinema multiplexes.

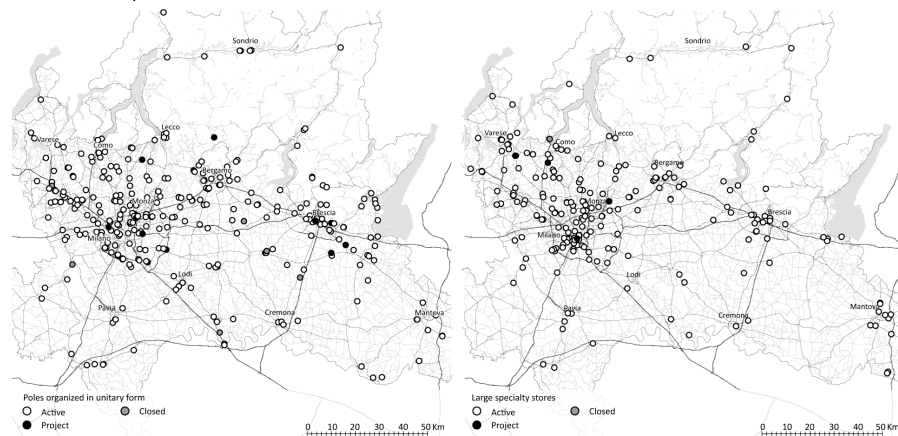


Fig. 4 Retail poles in Lombardy Region: Poles organized in unitary form (left) and large specialty stores (right)

Although they are not retail poles, we decided to involve also these specialized aggregated because we considered important attractors, and they produce spatial habits for their users that integrate the retail poles' ones. Therefore, we compared the regional data with many DBs, produced by different players (associations, think tanks, specialized journals, etc.) that provided other kind of information (GLA, number of existing shops, functional mix, brands, etc.) that are not contained within the regional database.

POLES	AMOUNT	TIPOLOGY	AMOUNT
Active retail poles	309	Shopping malls	198
		Multifunctional shopping malls	19
		Retail parks	73
		Multifunctional retail parks	4
		Factory Outlet Centres (FOC)	2
Projects	16	Entertainment centre and multiplexes	13
		Shopping malls	11
		Retail parks	3
		Factory Outlet Centres (FOC)	1
Dismantled/abandoned	7	Entertainment centre and multiplexes	1
		Poles organized in unitary form	6
Total	332	Entertainment centre and multiplexes	1

Tab. 1 Retail poles in Lombardy Region: Poles organized in unitary form

Large specialty stores

Together with the poles organized in unitary form, they appear 228 other structures (221 active, 4 projects and 3 dismantled/abandoned), organized as large specialty stores with different merchandising offers. Amongst active authorizations, it emerges the role of "Large general merchandise stores", that involved food dealers and supermarkets, and "Furnitures stores", with relevant companies as IKEA and other players.

POLES	TIPOLOGY	AMOUNT	SURFACE (sqm)
Active retail poles and projects	Sportswear and accessories	8	28,070
	Clothing and accessories	38	139,136
	Bricolage	23	137,440
	Large general merchandise stores (hypermarkets, superstores, etc.)	93	343,492
	Consumer electronics	5	20,403
	Department stores	6	59,906
	Furniture	46	270.746
	Dealerships	1	3,163
	Others	5	10,625
Total		225	

Tab. 2 Large specialty stores: merchandising mix

Looking at spatial distribution, there is a strong correspondance among retail poles and population density (Cavoto and Limonta, 2015), especially for the metropolitan corridor that links the cities of Milan, Bergamo and Brescia. But other conditions characterize a number of spaces where retail poles show specific settlement practices:

- Role of relevant infrastructures and major roads. Therefore, locations along these axis – or better, in their crossroads - maximize the potential attractiveness of the commercial structures (as in pre-alpine valleys, i.e. Val Seriana, Val Trompia, Valtellina)
- Tourists' presence, as in the area of Lakes (Garda, Como, Iseo) provides a number of no-resident users for retail poles;
- High competition for local markets where the proximity achieves a strong relevance. In these areas, there is a strong reduction in attractiveness – and consequently, in profitability - for retail poles that brings, in extreme cases, processes of progresive crisis and dismantling (as in the area of Pianura Padana).

3.2 DYNAMIC DATA: ATTRACTIVENESS AND VISITORS

Once portraited the spatial distribution of retail poles in Lombardy, we focused on their attractiveness as a relevant variable to define the competitive scenario for the region. In this case, we moved to "dynamic" data, focusing on the power of these spaces to entice visitors, due to their format (that depends to the management skills of tenant/developers) and their accessibility (relationship with infrastructures).

This task was aimed to defining a model of their attractiveness that exceeds the idea of "the largest, the most catching", focusing on their territorial role and taking in account specific characteristics of every poles.

TERRITORAIL ROLE/ ATTRACTIVENESS (DIMENSION)	GROCERY	NON-FOOD	WHEN THE STRUCTURE FORMS PART OF A RETAIL PARK OR A SHOPPING MALL
Intermunicipal attractiveness (less than 5.000 sqm)	15'	15'	15' Shopping malls and retail parks 25' Multifunctional shopping malls 30' Factory Outlet Centres (FOC)
Provincial attractiveness (5.001 < x < 10.000 sqm)	25'	25'	25' Shopping malls and retail parks 30' Multifunctional shopping malls 40' Factory Outlet Centres (FOC)
Interprovincial attractiveness (10.001 < x < 15.000 sqm)	35'	35'	35' Shopping malls and retail parks 40' Multifunctional shopping malls 50' Factory Outlet Centres (FOC)
Regional attractiveness (15.001 < x < 30.000 sqm)	50'	50'	50' Shopping malls and retail parks 60' Multifunctional shopping malls 70' Factory Outlet Centres (FOC)
Regional attractiveness (30.001 < x < 50.000 sqm)	70'	70'	
Regional attractiveness (50.001 < x < 80.001 sqm)	80'	80'	
Regional attractiveness (more than 80.001 sqm)	90'	90'	

Tab. 3 Reference isochrone (dimension in minutes) for the calculation of the catchment area of retail poles
(Source: Table 1 of Annex 1 of the D.G.R. X / 1193)

Following the definitions proposed by Regione Lombardia in the D.G.R. X / 1193, we define the dimension of the shopping polarities catchment area⁷. Therefore, in the analysis we introduced variables related with context's conditions (density of inhabitants, presence of infrastructures, accessibility, etc.) and format.

We carried out the analysis in GIS environment (ESRI Network analysis), where we identified the isochrone for each pole of our sample. We generated these isochrones through a network model based on the OpenStreetMap (OSM) data released with ODbL license⁸. We calibrated the travel speed of each arc according to the traffic level of the different urban contexts⁹ and the network model considers the effect on speed reduction due to the presence of nodes along the network and the effects of acceleration/deceleration of the vehicles between nodes. For the elaboration of isochrones, we assumed an optimal service level (level A) of infrastructure, without interferences between vehicles that could influence their travel speed. Once completed the simulation, the isochrone could be represented in two ways:

- as a linear element, taking a graph portion equal to the distance travelled by a vehicle in a discrete time;
- as a polygonal-area element, that occupies the hypothetical geographic area equal to the distance travelled by a vehicle in a discrete time.

For the present analysis we choose the representation based on polygonal elements because, in our opinion, allows a more effective representation and a better geographical interpretation.

Discussing our approach during the research, we pointed out how the isochrones are products of a simulation produced by an informatic algorithm, and as other spatial representations, there is an implicit risk of

⁷ The catchment area of every pole has been defined following the indications of Table 1 of Annex 1 of the D.G.R. X / 1193, the regional document that define the extension of the isochrone as a function of format and dimension

⁸ Open Database Licence.

⁹ The calibration is based on data of ISTAT Census 2011 about commuting practices by private vehicles (cars and motorcycles).

oversimplification of the reality and/or its distortion. In this specific case we focus on the oversizing of the geometry of the polygon and, for this reason, we produced a protocol that minimizes the area's approximation of the simulation. Therefore, we limited the area around major infrastructures, that often include portions of territory just partially affected by the attractiveness of a specific retail poles.

Using GIS technology, we produced a weight overlay map, that shows the overlays of catchment areas of poles that belong to our sample¹⁰. The map shows the interactions and overlays between polygonal geometries of isochrones, paying attention to the attractive power of each pole and, therefore, including in this model their relevance as a variable. In this case, we consider double the attractiveness of poles organized in unitary form compared with large specialty stores.

Resulting overlays are clustered in 5 classes through the Jenks natural breaks optimization¹¹ due to its effectiveness in the classification of values not uniformly distributed. The geographical representation describes the competitive context of regional market (very high, high, moderately high, low, very low), considering the relative proximity of poles with similar formats (horizontal competition) or other offers (vertical competition) and development of ongoing projects (existing competition and a scenario with new openings).

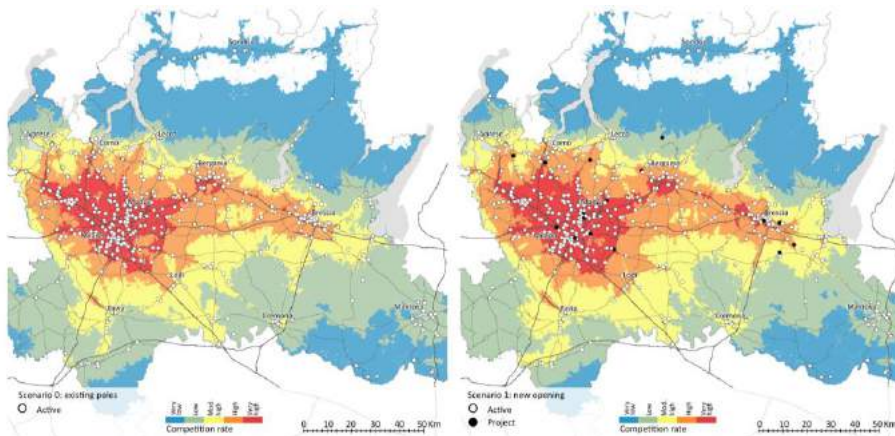


Fig. 5 Overlay of catchment areas of retail poles in Lombardy Region: Scenario 0 – existing poles (left) and Scenario 1 – new openings (right)

Once obtained the map of the competition among retail poles in Lombardy, we projected the overlays of their catchment areas on administrative structure of region through a process of geo-processing developed with GIS technology.

Therefore, we obtained a classification for each municipality¹², noticing a odd absence of competition on regional boundaries. Therefore, we decided to extend the sample of analysis to retail poles of other regions (Piedmont, Veneto and Emilia Romagna) or nations (Swiss) that have catchment areas that attracting visitors

¹⁰ We excluded in this phase those poles that are: (i.) dismantled or in crisis; (ii.) multiplex and entertainment centres, (iii.) those large specialty stores that showed a limited attractiveness.

¹¹ This is done by seeking to minimize each class's average deviation from the class mean, while maximizing each class's deviation from the means of the other groups (Wikimedia contributors, 2018).

¹² When a municipality belongs to a unique class, we assigned automatically them. When the municipal space belongs to different classes, we assigned the one that occupy the largest part.

outside the regional market. We found a set of “extra-regional” structures able to attract users because they are located near the regional administrative border (Brunetta and Morandi, 2009) and we integrated the model¹³ and the resulting regional classification with this information.

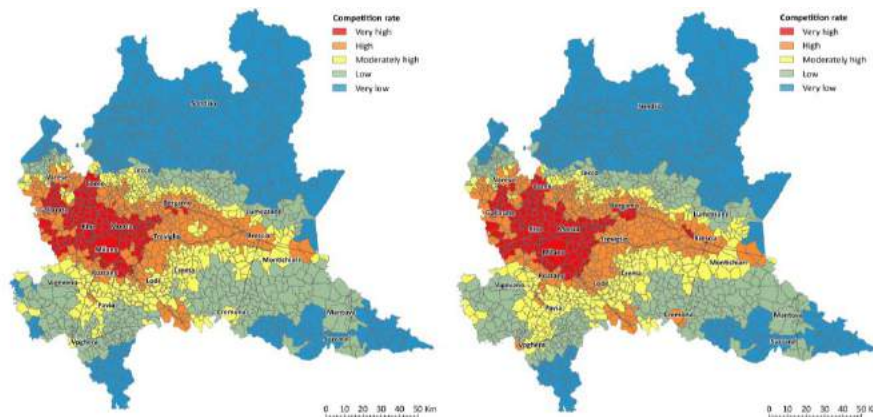


Fig. 6 Classification of Lombardy Region municipalities for competition rate: Scenario 0 – existing poles (left) and Scenario 1 – new openings (right)

These results show the limits of analysis based on static data, that does not take in account the regional competitive context. At the same time, through this approach, we discussed those parameters defined by Lombardy Region in Tab. 1 of Allegato 1, D.G.R. X/1193 (cfr. Tab 3 of this paper). Despite the interesting definition of isochrones according to dimension and formats, resulting model applies these parameters to the whole regional space, without modulating values according to the market competition.

We proposed a new protocol, in which the assessment of new openings takes in account existing spatial distribution of retail poles and - through it - definition a more precise rea of influence of these structures. Moreover, this original representation is a useful tool to understanding the attractiveness of retail poles and their spatial impacts and it can be used as a base to define strategies and actions not only for retail sector but, as in this specific case, to define an original approach to assess those impacts related with large transformations and give hints to evaluate the influences of new openings for infrastructures and private mobility.

3.3 DYNAMIC DATA: QUANTIFYING THE ATTRACTIVENESS

Over the last decade, we worked focusing on the spatial dimension of retail sector, and we assumed that models or algorithm that estimate a priori the attractiveness of a retail structure often over-simplify variables and parameters that influenced consumption behaviors and users’ practices of these structures. Despite our distrust for this approach, in the mentioned research we were expected to provide a predictive model based on gravitational ones, to estimate the number of potential visitors of each pole, taking in account those limits and risks pointed out in the section above.

¹³ We selected 68 Italian and Swiss structures, with more than 10,000 square meters GLA, considering a 30 minutes isochrone for each pole.

Recent studies show several econometric approaches to these estimations, with different degree of complexity and precision. Starting from the Huff-model (Huff, 1964) and its evolutions (Gonzalez-Benito, 2005; Simmond and Feldman, 2011) economists involved a Newton Gravitation Law in economic analysis and assume that the probability to choose a destination shopping decreases with the distance and increase with the size of the structure (Reilly, 1929). This approach is normally used as a representative element of attractiveness. Our aim was different from the general target of those models, that try to estimate the attractiveness of a specific location. We were called to give a tool for public authorities, that should evaluate impacts on infrastructure networks. Therefore, our model involves the same variables and parameters of gravity models but is different in terms of application and goals.

Therefore, we define an isochrone following regional guidelines, taking in account a reduction in terms of time (and, consequently, area) due to the existing competition. Together with this first isochrone, we defined also intermediate ones, every 5 minutes, and we consider the areas of each municipality involved with this subdivision.

The aim of this task is defining the footfall (visitors per year) and for this operation, once identified the population living within this area, we reduce the number of potential visitors taking in account the competition degree¹⁴ and consumption behaviors¹⁵ for each municipality within the catchment area. The validation of this approach is verified comparing values obtained following the protocol described with real data about visitors per year of a sample of Lombardy poles organized in unitary form¹⁶ provided by management companies of malls or from National Council of Shopping Centers (CNCC, 2017).

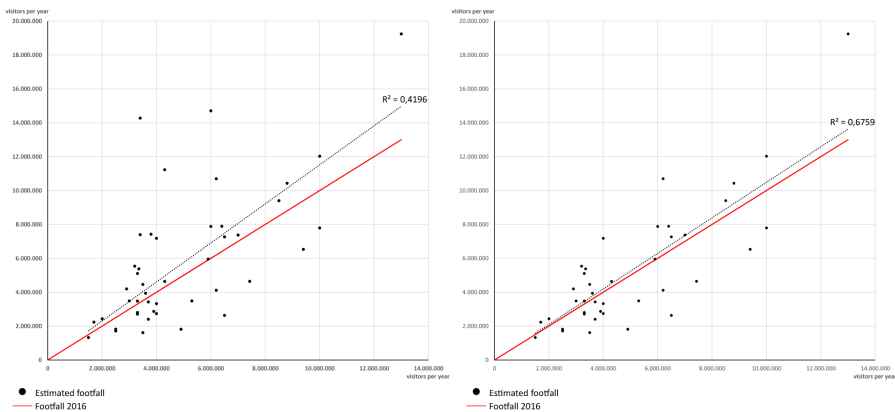


Fig. 7 Deviation of the values calculated respect to the visitors registered: with borderline cases (left) and without the borderline cases (right)

¹⁴ For this reason, we multiply the values of the resident population (potential basin) with a percentage parameter defined starting from the class of competition assigned to each municipality, and we obtain the number of inhabitants that – hipotetically – could choose a specific structure among the offers that they have in a local context.

¹⁵ We defined an “annual frequency coefficient” that takes in account the distance from the retail pole, and that describe the propensity of a inhabitant to visit a specific structure due to the travel time needed to get there. We applied this coefficient to the population of each 5 mins. Isochrone: 0-5 mins: 104 (2 visits/week); 5-10 mins: 78 (1,5 visits/week); 10-15: 52 (1 visit/week); 15-20 mins: 36 (3 visits/month); 20-25 mins: 24 (2 visits/month); 25-30 mins: 12 (1 visit/month); 30-35 mins: 4 (4 visits/year); more than 35 mins: 2 (2 visits/year).

¹⁶ Sample analyzed constitutes to 45 structures organized in a unitary form able to offer a homogeneous coverage of the regional territory.

This comparison highlights the relative reliability of this model for standard cases but its limits where the position of a specific localization or its features maximize its potential basin and, so, figures out a number of potential visitors very high but the real footfall is lower. In these cases, the deviation between real and estimated values is higher than 90%. In a "traditional" gravity model operators should analyze in deep competitors and spatial distribution of existing retail poles to starting this operation.

In this light, and excluding limiting cases, this approach estimates footfall for retail poles with an appreciable degree of precision, especially considering that our aim was the definition of attracted flows and their impacts on infrastructure networks.

3.4 DYNAMIC DATA: DISTRIBUTE THE ATTRACTIVENESS GENERATED. THE INTEGRATION WITH GOOGLE PLACES DATA

For the reasons mentioned above about the final aims of the research that we present in this paper, we were asked to foster the analysis about the rate of the flows generated by those poles and to define a methodology able to describe the users' attendance habits of these structures.

We discarded the hypothesis of a work based on direct survey that, although precise and commonly used for specific analysis, was impossible to extend to the whole sample of 557 identified poles. Therefore, we looked for a reliable and transversal source of data that allows to make comparisons and details on the distribution of the weekly attendance of single poles. This means that we looked for an effective and not expensive (due to the lack of financial and human resources to invest in this phase) process of data mining for these data.



Fig. 8 Google Places: Data related with users' attendance of a specific structure

Amongst data sources available for free, we explore the information related with the service Google Places. Google search engine displayed these data in the "Maps" web service and the "Search Results" page. They should support users in programming a visit to specific places, giving hints about crowding level of the structure, real time presences and an estimate of the average duration of the visit according to the day of the week.

Once defined the process of scraping of these data, we focus on a sample of 57 poles (28 organized in unitary form and 29 large specialty stores) focusing on different typologies, in coherence with the regional categories

defined taking in account their degree of attractiveness (see Tab. 3). To make comparable these data, we selected among structures that give the total amount of visitors over the year and thanks to these information, we could elaborate the extracted data from Google.

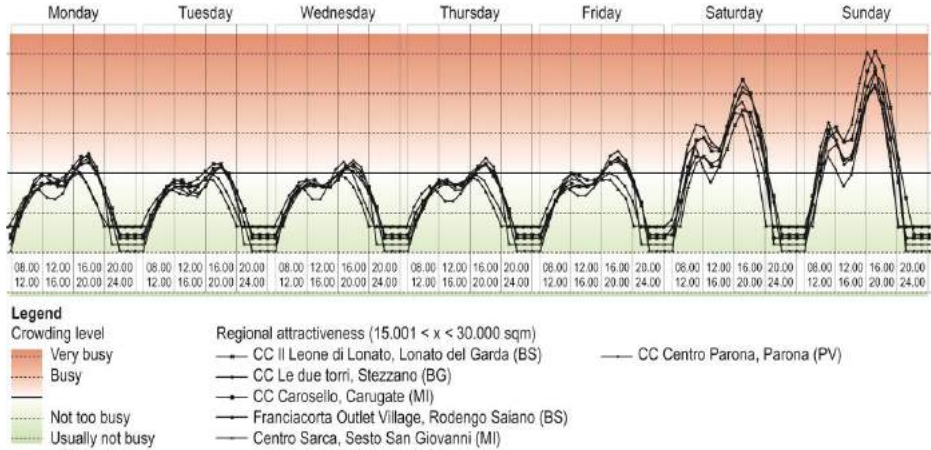


Fig. 9 Attendance profile of poles with regional attractiveness (15.001 < x < 30.000 sqm)

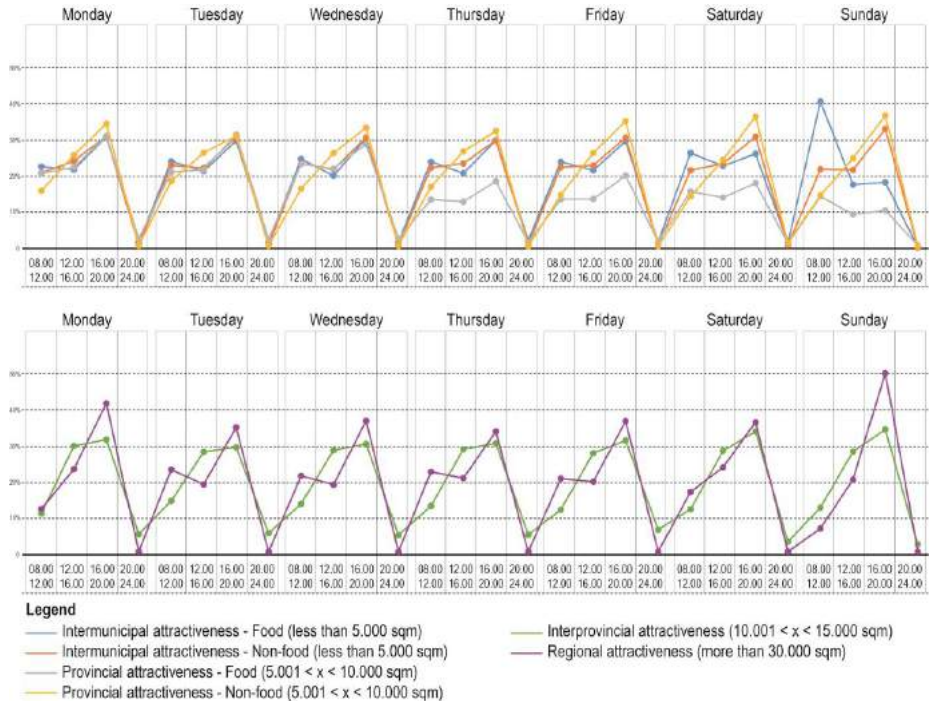


Fig. 10 Attendance profile of large specialty stores

For every typology, we collected examples to deal with the complexity of the system, selecting both central and peripheral structures, as well as paying attention to their accessibility and their formats. Finally, we defined attendance profiles for both Poles organized in unitary form and Large specialty stores (Fig. 10), pointing out which days are more crowded during the week (Tab. 4) and those rush hours (Tab. 5) that could affect on infrastructures' normal work.

TERRITORIAL ROLE/ATTRACTIVENESS (DIMENSION)	Most crowded week day			Most crowded week end day		
	Day	Time	% on whole day	Day	Time	% on whole day
Intermunicipal attractiveness (less than 5.000 sqm)	Friday	17:00-18:00	12,2%	Saturday	17:00-18:00	11,9%
Provincial attractiveness (5.001 < x < 10.000 sqm)	Friday	17:00-18:00	12,7%	Saturday	17:00-18:00	16,0%
Interprovincial attractiveness (10.001 < x < 15.000 sqm)	Friday	17:00-18:00	11,4%	Saturday	17:00-18:00	17,3%
Regional attractiveness (15.001 < x < 30.000 sqm)	Friday	18:00-19:00	11,0%	Sunday	17:00-18:00	21,00%
Regional attractiveness (30.001 < x < 50.000 sqm)	Friday	18:00-19:00	10,5%	Sunday	17:00-18:00	28,2%
Regional attractiveness (50.001 < x < 80.001 sqm)	Wednesday	17:00-18:00	11,1%	Sunday	17:00-18:00	26,9%
Regional attractiveness (more than 80.001 sqm)	Wednesday	17:00-18:00	10,9%	Sunday	16:00-17:00	28,9%

Tab. 4 Poles organized in unitary form: Rush hours per week

4 CONCLUSIONS: TOWARDS A DETAILED AND USABLE SPATIAL KNOWLEDGE FOR POLICY MAKERS AT REGIONAL SCALE

Within the present contribution we proposed an example in which a variety of methodologies and data have been involved to describe the retail poles distribution in Lombardy space, and the current condition of this Region as a mature context mature and high-competitive market. Our analysis exceeds descriptive images and tried to point out the attractive characteristics of every pole and the impact of the resulting system in terms of attraction for local populations and potential externalities on infrastructures.

This approach to the spatial distribution of retail poles is innovative because:

- It provides a vision that embraces the regional scale, considering the interactions and mutual influences between different poles and with their specific contexts (the metropolitan sector that connects the city of Milan, Bergamo and Brescia, the Northern mountains and the Southern plateau marked by low densities and some medium city, the intermediate territories, where stand-alone poles integrate the offer of central functions in consolidated urban cores);
- It overcomes conventional analysis based on gravitational models, considering variables related with retail poles (dimension, format, functional integration, etc.) that show a deeper and more sensitive know-how about retail and its dynamic and with specific conditions of local contexts (relation with infrastructure

networks, visit duration, frequency of visits, behaviors of visitors estimated with the presence of competitors, etc.) that affect a variety of field and sectors (mobility, economy, sociology, etc.). The result is a spatial interpretation more detailed and comprehensive than traditional market tools, because it considers interactions, synergies and – often – contradictions of settlement strategies of retail operators but, at the same time, it takes in account those factors that they use as criteria within their decision-making processes;

- Estimations developed with our approach could be improved by exploiting the potential of big data, that can be involved to define the effective attractiveness of the commercial polarities analyzed and to evaluate the real distribution of visitors' flows at different times of the day and the week;
- It has been involved in a decisional process of Regional Authority (*DG Territorio e Protezione Civile*) for the definition of new regulations about traffic impacts of large transformations. This example shows how non-conventional and interpretative readings of spatial complexity became useful tools for the definition of a territorial governance.

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