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Social system and collective technological knowledge. Data science and data analytics in the management of shocks and transactions

Territorial Capital and Transition processes: Smart Network in Calabria for dynamic scenarios reacting to shocks

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Abstract

The recent global pandemic is rapidly disrupting established systems of work, education, mobility and welfare, highlighting the need of sharp, place-sensitive and people-centered public policy measures. For the most vulnerable economies and population groups, the ongoing pressures and the associated socio-economic cost are twofold. On the one hand, the post-pandemic scenario indicates larger long-term detrimental effects (and slow-paced recovery) across territorial settings with weak institutional capacity, insufficient public healthcare, low social cohesion along with poor digital and technological development. On the other hand, the cross-domain decarbonization/climate neutrality objective poses additional *transition-related risks*, which will be felt very differently across different regions (EC 2019). In May 2020, the European Commission has proposed a powerful, modern and revamped long-term EU budget boosted by Next Generation EU, an emergency temporary recovery instrument, to help repair the immediate economic and social damage brought by the coronavirus pandemic, kick start the recovery and prepare for a better future for the next generation. To exit the crisis and embark on the path to becoming a smarter, environmentally responsible and cohesive EU economy, ensuring that *change* is being *equally* well received *across locations* is therefore critical. Sub-national regions – and so sub-regional economies - are differently endowed with a combination of 'tangible and intangible assets and conditions' including capital accumulation, natural resources, human and social capital, as well as established production factors and consumption modes, practices and routines among others', notably territorial capital. This paper is, hence, aimed at providing a novel approach to investigate the role played by specific characteristics and conditions of territorial capital in mitigating the social and economic cost of transitioning towards a climate-neutral economy based on dynamic analysis of equilibrium and disequilibrium in response to a shock. The territorial capital is turned in a grid pattern, composed by nodes and flows that change configurations according to the significance of data concerning an event. The paper is part of research activities conducting within the SOUND project, which aims to introduce this dynamic approach to building a smart platform to support transition-oriented planning activities. Concurrently, it is proposed a first application in the Calabria region in defining a configuration based on labour market areas, as spatial and statistical units of reference, to highlight the local performance for the technological progress related to climate change policy action. The dynamic aspect is investigated concerning the different patterns that clusters, according to the EU portal for emerging and changing industrial system for smart specialization, can activate with the dynamic observation of territorial capital components.

Introduction

Over the past months, the new Coronavirus pandemic has been rapidly disrupting established systems of work, education, mobility, welfare and social life with consequences unprecedented in recent human history. However, early post-pandemic data projections and observations point to *asymmetrical socio-economic impacts* across (sub-national) regions and locations (Berkowitz et al 2020; OECD 2020; EC 2020), requiring *sharp place-* and *people-centered* public policy measures (OECD 2020; Iammarino et al., 2019) along with *intense coordination* across all levels of government.

To exit the crisis and embark on the path to

becoming a smarter, environmentally responsible and cohesive EU economy, ensuring that *change* is being *equally* well received *across locations* is therefore paramount. In this perspective, while the impact of *location* in *competitive potential (or advantage) of regional economies* has long been subject to the investigation of a large body of work (Enright 1993; Porter 1998; 2000; Camagni and Capello 2009), we contend that the role of *territorial features* is vital to diagnose the current and future exposure and recoverability of (sub-national) regions and locations to future climate and environmental-related challenges.

Concurrently, the need to manage and tackle, effectively and responsibly, urgent transition challenges prompts/command a higher demand of data-informed/information-driven decisions that – by means of data-driven methods, processes and tools - allow to capture/extract reliable, real-time, customized and relevant information on geographies at different scales. In this perspective, we argue that the notion of territorial capital can help to make accurate predictions on the different performance, exposure and response of different locations to the same event, when:

- re-configured as *operational/assessment framework* to unravel/pinpoint factors and conditions *in context* ***(definition of specific performance indicators)*** that can contribute to mitigate the exposure/impact and enhance preparedness of locations to a specific event;
- coupled with *data analytics approaches, techniques and tools* that allow to track and explain the evolution of performances of different locations as *complex, non-linear dynamics (e.g. entropy statistics, multi-dimensional scaling instead of multi-dimensional analysis and time-series);*

From this perspective, this study contributes with a novel approach that could be developed and harnessed to investigate the role of specific characteristics and conditions of *territorial capital* in mitigating the socio-economic risks and costs of transitioning towards a climate-neutral economy; based on a dynamic analysis of equilibrium and dis-equilibrium in response to a shock. We argue that the *geographical distribution of territorial capital components* cannot be *statically* identified, but can rather assume dynamic combinations to recover from sudden shocks and respond to stresses. To this end, the dimension of 'territorial capital' is conceived as a grid pattern, which consists in nodes and flows and whose configuration varies according to the relevance of data concerning a given event. The paper is part of the research activities conducted within the SOUND project (MIUR-funded PRIN 2017), which aims to introduce a dynamic approach to track and explain the evolution of performances of different locations to support transition-oriented planning activities.

The paper presents an exploratory study on a single EU NUTS2-level region to define a *territorial capital configuration* based on Local Labour Market Areas (LMAs) that allows to track and highlight the economic performances of different locations within the same region and, their contribution towards delivering the *transformative environment and climate change policy actions* underlying the EU Green Deal growth strategy. In so doing, among Southern regions of Italy, Calabria is selected for the purpose of the study being acknowledged as an historically lagging socio-economic, institutional and infrastructural setting, hence with low degree of resistance and slow-paced recovery from the crisis. Although the strongly multi-dimensional nature that the notion of territorial capital underlies, for the purpose of this application we define the latter across one indicator and collect available ISTAT data at the LMAs level - sub-regional geographic areas defined on the basis of travel-to-work data – across 44 LMAs within the Region of Calabria and on one high-performing *emerging cross-sectoral industry* in 2011. Data are first processed building the association between the European and North American industrial classification systems (from NACE Rev.2 to N.A.I.C.S 2007) to obtain and information is therefore visualized using geographic information systems (GIS) to illustrate the distribution of local units of active enterprises within the selected industry. The dynamic aspect is investigated concerning the different patterns that clusters, according to the ***EU portal for emerging and changing industrial system for smart specialization***, can activate with the dynamic observation of territorial capital components.

Firstly, the paper introduces the current dimensions of transition in Europe, discussing the role of key territorial features (territorial capital) endowments to help measure performances, predict vulnerabilities, resistance and recoverability of different locations to the same event, towards stimulating green competition and address environment degradation and climate change challenges. Afterwards, it covers the exploratory study, briefly introducing the use of functional geographies (Labour Market Areas) to capture/extract information in context. Finally, the paper illustrates the methodology, data sources and collection methods.

The territorial dimension of transition(s)

The systemic crisis triggered by Covid-19 has since accelerated the need to transition towards a more *resource-efficient, inclusive* and *competitive* economy. In fact, for structurally vulnerable economies and population groups, the unceasing pressures and associated socio-economic and environmental-related costs are twofold: On the one hand, the post-pandemic scenario indicates larger long-term detrimental effects (low degree of resistance and slow-paced recovery from the crisis) in territorial context with weak institutional capacity, low-performing public healthcare sector, low social cohesion along with poor physical, digital and technological development. On the other hand, delivering the substantial transformation foreseen by the ambitious European (EU) investment plan and its cross-domain *decarbonization* trajectory underpinning – namely *European Green Deal* - poses new *transition*-related risks, which once more will be felt very differently across different regions (EC 2019; European House 2019).

The renewed policy focus on *resilience* of regional economies to downturns induced by unexpected shocks - increasingly complex, interlinked and simultaneous - of global resonance (OECD 2020; Di Pietro *et al.*, 2020; EU 2019; Šucha et al., 2015, Alessi et al., 2018) appears to point now to a resurgence of the importance of the *'economic impact of location' and locational factors*, which goes well beyond the *competitive advantage* discourse. Yet, how remarked by the OECD (2020) in a recently released policy note, preparedness to overcome future shocks requires managing *who* does *what*, within *which geographical boundaries/territorial confines*, and *what actions are to be taken* to increase *resilience* across *transitioning* economies. In this perspective, the impact of *location* in *competitive potential (or advantage) of regional economies* has long been a staple for a conspicuous strand of economic geography literature (see Perroux 1954; Enright 1993; Porter 1998; 2000; Camagni and Capello 2009).

Within such conception, regions – and so local economies – have different capacity to nurture their economic initiatives as they are differently endowed with a combination of 'tangible and intangible assets and conditions' which may include: i) the geographical location, extension and features, natural resources, established production factors, capital accumulation, infrastructure and human capital; ii) the agglomeration economies provided but urban areas, industrial districts or other networks of economic activities that help reducing transaction costs; iii) the reciprocal

aid and co-opting of new ideas that generally occurs within clusters of SMEs operating in a given domain of specialization; iii) traditions, cultural values, consumption modes, practices and routines among others', notably *territorial capital* (Cojanu & Robu 2019; Camagni and Capello 2009; OECD 2001). Despite the success of the concept and the prolific scientific empirical production, the contribution of Camagni (2009; 2007; 2001) - who foreseen in the notion of territorial capital the opportunity to introduce and operationalize a "cognitive approach to territorial development" – has been somehow been undermined by the both the plurality *ambiguity* underlying its notion and by data limitations issues (Cojanu & Robu 2019). Accordingly, Cojanu & Robu (2019) observed how the broadness of the concept of territorial capital has induced experimentations and "ramifications in several research streams while at the same time it apparently has made its practical implications more impenetrable. Most of the studies have shown that competitive positions (or any other measure of economic success) can be achieved in different geographical areas only by correlating decisions to the unique territorial capital of local economies".

Re-configuring the definition of territorial capital from an *asset-led growth* to a contingent *resilience-oriented perspective*, regions – and so local economies - have different capabilities to absorb (different) shocks and respond to them (EC 2020; Abraham 2020; Di Pietro et al., 2020) which depends on the presence of territorial assets in a given combination. Consequently, we contend that the recognition of *pre-shock territorial features* should become an indispensable step to diagnose the future exposure and recoverability of (sub-national) regions and locations to future climate and environmental-related challenges. Relevantly, among specific *locational attributes/factors* recently highlighted by the OECD (2020) as sensibly influencing the vulnerabilities and recover potential of locations are industrial composition, labour market activity and engagement in the global trading systems.

Despite the need to re-configure territorial capital as *operational/assessment framework* for resilience-building post-crisis recovery of territorial settings, this paper chooses to narrow the investigation on the geographical aspects of the matter.

Exploratory Study: The Case of Calabria Region

This exploratory study, conducted on a single EU NUTS2-level region, aims to define a territorial capital configuration based on Local Labour Market Areas (LMAs) that allows to track and highlight the economic performances of different locations within the same region, disclosing their contribution in predicting and measuring exposure, recoverability potential at the local level. This application illustrates the preliminary results of the research activities conducted within a project funded by the Italian Ministry of Education, University and Research (MIUR) named *'Smart Open Urban-Rural Innovation Data' (SOUND): A project for Smart Specialisation Strategies and Territorial Knowledge built in an Open Innovation Platform for Economic Regeneration'*. Overarching objective of the research programme is designing a research methodology for dynamic modeling and analysis of the *spatial dimension of competitiveness and innovation* across three Southern Italian regions.

From this perspective, within the regional innovation network model to be built and analyzed during the course of the SOUND project, *territorial capital* is conceived as a *grid pattern* consisting in *nodes* (concentration of innovation and high-specialization) and *arcs* (whereby innovation flows throughout the regional innovation system) and whose configuration varies according to the relevance of data concerning a given event. Innovation concentration is proxied by presence and composition of emerging industries at the sub-regional level, using functional geographies (LMAs) as statistical and spatial unit of reference. For the purpose of this application we take into account a single component of territorial capital (defined across one indicator) and collect available ISTAT data at the LMAs level across 44 LMAs within the Region of Calabria and on a single *high-performing emerging industry* in 2011. Data are first processed combining NAICS-coded data with business pattern and LMAs geo-spatial data, in order to analyze industrial composition. Ultimately, data is conveniently processed using a visualization tool to display the distribution of local units of active enterprises within the selected industry.

Data and Methods

On what concerns the *geographic scope*, the study selects Calabria Region (Italy) as an exploratory case study to test the application of Labour Market Areas (LMAs) as an historically lagging socio-economic, institutional and infrastructural setting, hence with low degree of resistance and slow-paced recovery from crisis. Local Labour Market Areas (LMAs or Local Systems of Labour 'SLL') - based on commuting to-work patterns stemming from the 2011 Population census - are selected as the spatial units of reference for the purpose of the application. By definition, LMAs are functional geographies or economically integrated spatial units within which demand and supply for labour meet and set a price for labour; or in other words community clusters within which workforce is willing and able to commute without changing its place of residence (U.S. Department of Labor-Bureau of Labor Statistics, 2013). Moving beyond administrative boundary constraints and distortions, the delineation of LMAs, which provides a subregional account of labour market dynamics and over time performance (Bates 2017), aims to more closely reflect the local economy where people live, work but also establishes social relationships. A key feature of LMAs is self-containment, that must be verified both on the demand and supply side. Self-containment Regarding the demand-side for labour, the self-containment index is expressed as the ratio of the number of people living and working in the ith-LMAs and the total number of people employed in the same LMAs. Home-work commuting patterns are used as a proxy of the system of relations established/taking place in a well-defined geographic scope. Since their release in 2001 and revision in 2011, the application of LMAs has increasingly drawn the interest of research and policy across Europe. Recent developments in the research field refer to LMAs as a powerful tool to design and monitor policies regarding employment, labour mobility, urban planning (Franconi 2017) and socio-economic development and Social Welfare. Therefore, LMAs provide the most meaningful spatial mean to build the geography of competitiveness in Southern regions of Italy, while ensuring comparisons across European countries and jurisdictions. In fact, they include a harmonised methodology along with standardized definitions, which should be usable and replicable across EU.

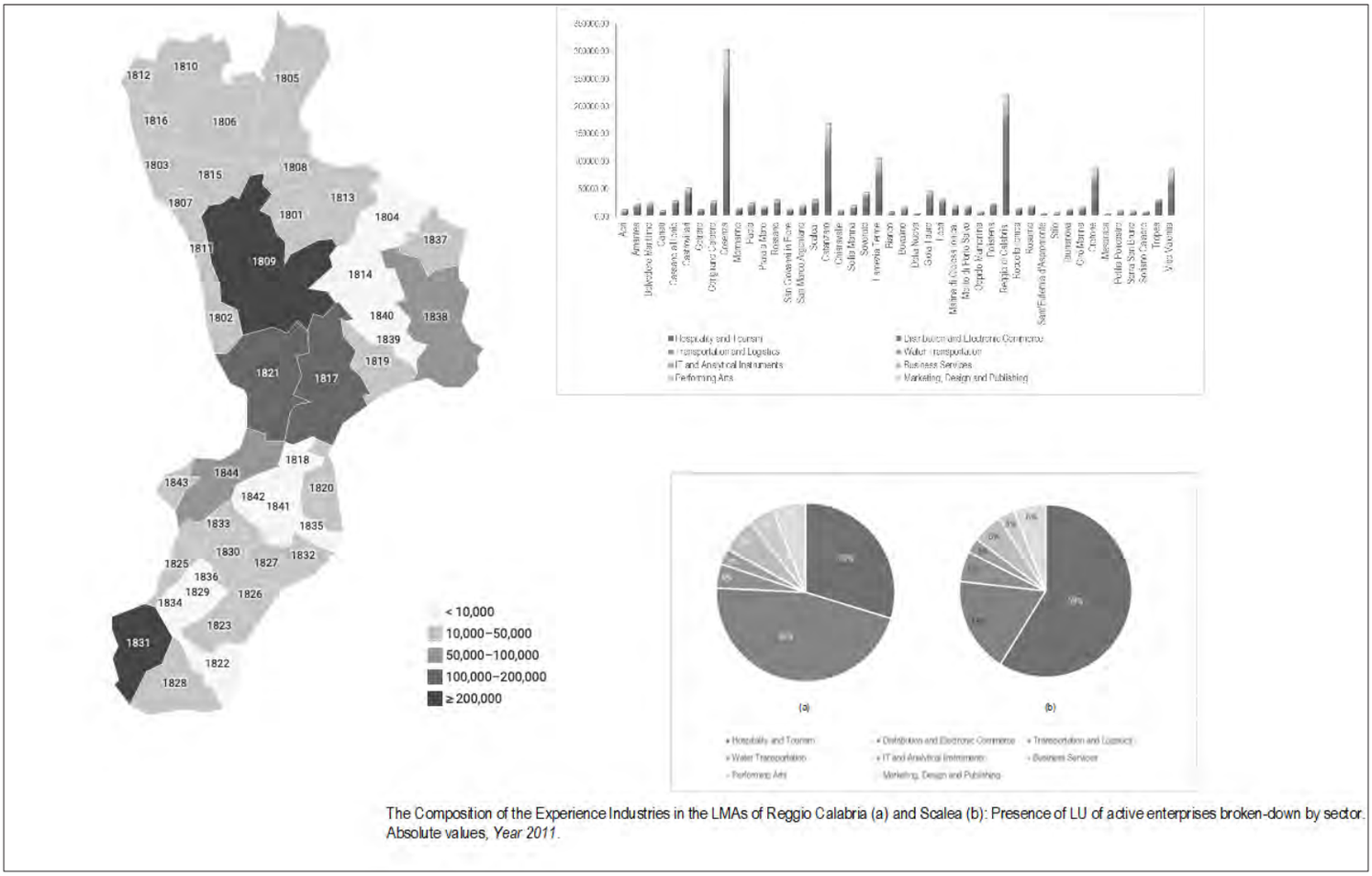
On what concerns the *industry category* to be selected for the purpose of identifying one of the "nodes" of the regional innovation network, Emerging Industries (EIs) are conveniently selected. Their definition, regardless of the 'common definition of cluster categories' (based on Delgado, Porter and Stern 2016), stems from an intuition of the European Cluster Observatory for Industrial Change (ECOIC 2019). The latter focuses on the definition of 'economic activities emerging at the cross-road of different economic sectors' (small-sized and cross-domain industries), identifying new trajectories of regional specialization. Therefore, their definition underlie a timely, more accurate and dynamic

notion of knowledge and innovation, which provides: i) a more cross-sectoral account of the 'patterns of location-specific linkages and spill-overs' occurring across location; ii) indicates a closer alignment with the 'new trajectories of innovation and industrial development' identified within the RIS3 (areas of innovation are closely related in the case of Calabria Region), hence being more suitable for an application in the European context. In addition, the definition of EIs is grounded in a novel standardized definition provided by the EOCIC (2020), allowing to systematically establish and measure cluster occurrence. In this regards, the EOCIC (2020) provides the full definitions for the 10 Emerging industries cutting across different sectors and establishing the link with 2007 four-digit NACE/ATECO sectors. On what concerns the dimension of *territorial capital* being investigated, we select a single component or asset (Economic) defined across a single indicator (*Are's endowment with highly-performing clusters)*, where cluster occurrence at the sub-regional level is proxied by the *number of local units of active enterprises* - where one or more economic activities are performed - within each LMAs.

Shifting from theoretical to *operational* aspects, using the 'standardized set of benchmark cluster definition' provided by the U.S. Cluster Mapping Project methodology (Delgado, Porter & Stern 2016) as a key methodological reference, locational specialization and employment is established as a selection criterion to run the test in Calabria Region. Consequently, using data from the '*European Observatory for Clusters and Industrial Change Mapping Tool*', the *Experience Industries* are conveniently selected. Among the ten *emerging industries* identified by the EOCIC, the *Experience Industries* exhibit the highest score in both specialization and employment index (upper 10th percentile) of the region. In addition, the region's performance in the *Experience* sector registers a moderate growth from 2010 to 2017.

To assess the presence of the selected industry in Calabria Region, a *four-step approach* to collect and process data has been followed. Firstly, concordance tables have been set out between the EU-wide (NACE)/Nation-based industrial nomenclature systems (ATECO) and 2007 6-digit *North American Industry Classification System* (NAICS*)*, consistently with the Emerging Industries definition and NACE sectors composition defined by the EOCIC (2020). Secondly, given the cross-sectoral nature of the industry, *industrial composition* has been analyzed using the '*U.S. Cluster Mapping methodology*' and their benchmark definition of Traded clusters (Delgado et al 2016). Thirdly, available ISTAT data (2008 ATECO industry code 3-digit) has been collected at the LMAs level across 44 LMAs within the Region of Calabria. Consequently, data has been cross-referenced with data on Local Units of active enterprises in LMAS provided by the 2011 Business Census and, with geo-spatial data defining LMAs boundaries. Ultimately, data is conveniently processed using a visualization tool to display occurrence and distribution of *local units of active enterprises* operating in the *Experience sector* across the 44 local labour market areas delineated in the region of Calabria, as outlined in Figure 1.

The map in Figure 1 shows overall presence and distribution of the *Experience Industries* in Calabria Region (Total number of establish-



The Composition of the Experience Industries in the LMAs of Reggio Calabria (a) and Scalea (b): Presence of LU of active enterprises broken-down by sector. Absolute values, *Year 2011*.

Figure 1 – The Experience Industry in Calabria Region: Occurrence and distribution of Local Economic Units of active enterprises by Local Labour Market Areas (LMAS). Absolute values, Year 2011.

Source: Authors' elaboration from ISTAT

ments in absolute value), revealing a nuanced pattern at the sub-regional level.

On the one hand, the highest density of local units of active enterprises rests in the largest urban agglomerations of the region and, precisely in the LMAs of *Reggio Calabria* and *Cosenza* (highlighted in *dark grey*), followed by *Catanzaro* e *Lamezia Terme*. On the other hand, small-sized municipalities and inner areas are heavily disadvantaged, registering a scarce presence of operating enterprises. The graph in the figure outlines the presence of the *Experience Industries* in Calabria Region broken-down by sector, whilst the pie charts show their percentages (weight) across the LMAs of *Reggio Calabria* and *Scalea*. The Experience economy group/cross eight different industries providing a wide range of services, ranging from accommodations and tour-operating services (*Hospitality and Tourism)*, *Performing Arts*, Urban and Marine transport services (*Transportation and Logistics*, *Water Transportation*) along with *Business Services*, *Marketing*, *Design and Publishing* but also *Information Technology and Analytical Instruments*. In the majority of the LMAs, three quarters of the active enterprises are allocated to the *Distribution and Electronic Commerce and Hospitality sector*. In the LMA of *Reggio Calabria*, nearly half of the local units of active enterprises operate in the cluster of *Distribution and Electronic Commerce, followed* by the *Hospitality and Tourism* sector which holds a third of the establishments. Conversely, more than half of the local units serving the Experience cluster in the LMA of *Scalea* operate in the *Hospitality and Tourism* industry.

Concluding Remarks

Understanding the territorial dimension of transitions rests a crucial concern to embark on the path of a Low-carbon, climate-resilient and socially just transition. The need to manage – more effectively and responsibly – simultaneous transition processes prompts the ever-growing demand of data-informed decisions that – employing data-driven methods, processes and tools - allow to capture reliable, real-time, customized and relevant information on different contexts. In this perspective, we argue that the notion of territorial capital, when re-configured as operational/strategic framework to unravel/pinpoint distinctive features and conditions of location upon which gather data, can provide accurate insights on transition-related issues in context utilizing data analytics.

Ultimately, what are the domains that by already exhibiting a performance in terms of green technological innovation would display a better adaptation and response to climate change mitigation policy actions (recovery fund thereby), or what are the potential/drawback that by facing the technological resilience due to the green demand would claim a more "tailored" policy action to adaptation and response to climate change mitigation, can contribute to lead/facilitate the climate-neutrality transition across different locations.

Notes

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Networking analysis in the urban context: Novel instrument for managing the urban transition

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Abstract

Nowadays, the insurgence of shocks in every dimension of life is questioning the effect of globalization on the urbanization process. The exposition to risks, related to the impact of continuous environmental and economic shocks, seems, in turn, increasingly connected to high urbanization processes. Among a variety of specific vulnerability factors that can influence the life of the population in each settlement, two sources of them seem to be generalized: Higher levels of income inequality spread in urban areas, the concentration of knowledge complexity in large cities. Traditional urbanization theory has become hard to interpret these changes on a global scale, and "innovation" is a core concept to explain the new differences in the urbanization dynamics.
The paper aims to combine urban and innovation policy towards the post-Europe 2020 Strategy, as a scientific advance in urban and regional studies within innovation policy design. It is argued that this combination is a crucial need due to the pivotal role that the city is acquiring in managing adaptation to shocks and in designing new approaches in line with the Just Transition mechanism introduced by the European Union.
The paper argues that in light of a completely new scenario of development, especially after the pandemic, due to the necessity to make a transition towards sustainability, the traditional approach of analyzing the context to drive the political choices of transition need to change. Data analytics is acquiring importance in the decision making that required to be faster due to the continuous and unpredictable shocks are facing us. The technological progress, the engine of development is crucial in driving cities and territories towards a transition to a post-carbon economy.
Since the city transition is not formal top-down management, the network modeling of this structure and the complexity of the component would be an exciting approach. Network analysis, both as a tool to measure the change and as a new framework for urban management, could play an essential role for policymakers to develop a responsive dashboard that benefits from local data to generate place sensitive materials for decisions. The urban system is consistently facing turbulence which leads politicians to convert them to a path to analysis, this point of translating the routine tensions into the challenges following a pattern of emergence and remedies to a cure are resilience building. Defining urban resilience in city level is double-sided sward however it grasps the prosperity of the innovation tightly, but would stem educational shields for fresh ideas required incubators to grow.
The expected result is to explain how applying the networking analysis at the urban level can change the perspective of urban planning, create an Ex-ante mechanism based on network modeling for policymakers to foresight trajectories based on their decision could depict an utterly novel approach in urban management tools.

Introducing Urban Transition

Due to the European Commission council, the aim of applying cohesion policies is to lead the regions as a whole in the transition pathway (1), this goal acknowledges that the green, digital and demographic transitions affect different people in different ways and that equal opportunities and jobs for all means empowering people through quality education, training, and skills (2). Hitherto, the regional scale has been considered essential, however, the local one is more tangible: the current phenomena of urbanization tend the transition more in an urban manner, which claims for orienting urban planning towards "Managing Urban Transition," in short it is vital to explore the concept based on urban context and investigate the connections and dynamics on this boundary. Much of the novel consideration of European horizon, planning is built from the starting point of the set of applications on the region to develop a more comprehensive development path called smart specialization. Smart specialization is the capacity of areas to implement structural changes in their economies through the "Entrepreneurial discovery process (EDP)" as an opportunities and the concentration of resources in those fields (3). These series of policy-making stimulates the process in a non-neutral logic favoring selected new activities employing concentrating resources to those that are anticipated to transform existing economic structures. Proposed policies range from public venture capital and entrepreneurship development programs to those that support the improvement of human capital conditions, R&D competencies, and the region's embeddedness in interregional research networks. Typically, modern cities spread overbroad areas. Spatially speaking, sustainability research and policy-making should shift focus from city centers to urban regions and global networks of production, consumption, and distribution (4).
The urban system is consistently facing the shocks and stress which inflected by economic, social, and environmental dynamics forcing the policymakers to convert them at the path to investigate and to encounter, this

approach of translating the everyday tensions into the challenges, following a pattern of emergence and remedies to cure, is resilience-building based. However, this process is often costly and risky. Still, the big mass developing by the implementation of the action plans is crucial; the outcome is a system by itself called "urban resilience." Urban resilience has many definitions, most of which take into account the ability to manage the full range of shocks and stresses which may occur in a city (5). Notably, resilience refers to the capability of a system to maintain or quickly return to desired functionality following a disruptive event (either natural or human-induced), which may not be predictable. It incorporates the ability to avoid shocks and to manage risks while being able to adapt to change when needed and continually quickly transforming systems that inhibit current or future adaptive capacity. Synergies and tradeoffs must also be considered to identify how investing in resilience contributes to long-term sustainability by ensuring that current development gains are safeguarded for future generations. As aforementioned, we do not yet know how challenging it is to decentralizing the transition with smaller-scale distributed systems (urban level). However, smart cities and smart communities are popularly experimented with (6,7,8) and may eventually lead to useful conclusions, but that time is still somewhere in the future. This article is forming the transformation structure into a mixed scenario of qualitative evaluation in the quantitative monitoring approach, which intended to suggest a new perspective for Managing Urban Transition.

The problem statement: Place Sensitive- Context driven approach

The paper argues that in light of a completely new scenario of development, especially after the pandemic, due to the necessity to make a transition towards sustainability, the traditional approach of analyzing the context to drive the political choices of transformation need to change. In this extent, nowadays the insurgence of shocks in every dimension of life is questioning the effect of globalization on the urbanization process. In one hand with the Industrial Revolution, the primary source of wealth moved from the countryside into the city (9) in another hand exposition to risks related to the impact of continuous environmental and economic shocks, seems, in turn, increasingly connected to high urbanization processes. Among a variety of specific vulnerability factors that can influence the life of the population in each settlement, two sources of them seem to be generalized: Higher levels of income inequality spread in urban areas (10, 11), the concentration of knowledge complexity in large cities (12, 13). Traditional urbanization theory has become hard to interpret these changes on a global scale, and "innovation" is a core concept to explain the new differences in urbanization dynamics.

Focusing on the structural change in these years, the shifting from the capital accumulation to the innovation concentration, heading the novel economies to constrain the knowledge diffusion and the technological spread by different means, is growing faster. This has been causing a new phase of disparities, which involves the accessibility of knowledge and techniques of converting information to the wealth called "Technological resilience." A new factor influencing urban context and defining an empirical pattern for technological readiness by examining the degree of relatedness to exploit technical flexibility is crucial to demonstrate whether long-term vulnerability factors (VF) are measurable. We propose to investigate the VF of an urban system by introducing networking analysis as a way to measure the responsiveness of the network built on the flexibility (technological resilience) and the intensity (knowledge diffusion) to adapt and change the trend in facing a shock or multiples shocks. (14). We argue that the new pattern of urbanization dynamics may have a significant negative effect on the flexibility of urban knowledge structures and, in turn, acting on crisis intensity (14). This new variable is based not only on a spatial unit's economic structure, but more comprehensive view demonstrates that both social and environmental axis is essential in the specific pattern of an area. In this manner, the factor is more "place sensitive" than an empirical one-size only equalization to deal with.

Place sensitive approach recognizes that the criteria for future priorities will be context-specific for any given the solution. Any urban settlements can be tested to determine their likely long-term ability to continue and deliver their function– that is, their resilience to achieve the ultimate transition goals. However, those mentioned factors are the most critical area of intervention. Still, the dynamic of the challenges into dense, interconnected, and fast-changing systems is an inevitable issue that requires a new perspective to encounter. The paper intends to combine urban and innovation policy towards the post-Europe 2020 Strategy (15) to advance urban and regional studies within innovation policy design. It is argued that this combination is a crucial need due to the pivotal role that the city is acquiring in managing adaptation to shocks and in designing new approaches in line with the Just Transition mechanism introduced by the European Union. According to this objective, the research's methodological approach is formed because since the city transition is not formal top-down management (16,17,18), the network modeling of urban structure and its complexity would be an inspiring approach. Network analysis, both as a tool to measure the change and a new framework for urban management, could play an essential role for policymakers to develop a responsive dashboard that benefits from local data to generate sensitive materials for decisions. Formal urban management rarely addresses the socio-economic The nexus directly assumes that continuing affordable economic requirements to each aspect will be assured without any particular additional measure. Because of this path dependency, it is arguable that the assessment tools, models, and policy recommendations of many planners seldom build on the nexus of risks and solutions. Conventional planning, design, and governance systems, struggle to meet the supreme position that cities have taken, namely the most prosperous places in the modern world. To avoid making the same mistake, considering the city as a dynamic Network is essential, then the network analysis as a tool of monitoring and evaluating the system can investigate the context both at the micro and macro level. The latter functions depend on the maturity of the network and its scale. It is vital to (re) define the terms in Network Theory to form the hypothesis and reasoning; thus, we start with a short glossary of the definition and vocabularies. Then we will continue on the basics of network connectivity, clustering analysis, and resistance as the system's attributes. "Network analysis" would not solely unilaterally examining the data, but the multilateral nature of the change (Transition) and system adopting phases (Resilience) regarding time intervals and correlations will be taking into consideration. To (re)structure the hypothesis, the methodology derived from graph theory attempts to describe how to assemble the relations (displayed by links) between given observing (displayed by nodes) and apply quantitative techniques to produce relevant indicators and results for studying the characteristics of a whole Network and the position of individuals in the network structure.

Glossary of Network analysis

Node

In the specific definition of network analysis in urban management, nodes are the

multi-scale boundary of stakeholders or even spatial units dominated to particular functions. These properties are scalable and trans-dimensional, providing an opportunity to investigate the micro and macro levels of interaction. However, the methodology for defining the nodes is essential, but the most vital point of analyzing the nodes is addressing them into the network. One of the main applications of network analysis is identifying the "important." nodes in their network (19). The idea of individuals' centrality in their system is one of the earliest to be pursued by network analysts (20). It is used to acquire the positional features of individual nodes within networks. Freeman (21) identified three forms of centrality. It is the most intuitive property of a node. The second measure of node centrality, closeness, is based on distance or proximity. The action focuses on how close a node is to all the other nodes in the set of nodes (19). The degree of closeness is not only based on the nodes and the neighbors but also demonstrates the degree of relatedness in the network. In data analytics literature, we translate nodes as the data production unit, the observation box that carries unique coordination into the data pool.

Edge

Edges are representing the connection in classic literature for graph theory and network analysis. This link is either tangible or on a conceptual level, known as possible connectivity. However, in this article, we introduce a novel perspective to all these definitions but play a role in the same grounds for all the connected nodes in need of drawing a link. We do not yet know a robust protocol for proving a potential connection. However, the importance of bilateral transactions between nodes is considered a direct transmitting path for the proposed network. In terms of innovation networks, the number of patents traditionally is considered a quantitative indicator for the depth of knowledge and innovation creation. Our proposal considers this quantity as a potential demonstrator of the ground for interaction between the nodes. For instance, the higher number of patents in a node shows a more intense connection between intra-node dimensional contacts. Researchers in IT and data science disciplines do not consider all the links simultaneously; for instance, Convolutional Networks demonstrates the multi-level connections between two or more nodes in three dimensions. An artificial neural network is another example of interdisciplinary investigation on urban management and data science, which translating the urban reciprocity into the term of collection of connected units or nodes called artificial neurons.

Degree of connection (two-edged)

In much transitional literature, knowledge is assumed to be a public good: once discovered and publicized, it is freely available to all in the context. The diffusion of information is a process embedded in location. Distance is essential in knowledge diffusion — the closer we are to the area of the originator of knowledge, the sooner we acknowledge the benefits of the innovation network (22). Looked at diffusion over a geographical distance; (23) adds social distance. Knowledge diffusion is not only a geographically spatial phenomenon, but it is also a "socially spatial" phenomenon. The more closely connected socially, in other words, suggests that knowledge diffusion is taking place to a considerable extent by personal contact. Space matters for knowledge diffusion, and social space may matter as much as or more than geographic space. "Social space" can only be sensibly understood in the context of social networks. It is mainly the case in the context of innovation when the transmission of knowledge plays such an important role. Another side of this network formation is the class of knowledge and the level of sedimentation for a particular property processed between and inside the nodes. For instance, codified knowledge can be diffused globally, without reference to underlying connection structures, but tacit knowledge has different properties. Its diffusion depends heavily on the network of agents through which it will spread. The central idea is that the "Urban system" takes advantage of a large amount of autonomy between nodes, but at the same time uses links between those nodes to transmit value between them. This sounds much like the suggested description of an innovation network for a potential urban context where agents (despite the socio-economic classifications) are nodes. They are linked to particular other nodes, and interconnection takes place only over these (re)direct links. Social capital, developed by direct interactions between agents, in this proposed network is innovation. It permits the agents to circumvent many of the problems implicit in anonymous markets such as opportunistic behavior, imperfect information, incomplete contracts, the transmission of tacit knowl-

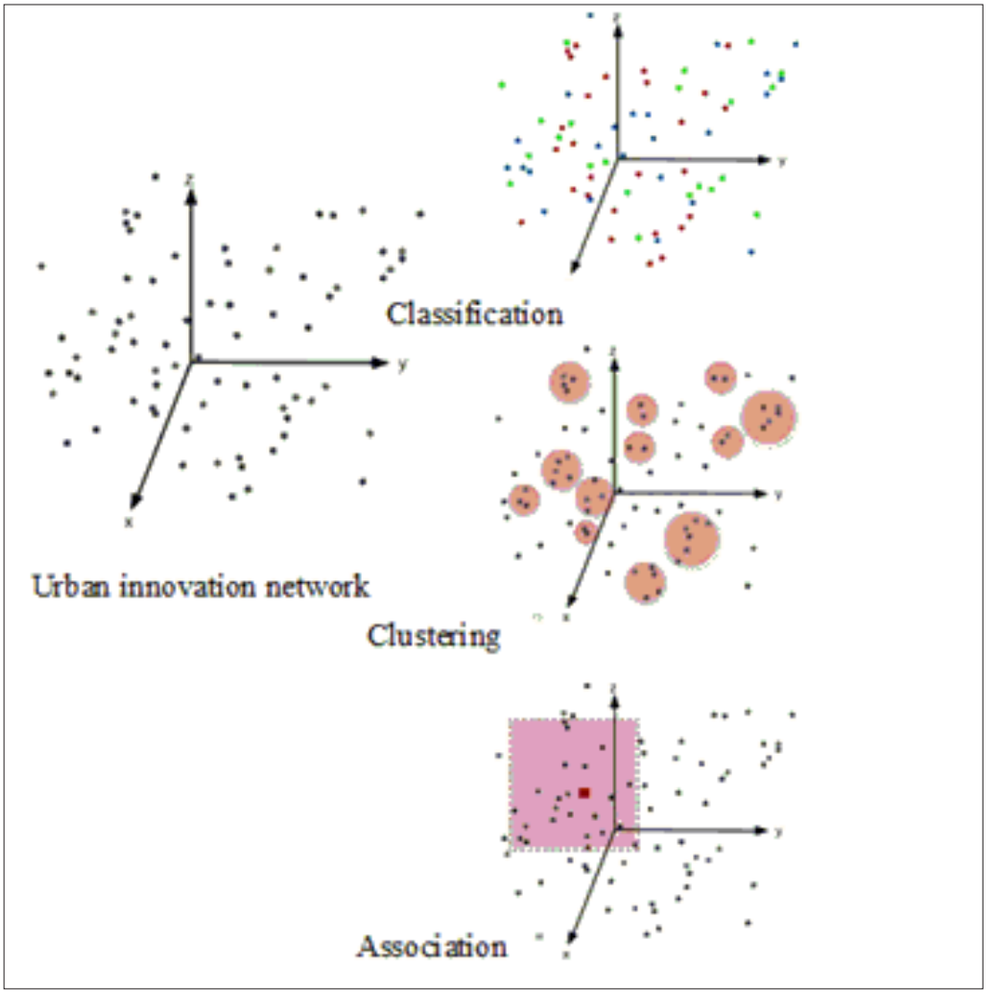

Figure 1 – Classification, clustering and association

edge, knowledge spillovers, etc. Therefore, social capital developed through network interaction reduces transaction costs and can serve to make the node more efficient in many ways. This is a more profound understanding of new urban resilience in the innovation era, Technological Resilience, which leads the nodes to optimize the connection by economic filters to maximize the competitiveness and cut back the transmission to prevent any unsought knowledge spillover.

Classification, Clustering and association

Due to the context of this paper, we do not explain classic network formations (i.e., Ising, Marshall) instead of the interaction between the transitional property and the connection building progress is taking into account. The main objective of this section of the research is the target, defining the aim of contact and describing the best scenario for interactions between the nodes includes three different layers, first, to investigate Why the nodes are connected? following this path, the identity of each coupling is interconnected, the transaction has its own identity as well and agglomeration of those same ground, same target transactions form a "classification." As an example, in an Urban Context, all industries, research centers, and private/public stakeholders who are connecting each other for a project (contest) are considering as **n** number of coupling interconnected nodes, then the **m** number of transactions despite the positive or negative result demonstrating the coordination (n,m) of a the single multilevel node in the innovation.

Another concept in this field is based on the maximizing the differential variance of the nodes in a context and, at the same time, minimizing the difference of similarity. More in details, the interconnection between the nodes would not necessarily follow the same target but the proximity both in term of the spatial unit or knowledge creation codification is the clustering element. To form these structures among the nodes, an ex-ante consideration of target is keen, and the evaluation is an N-folded scenario in which there is no fix coordination of coupling in the transaction matrix.

An important property for connections is the probability of co-occurring the transaction between n nodes, in this element, there is no coupling scenario to investing instead of being in the same ground and acting at the same level despite quantity or target considered a group of convergence association; on of possible translation for this categorizing into our research context is performing for or against a challenge in an urban system required a series of interactions between actors, in this system, there are numbers of the classification which is classically dominated to the target of this rescue mission, in another level, the geographical proximity to the hot spot form clustering dimension between infusers of the risk, but there is always the third layer which doing transactions neither directly connected to the target nor geographically close to the spatial unit but perform most appropriately and impact the result.

Networking Coefficient

After defining interconnections properties for the proposed innovation network, it is essential to investigate intra-connection the factor for it, it seems there is a meaningful relationship between the constraints of transmission, number of nodes and connection in one hand and the ability to the classification of the network in another, which we suggest to call it Networking coefficient. This coefficient forms the network from a multiplex perspective. This structure has its unique dynamic, in which each period one transaction is chosen due to the mentioned coefficient. In an urban context, it selects one of its interaction, and with that level of probability makes all possible trades. Over time, the node's knowledge endowments change as they trade. The possibility to expand the network is another function which following this coefficient, absorbing knowledge and developing new transaction by brand-new nodes assist data collection phase-in elaborating evaluation more in detail. This diversification session has been one of the fundamental causes of arrangement growth. Besides, because an expanding innovative transaction base demands an expanding knowledge base, this Multiplicity has been a leading cause not only of an increase in R&D sectors but also of an increase in external technology sourcing (24).

Data analytics in network analysis

Data analytics is acquiring importance in the decision making that required to be faster due to the continuous and unpredictable shocks are facing us. The technological progress, the engine of development, is crucial in driving cities and territories towards a transition to a post-carbon economy. As mentioned before, considering the city as a network of interactions and the spatial units as possible nodes, the data transmission between the actors is the key factor to monitor, evaluate, and control the transition. In this section, we will suggest combining one of the standard data science methodologies (CRISP-DM) with urban management to initiate a transition dashboard for policy-makers. The CRISP-DM method is described in terms of a hierarchical process model, consisting of sets of tasks related at four levels of abstraction (from general to specific): phase, generic job, the specialized task, and process instance (25). Converting this to urban transition management generates a novel framework for mapping city transformation based on data pool creation. At the top level, the data mapping process is organized into several phases; each phase consists of several second-level generic tasks. This second level is called generic because it is intended to be general enough to cover all possible data gathering situations. As aforementioned improving the ability to collect complete and stable data closely relates to prediction and dynamic explanatory model generation. (25) Complete data means that are covering both the whole process of transactions and all possible data for interaction. Stable means that the model should be valid for yet unforeseen developments like new modeling techniques. At a third level, which we call it cleaning data to achieve a total specific solution, the research team should consider all possible investigation target(s) and act in the most optimized way. In practice, many of the tasks can be performed in a different order, and it will often be necessary to backtrack to previous assignments and repeat specific actions regularly. At the final level converting data to information and then the decision is expected. It is needless to say that all this methodology established on an EX-Ante regulation; thus, every possible information necessarily follows the expected prognostication requirements.

Conclusion

In this paper, the expected result was to explain how applying the network analysis at the urban level can change the perspective of urban planning, create an ex-ante mechanism based on network modeling for policymakers to foresight trajectories based on their decision could depict an utterly novel approach in urban management tools. As previously described, this tool is based on data piling as fuel for the innovation engine to run the transition, these cascade of cause and effect give on to authors for enriching unusual experience in a combination of data science, applied math, and urban management. At this stage, there are lots to do to profound the instrument as a reliable tool for investigation moreover among all rhetorical questions "How aggregate knowledge levels grow with these underlying urban data nexuses?" is one of the open questions in front of the research team.

Notes

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Public engagement nei processi di recovery post-Shock: reti sociali ed il caso "SOLIVID"

Giusy Sica

Abstract

To define the scientific and epistemological coordinates of the contribution focused on public engagement in post-shock recovery processes, with a focus on social networks and the "SOLIVID" case, it is necessary to define the conditions and terms within which the Responsible Research and Innovation is inscribed (RRI). In the knowledge society, every individual is potentially involved in the process of building knowledge, which is no longer limited to universities and research centers only. Public and civic engagement practices provide a deep understanding of the new emerging needs of society and individuals and is based on multiple dimensions of sustainability: economic, social, cultural and environmental, which also overcomes obsolete social innovation concepts linked exclusively to the technological component, such as that of the Smart city. The goal is to have a positive social impact on a reference community, with the ultimate aim of improving the quality of life of individuals.

Appunti e spunti sul ruolo dell'istruzione superiore e la RRI

L'approccio del Responsible Research and Innovation (RRI) «has become an increasingly important phrase within policy narratives, in particular in Europe, where it will be a cross-cutting issue under the prospective EU Framework Programme for Research and Innovation "Horizon 2020". In EU member states, there are also various initiatives supporting RRI, notably under schemes of national research councils (e.g. the United Kingdom, Norway, and the Netherlands). However, there is no agreed definition of the concept, and approaches how it should be implemented may vary. This chapter outlines a vision behind Responsible Research and Innovation, taking a largely European policy perspective, provides a definition of the concept and proposes a broad framework for its implementation under Research and Innovation schemes around the world» (Von Schomberg, 2013). È un approccio che parte dal presupposto che ogni individuo, nella società della conoscenza, è potenzialmente partecipe del processo di costruzione del sapere, vale a dire che gli attori della società, quali Università e Centri di ricerca, che finora hanno agito in tale direzione, non saranno limitate a tale processo. Ciò