

The assessment of clusters and local innovation hotspots

Notes from the MAPS-LED project

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ISBN: 9798498662145

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INTRODUCTION

The role of clusters in fostering economic development is a fertile field of investigation for economic geographers and policymakers. How, where and by what circumstances clusters thrive is still an open question that can deliver different outcomes. What follows is a gathering of studies on clusters conducted in Boston (US) and Rome (Italy) for the project “Multidisciplinary Approach to Planning of Smart Specialization Strategies in a prospective to enhance Local Economic Development” (MAPS LED), funded by the European Commission through the HORIZON 2020 Research Programme – Marie Skłodowska Curie RISE Actions under the Grant Agreement No. 645651. The project intended to examine how Smart Specialization Strategies (S3) can be implemented, with respect to the new agenda of Europe 2020, by incorporating a place-based dimension. The main activities carried out within this project were: 1) analysis of S3 in terms of spatial, social and environmental factors; 2) field work, by means of qualitative research, in the area of Boston (USA).

After a theoretical (*Chapter 1*) and methodological introduction (*Chapter 2*) for the assessment and the analysis of clusters, two empirical works are presented in the following sections: *Chapter 3* provides a comparative study of traded and local clusters between two US Metropolitan areas (Boston and San Diego) and one Italian province (Rome); *Chapter 4* presents an explorative case study on the inception of a cleantech cluster in Sommerville (Boston, MA), focusing on the regulatory tools adopted by the Municipality that fostered the settlement of a major player in the area: Greentown Labs. The

1. Clusters in Economic Geography: some milestones

Introduction. Clusters have become a key concept in a variety of research fields and policymakers have long made their way to seize on this notion as a tool for promoting regional growth and competitiveness. After a brief outline of the development of the concept of cluster in economic geography, along with some methodological cautions (§ 1.1), the work will survey some of the main contributions made by the Evolutionary Economic Geography in cluster theory (§ 1.2).

1.1 The theoretical and methodological framework of “cluster”: an undergoing process

Early theorisations of the concept of “cluster” date back to Marshall’s seminal contribution *Principles of Economics* (1920) and massively derive from his notion of external economies of scale, i.e. those micro-economic benefits arising from the location in an area that is home to many similar or interconnected firms, and provided by a local pool of specialised knowledge, labour and suppliers. Challenging the dominant narrative of internal economies of scale as main sources of specialisation advantages, the later-known “Marshallian economies” basically entails that a firm can remain small and still capable to be highly specialised and competitive, as far as it interweaves with other firms an extensive network of direct and indirect intra-industry relationships, this condition representing a first baseline for the identification of the functional structure of a cluster (Bathelt et al, 2004).

Despite their potential, Marshall’s speculations have long struggled to find their way within the mainstream economic theory. A resurgence of the idea of industrial district, originally formulated by Marshall with reference to the metals industry in Sheffield and South Yorkshire in the UK (Potter and Watts, 2011), occurred on a pervasive scale only many decades later, when scholars started taking a renewed interest in the dynamics occurring within regional agglomerations of SMEs and (re)discovered the “flexible specialisation” as a promising alternative of the declining Fordist organisation of work (Brusco and Sabel, 1981; Piore and Sabel, 1984). Nevertheless, the flourishing of industrial districts, as repeatedly stressed in the literature (ibidem; Schmitz, 1989), was not a residual phenomenon stemming from the crisis of large corporations but, rather, the result of an emergent model of production that was more responsive to the market uncertainty and the social backlashes charactering the post-Fordism transition in the 70’s (Bignante et al., 2014). Indeed, many regions in central-northern Italy, the so-called “Third Italy” (Bagnasco, 1977), were traditionally home to a large variety of local socio-economic systems characterised by “the active presence of both a community of people and a population of firms in one naturally and historically bounded area” (Becattini, 1989). And, specifically, the identification of a local community of actors prone to “channel the competitive pressure towards permanent innovation” (Schmitz, 1989, p. 18) was undoubtedly one of the most relevant features of the industrial districts, especially for the Italian case, and substantially contributed in paving the way for a more systemic and policy-friendly definition of cluster (Das and Panayiotopoulos, 1996).

Particularly thanks to Porter’s works in the early 90’s (Porter, 1990), cluster theory went through a more structured systematisation. Porter mapped the clusters of successful industries in several leading industrial economies, examining the dynamic process by which their competitive advantage was created. His analysis delivered the well-known “diamond model”, that ascribes competitiveness to four principal

factors: (1) firm strategy, structure and rivalry, (2) factors conditions, (3) demand conditions and (4) related industries. While further considerations about Porter's theoretical and methodological framework can be found in Chapter 2 (§ 2.1), some of the Porter's undoubted contributions to agglomeration and cluster theory will be outlined here. Firstly, he emphasised the critical duality between collaboration and rivalry, which concurrently create pressure to innovate and upgrade competitiveness in the system. Secondly, his general definition of cluster allows encompassing a broader range of regional agglomerations, beyond the traditional Marshallian industrial district (Markusen, 1996). Finally, and most notably, Porter has "not only promoted the idea of 'clusters' as an analytical concept, but also as a key policy tool" (Martin and Sunley, 2003), by explicitly including policy-makers as key actors in fostering local economies.

Eventually, in a first attempt to draw some regularities about the rationales of clusters spotted in the literature, two core elements can be identified:

1. Clusters are characterised by the interconnection of firms and associated institutions, linked by commonalities and complementarities (*ibidem*). These links are both vertical (supply chain) and horizontal (pooling of material and immaterial resources), as well as they involve the creation of social and knowledge networks that produce micro-economic (though hardly quantifiable) benefits for the firms involved.
2. Clusters are geographically and spatially defined entities, constituted by groups of interlinked companies. Location economies arise from co-location and the interactions occurring between proximate firms.

However, clear boundaries, both industrial and geographical, are still lacking in cluster definitions (§ 2.1). As remarked by Martin and Sunley (2003, p. 20), "there is no agreed method for identifying and mapping clusters, either in terms of the key variables that should be measured or the procedure by which the geographical boundaries of clusters should be determined". These procedures vary considerably, in consideration of four elements:

- a. *Conceptual/definitional depth*;
- b. *Empirical methodology*;
- c. *Ease of measurement*
- d. *Empirical support*.

As summarised in **Figure 1**, the "Cluster Measurement Problem" involves an irreducible gap between, on one hand, top-down and easily measurable methods based on co-location data and technological proximity of firms (§ 2.1), and, on the other hand, bottom-up approaches that investigate informal knowledge spillovers and collaboration patterns among firms mostly employing qualitative and hardly comparable methodologies. Indeed, one of the most relevant shortcomings of cluster analyses is find a proper way to measure inter-firms knowledge exchanges, thus leading to a systematic neglecting of their role in the mainstream economic theory ("Knowledge flows are invisible, they leave no paper trail by which they may be measured and tracked" Krugman, 1991, p. 53). Therefore, as it will further stressed in Chapter 2 (§ 2.2), a mixed methodology that associates quantitative, large scale analyses and a narrower, qualitative assessments of clusters is probably the most viable approach to correctly identify clusters' industrial and geographical boundaries and to set up a systematic empirical framework.

Cluster concept	Conceptual/ definitional depth	Empirical methodology	Ease of measurement	Empirical support
Co-location	Shallow	Top-down	Easy to measure (quantitative)	Indirect evidence
Co-location and technological proximity	↓	↓	↓	↓
Input-output table and complementarities				
Co-location and superior performance				
Marshallian externalities				
Network firms				
Explicit collaboration				
Informal knowledge spillovers				

Figure 1 - The Cluster Measurement Problem.

Source: Martin and Sunley (2003), p. 19 adapted by Swann (2002)

1.2 The evolutionary turn in cluster theory

The Evolutionary Economic Geography (hereinafter, EEG), from its start, has substantially contributed to the understanding of industrial clusters, by challenging the dominant Marshallian thinking about the role of localisation economies for the emergence and the evolution of clusters. Indeed, as repeatedly stress in this literature (Sorenson and Audia, 2000; Aldrich and Fiol, 1994; Maggioni, 2002; Wenting and Frenken, 2011), clusters can emerge *despite* the absence of localisation economies. Starting from the assumption that firms differ from each other due to firm-specific routines (Nelson and Winter, 1982), “spinoff firms inherit superior capabilities from successful parents from the same or related industries and, therefore, tend to outperform other types of entrants” (Boschma and Frenken, 2015). Since spinoff firms usually locate close to founder’s home region and do not easily relocate (Stam, 2007; Dahl and Sorenson, 2012), a cluster could emerge as the outcome of a self-reinforcing process of industrial branching and local entry, rather than emerging from the attraction of outsiders in the region thanks to the presence of localisation economies. On a brighter note, Marshallian externalities (by means of intra-industries linkages), as well as not playing a decisive role in the creation of clusters, can also determine a negative effect on the survival of firms within a cluster. More specifically, they are likely to harm well-performing firms, whose knowledge-based competitive advantage can be jeopardised by the interaction with other firms, while small and young firms can benefit from intra-industry exchanges as a mean to compensate for their weak internal capabilities (Rigby and Brown, 2015).

Besides, two other main contributions to cluster theory provided by EEG deserve to be mentioned here:

1. The cluster-life cycle;
2. The dynamics of knowledge and innovation networks.

The “cluster life cycle” is a major branch in the EEG literature that studies the evolution of clusters over time, in particular “the endogenous dynamics that may turn successful clusters into declining ones” (Boschma and Frenken, 2015, p. 4; see also Pouder and St. John, 1996; Brenner, 2004; Iammarino and McCann, 2006; Belussi and Sedita, 2009). As the cluster evolves (cf. **Figure 2**), the heterogeneity of firms’ capabilities initially increases but subsequently decreases, due to processes of competition and assimilation (Rigby and Essletzbichler 1997; Vicente and Suire 2007), thus leading to a progressive loss of recombinant potential and incumbent cognitive lock-ins (Grabher, 1993). However, declining clusters can overcome lock-ins “by upgrading its knowledge base through inflow of new knowledge from outside the cluster (‘adaptation’), by integrating various local knowledge bases (‘renewal’), or by diversifying into new activities while building on the local knowledge base (‘transformation’)” (Boschma and Frenken, 2015, p. 4).

Eventually, the implementation of network theory within the EEG theoretical framework allowed addressing how ties between firms are created or disrupted in a cluster and which variables can interfere in network dynamics. First, knowledge is not “in the air”, as theorised by Marshall (1920), but is actually channelled in specific networks and it is not freely available to any firm locating in the cluster (Giuliani and Bell, 2005). Secondly, different kinds of “proximities” (Boschma, 2005) actually catalyse the potential interaction between the actors involved. Finally, network relations tend to become more inward-looking over time, whereas non-local linkages are pivotal to foster the competitiveness of cluster firms by bridging together different sources of knowledge and competitive advantages (Ter Wal and Boschma, 2011).

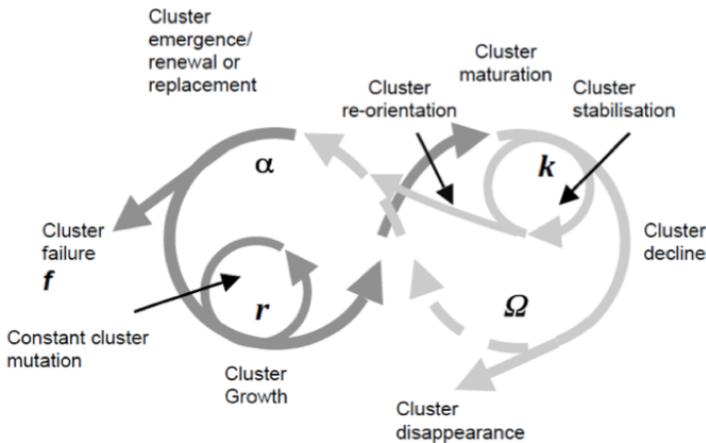


Figure 2 - Cluster's Life Cycle.
Source: Martin and Sundley (2011)

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2. Methodological Contribution for the Case Studies Analysis

Introduction. The 1st Working Package of the MAPS-LED project explicitly targeted the identification of the successful, place-based factors that characterise US clusters with respect to the kind of innovation produced, the level of specialization acquired, and the level of territorial milieu activated. Indeed, the disentanglement of the economic and social, locally embedded, processes occurring in the world-leading industrial regions is pivotal to understand the role of clusters in fostering innovation and regional growth (Foray et al., 2012). By drawing insights from existing successful US clusters, MAPS-LED project aimed at providing an evidence-based methodology for recognising and assessing emerging and potential of S3 with respect to each “region's distinctive industry structures and knowledge bases” (*ibidem*, p. 11).

A key prerequisite to achieve this objective was developing a spatially led and governance-oriented approach to analyse clusters. The web platform of the US Cluster Mapping Project, led by Professor Michael E. Porter at the Harvard Business School (hereinafter, HBS), provided a major initial source of economic and socio-demographic indicators, though the website lacks a thorough assessment of the

spatial configuration of clusters. Indeed, the literature review carried out revealed how “the physical dimension and the morphology of clusters” had frequently failed to be taken into account by scholars involved in empirical cluster analyses (cf. First Scientific Report, MAPS-LED 2015, p. 28). Hence, MAPS-LED’s Preliminary Research Activity tested a new “Cluster Spatialisation Methodology” in order to display “where clusters are physically localized within a smaller territorial scale than the Porter considered one” (*ibidem*). While the implementation of a geocoding technique undoubtedly broadens the horizon of empirical applications, HBS’s clustering strategy, in terms of its methodological implications, involves closely linked advantages and disadvantages whose overarching assessment cannot be neglected.

After a brief survey of the aforementioned Cluster Spatialisation Methodology, the following paragraphs identify the main pluses and minuses related to the application of the Cluster Mapping’s strategy (§ 2.1), along with some methodological proposals for the forthcoming case-studies analysis (§ 2.2).

2.1 Advantages and drawbacks of implementing HBS's analytical framework into the Cluster Spatialisation Methodology

The lack of a specific spatial dimension, both in the main cluster literature reviewed so far and in the HBS's web platform "Cluster Mapping", has been the main driver for the development of the Cluster Spatialisation Methodology. This new methodological framework rests upon the integration of three sets of data:

1. Economic activities, in terms of number of establishments and size, by NAICS 2008 code and ZIP code (Source: Census Bureau website, *Zip Code Business Statistics*);
2. Land Use codes, provided with code's description and category, by ZIP code (Source: City of Cambridge GIS system)
3. Cluster/Subcluster compositions as derived by Porter's clustering methodology (Source: US Cluster Mapping project).

A three-step process has been carried out for this purpose, as summarised in **Figure 3** (cf. First Scientific Report, MAPS-LED 2015):

- a. The identification and the NAICS codification of the industries composing each subcluster/cluster by tracing back the clustering processes developed by Porter;
- b. The linkage between NAICS and Land Use codes, which delivers the location of each industry within a specific area;
- c. The labelling of each area according to the

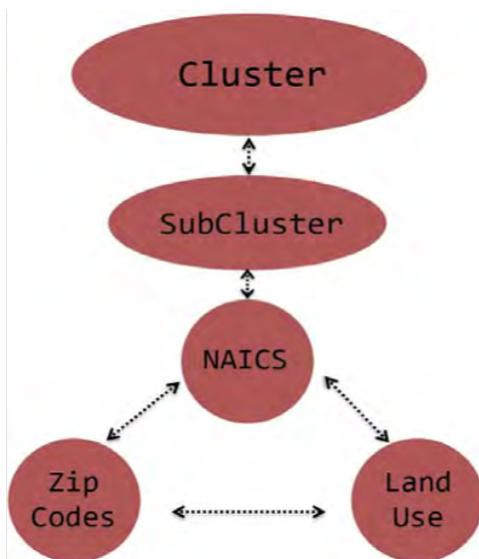


Figure 3 - Cluster Spatialisation Methodology
Source: 1st Scient. Report, MAPS-LED 2015

corresponding Cluster/Subcluster present on the ground.

The procedure relies on the use of the ESRI's ArcGIS software both as a visualisation and analytical tool and has been tested for the ZIP code 02138 of Cambridge, MA.

While the full potential of the methodology has still to be exploited, the preliminary findings provided in the First Scientific Report convincingly proved the usefulness of the clusters' spatialisation procedure, particularly with reference to the linkage between Land Use codes and the economic activities identified by NAICS and ZIP codes (steps sub a. and b.). Notwithstanding, the transferability of this process to the European clusters is intrinsically dependent on data availability and comparability.

On a brighter note, a few relevant concerns should be addressed with regard to the utilization of the HBS's methodology, which is functional for the step sub a. of the procedure. Indeed, the adoption of Porter's clustering strategy, i.e. the grouping of industries within a specific cluster, involves sharing many of its strengths and shortcomings. For the sake of completeness, a brief review of Porter's methodology is available in the next paragraph.

2.1.1 Porter's categorization of US traded and local clusters in a nutshell

Traded Clusters are defined as industries that are concentrated in a subset of geographic areas and sell to other regions and nations. A three-step procedure has been applied:

1. Identification of Traded and Local Industries

Three alternative criteria have been applied to identify traded industries. All remaining industries are considered local.

1st Criterion – The percentage of areas with very little employment (0-10 employees) in that industry is 50% or more.

2nd Criterion – The share of US industry employment in the top 10% areas by employment-based Location Quotient (LQ) is 25% or greater. The Location Quotient is estimated by the following formula:

$$LQ_{ij} = \frac{L_{ij}/L_i}{L_j/L}$$

where L_{ij} is the number of employees in the industry i in the area j , L_i is the total number of employees in the industry i , L_j is the number of employees in the area j and L is the total employment in the country.

3rd Criterion – The difference between LQ at the 90th percentile and LQ at the median over all areas is 1,5 or greater for the given industry.

2. Clustering of industries by means of relatedness algorithms

The clustering function they used required measures of the relatedness between any two industries and some concrete parameter choices, using the relational data summarised in **Figure 4** below.

REGION-INDUSTRY MEASURES	INDUSTRY MEASURES
Co-location of Industry Employment (U.S. Census Bureau: County Business Patterns)	Input-Output Links (U.S. Bureau of Economic Analysis: National Input-Output Tables)
Co-location of Industry Establishments (U.S. Census Bureau: County Business Patterns)	Occupational Correlation (U.S. Bureau of Labor Statistics: Occupational Employment Statistics)

Figure 4 - Relational data used for calculating relatedness between industries.

Source: Delgado et al., 2014

3. Identification of Strong Related Clusters

Strong clusters are defined as those where the location quotient, i.e. the cluster's relative employment specialization, puts them into the leading 25% of regions across the U.S. in their respective cluster category.

2.1.2 Strengths and weaknesses of Porter's approach

Among the main pluses related to Porter's methodology, *comparability* is by all means one of the most relevant. Porter's definition of clusters is based upon the measurement of average inter-industry linkages at national level, thus "providing a benchmark for clusters to be compared across locations" (Delgado et al., 2015, p. 7). By scaling down the general definition into any regional unit, the approach basically provides a comparison tool both *across* and *within* regions. This feature substantially distinguishes Porter's "benchmark cluster" definition from other, narrower "region-specific" ones, which can only account for "observed linkages" and inevitably overlook activities that are not present in the region (*ibidem*). Secondly, the methodology relies upon the utilisation of multiple sources of inter-industry linkages' data (co-location of employment or establishments, input-output linkages and occupational correlation). This methodological *comprehensiveness* is pivotal to capture "many types of externalities present across industries" (*ibidem*). Moreover, this allows the model to encompass the well-known notion of *related variety* (Frenken et al., 2007) insofar as the strength of a specific regional cluster is not built upon narrow specialization in a specific industry, but it is dependent on the presence of complementarities among industries in terms of shared competences (Porter, 1998a, 2003, Porter and Ramirez-Vallejo, 2013; Feldman and Audretsch, 1999; Delgado, et al., 2012; Frenken et al., 2007). Furthermore, the clustering algorithm developed by Porter can be applied to other countries and to individual regions, depending on data

availability (. Eventually, as repeatedly stressed in the literature (Scott et al., 2001; Keeble and Wilkinson, 2000; Martin and Sunley, 2003), Porter's focus on competitiveness of regions and the framing of his ideas in terms of economics of "business strategy" undoubtedly provide a policy-friendly research agenda readily to be translated into practical strategies (Martin and Sunley, 2003).

The underlined features of Porter's methodology confirm its potential for the comparative analysis to be carried out in the forthcoming stages of the project. Nevertheless, some relevant weaknesses inherent to Porter's approach might pose a threat to a proper utilization of the methodology for the choice and the assessment of the case studies. As earlier mentioned in this report, a top-down approach of this kind cannot but bring along inevitable shortcomings related to the *empirical methodology* and the *conceptual/ definitional depth* adopted.

With respect to the former, a major concern related to Porter's definition of cluster is "the lack of clear boundaries, both industrial and geographical" (*ibidem*, p. 10) and the absence of any specific reference to the presence of Marshallian externalities (Marshall, 1890). Indeed, top-down measures can only provide indirect evidence of the presence of explicit collaboration and informal knowledge spillovers between firms, since they cannot establish "the precise boundaries and composition of clusters" (Martin and Sunley, 2001, p. 20). Moreover, the use of the Location Quotient (hereinafter, LQ) to discriminate between "traded" and "local" clusters, which is the first step of Porter's methodology (cf. § 2.1.1), cannot allow to "differentiate between external and internal economies" (Woodward and Guimares, 2009, p. 19), since "the LQ will be the same whether the industry employment in region j is due to the existence of a single large establishment, or due to the existence of several smaller sized establishments" (*ibidem*).

Most notably, Porter's concept of clusters does not capture "the critical contribution made by soft factors, such as trust and social capital, as well as the organisational dynamics of the cluster" (Wolfe and Gertler, 2004, p. 1081). Despite the claim about the importance of "social embeddedness" for the functioning and upgrading of clusters, "the social dimension of cluster formation and cluster dynamics remain something of a black box in Porter's work" (Martin and Sunley, 2001, p. 16). Social and knowledge networks are systematically overlooked in Porter's cluster theory (Cumbers and McKinnon, 2013), notwithstanding the undisputable role played by *non-market-based* factors (Wolfe and Gertler, 2004) or "untraded interdependencies" (Storper, 1997).

A few final remarks should be made with regard to the *focus of the analysis* and the *policy implications*. Firstly, the empirical approach adopted by Porter tends to overlook the nature of cluster life cycle (§ 1.2). As clusters frequently go through specific stages of development, the identification of these stages is pivotal to understand the formation, the dynamics and the evolution of clusters (Breschi and Malerba, 2001). Finally, the emphasis laid on the role of "traded" clusters as driver of regional growth risks to neglect the role played by local non-tradable activities for local wealth and prosperity, which are not included in a competitiveness-led vision of local economies (Krugman, 1997). Therefore, a narrow approach by policymakers aimed at exclusively promoting the "core" clusters in a specific region might lead to an unbalanced economic development (Venables, 1996), since a holistic view of regional development is lacking.

Eventually, the adoption of Porter's methodology is likely to be the most practical and useful approach to concurrently enable future comparisons with the European clusters and pave the way for the choice of US case studies. While amending many of the abovementioned weaknesses of the methodology is beyond the current purpose of this project, some feasible inclusions can be made, as discussed in the following.

2.2 Case studies selection and analysis: some methodological considerations

The development of the Cluster Spatialisation Methodology goes along the right line for the implementation of a spatially led approach in the assessment of US clusters, consistently with the rationales of MAPS-LED project and the objectives of the 1st Working Package (cf. Grant Agreement, EC-REA 2014). The forthcoming stages of the research activity firstly involve the *selection* of the case studies. At this regard, the research strategy may be consolidated as follows:

- ❖ Strengthening the categorisation approach, by taking into account other sets of economic data, like exports data, which can provide a more direct evidence of the “traded” or “local” nature of clusters and/or economic areas. Clusters showing clear signs of enhanced tradability might be more likely to exhibit those factors related to a durable competitive advantage. A preliminary application of this methodology for the province of Rome will be presented in chapter 3.
- ❖ Including local clusters as additional targets, in order to investigate the critical contribution made by local activities for the diffusion and the sustainability of wealth and prosperity among the population residing in leading economic regions and in the surrounding area. Indeed, the demand for an “inclusive” growth (European Council, 2010) cannot be materialised without promoting a balance between local production and local consumption, as stressed by Professor Christer Bengs in his recent contribution for the MAPS-LED Open Panel Discussion (Bengs, 2015). Although Porter emphasises how outward-oriented clusters are the primary long-run source of economic growth and prosperity (Martin and Sunley, 2001), he also recommends that policymakers should not try to discriminate between clusters (Porter, 1995, 1996, 1998b).

With reference to the framing of the *empirical methodology* for the analysis of the selected case studies, some final remarks can be made:

- ❖ The role of non-market relationships should be explicitly taken into account by analysing and displaying the network dynamics of clusters. At this purpose several empirical studies adopted secondary data, such as

patents' citations or joint-ventured research activities, which are more likely to deliver a deeper definition and identification of clusters based on formal knowledge spillover or explicit collaboration (Kerr and Kominers, 2015; Boschma and Frenken, 2011). The OECD Citations Database provides a major source for innovation networks' data (<http://www.oecd.org/sti/inno/oecdpatentdatabases.htm>). Concurrently, primary data, to be collected by surveys or interviews, can also contribute to a deeper, bottom-up reconstruction of cluster's dynamics, as documented by a well-established literature (Taylor et al., 2003; D'TI, 2001; Porter and Ramirez-Vallejo, 2013)

- ❖ In preparation for the assessment of the most relevant best practices within US cluster policies, both soft and hard institution factors should be expressly targeted in the analysis; the latter including, most notably, universities, research institutes, Technology Transfer Centres, and venture capitalists, while the former including, among others, the quality of institutions, Federal and National incentives, or entrepreneurial attitudes.

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3. Traded clusters in the province of Rome

Introduction. The preliminary research activity conducted within the MAPS-LED project aimed to test the methodological proposals suggested in chapter 2 and to compare the clusters of Boston/San Diego MSAs with a commensurate European area, which has been identified in the province of Rome.

Why is it worth focusing on the province of Rome? First of all, the province of Rome is characterised by the presence of key industrial sectors that are likely to exhibit a high level of relatedness, thus benefiting from a variety of synergies in terms of exchange of information and knowledge and the development of relations between firms. Furthermore, the preliminary study undertaken shows the presence of relevant similarities between Rome, Boston and San Diego in terms of Traded Clusters, thus allowing a proper comparison between the three areas. Finally, the strengthening of an advanced service sector is consistent with the economic structure of the two US cities under consideration.

The approach initially follows Porter's methodology (§ 3.1) by deploying:

- ❖ the employment-based Location Quotient (LQ) index as a measure of specialisation economies, in order to discriminate between Italian "Traded" and "Local" industries;
- ❖ the composition of each "Traded" or "Local" cluster as delivered by the relatedness algorithm elaborated by Porter (cf. § 2.1.1).

Furthermore, LQ indexes based on exports data have been calculated to provide a narrower definition of those clusters formerly categorised and to detect additional or hidden specialisation economies (§ 3.2). The findings for the Province of Rome have been compared to the ones provided by the web platform www.clustermapping.us for the MSAs of Boston and San Diego, thus drawing a list of clusters to be potentially selected as case-studies for the forthcoming comparative analysis (§ 3.3).

3.1 Methodology

The workflow followed four main stages.

1. Selection of top strong clusters in the MSAs of Boston and San Diego

The website platform www.clustermapping.us uses a bundle of secondary data drawn from the County Business Patterns databases (<http://www.census.gov/econ/cbp/>) on employment, establishments, and wages by 4-digit SIC codes. A Cluster Portfolio tab is provided for different geographical scales (State, Metro/Micropolitan Statistical Area, Economic Area, or County), allowing the user to easily select and display the findings related to his spatial unit of interest. For the purpose of this analysis and for an easier comparison with the Italian scale of analysis adopted (Provincial area), data related to the MSAs of Boston and San Diego have been selected. The top Strong Traded Clusters for the two areas are shown in **Figure 5** and **Figure 6**.

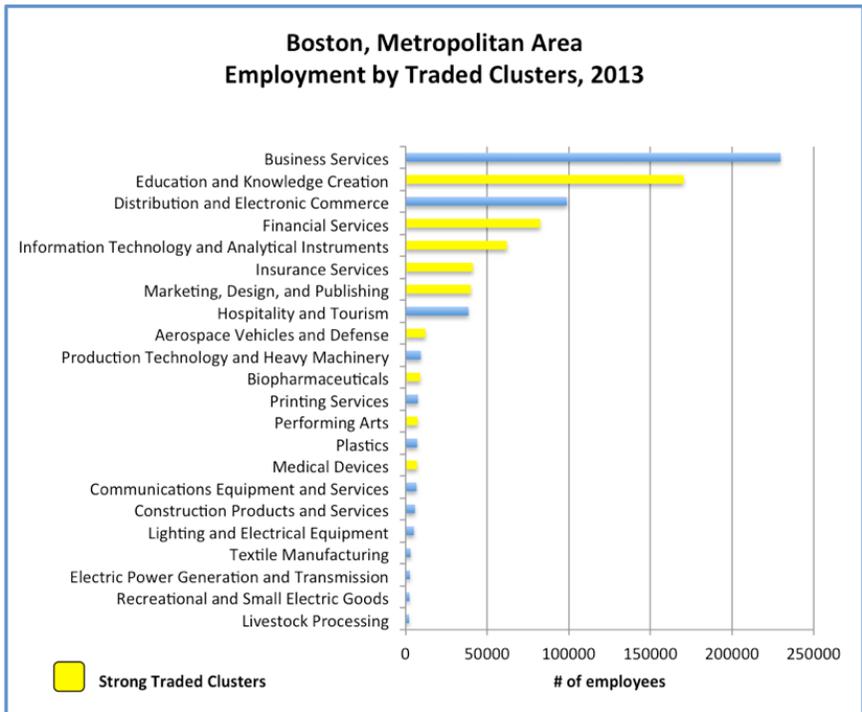


Figure 5 - Boston MSA's Traded Clusters.

Source: author's elaboration, 2015

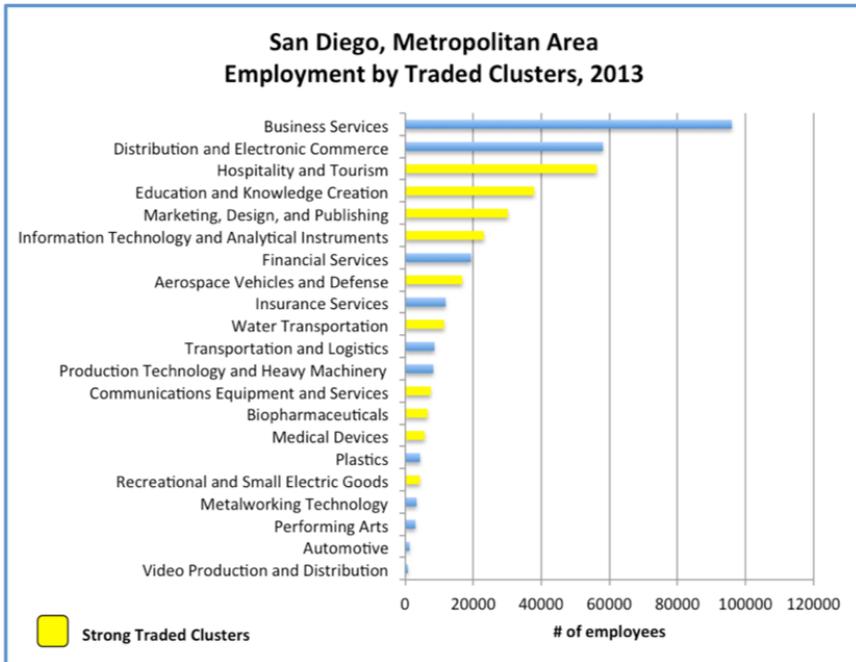


Figure 6 - San Diego MSA's Traded Clusters.

Source: author's elaboration, 2015

2. Data gathering for Italian provinces and computation of LQ indexes

Following Porter's categorisation of "traded" and "local" clusters by means of LQ indicator (cf. § 2.1.1), the corresponding LQ s for the Italian provinces have been calculated using two sets of data:

- a. National labour force data, gathered from the ISTAT data warehouse <http://dati.istat.it/>, by means of number of employees and establishments per industry classified by province and by ATECO 2007 2-digit codes.
- b. Exports data, gathered from the ISTAT data warehouse www.coeweb.istat.it, by means of total value of exported goods or services classified by province and ATECO 2007 3-digit codes.

3. Implementation of Porter's methodology for the identification of traded and local clusters using employment data

Firstly, "Traded" and "Local" clusters have been discriminated following the three criteria adopted by Porter for the Cluster Mapping project (cf. § 2.1.1):

- a. **Identification of Traded and Local Industries.** Almost the 88% of the traded industries (45) derived from the application of the 2nd criterion, while less the 10% (5) derived from the application of the 1st criterion, the 3rd one being mostly irrelevant (only one case). Indeed, the 1st criterion exclusively proved suitable to detect those specialisation economies related to the

exploitation of natural resources (coal, oil and metals).

- b. **Clustering of industries.** Cluster Mapping project provides a list of the 51 clusters identified with the 2nd step of Porter’s methodology (cf. § 2.1.1) based on co-location patterns and other regional data computed by an algorithm to find inter-industry linkages. The present study adopts the same grouping strategies, by decomposing the 51 clusters listed in Delgado M., Porter M. E. and Stern S. (2014) in their respective sub-clusters and industries (identified by means of NAICS code) and then grouping Italian industries following the same schemes. **Figure 7** shows the composition of the “Biopharmaceuticals” cluster in Delgado et al (2014).

Cluster Name:	Biopharmaceuticals		
Cluster Code:	5		
Description:	Establishments in this cluster produce complex chemical and biological substances used in medications, vaccines, diagnostic tests, and similar medical applications.		
<table border="1" style="margin: 10px auto;"> <tr> <td style="padding: 2px;"><i>Number of Industries</i></td> <td style="padding: 2px;">4</td> </tr> </table>		<i>Number of Industries</i>	4
<i>Number of Industries</i>	4		
NAICS	NAICS Name	Subcluster Name	
325411	Medicinal and Botanical Manufacturing	Biopharmaceutical Products	
325412	Pharmaceutical Preparation Manufacturing	Biopharmaceutical Products	
325414	Biological Product (except Diagnostic) Manufacturing	Biological Products	
325413	In-Vitro Diagnostic Substance Manufacturing	Diagnostic Substances	

Figure 7 - Biopharmaceuticals Traded Cluster.

Source: Delgado et al., 2014

Nevertheless, two main issues related to this step deserve to be mentioned:

- I. Italian employment data were only available at a broader level of industrial classification, i.e. 2-digit code instead of the 6-digit one used by Porter. This entailed, on one hand, some unavoidable merges of clusters and, on the other hand, a less degree of specificity in the composition of each cluster.
- II. Italian data are classified by means of ATECO codification, while US adopt NAICS classification. The ATECO system is the Italian version of the European nomenclature, Nace Rev. 2 (EC, 2006), which, in turn, is a derived classification of the international codification system ISIC 4.0: categories at all levels of Nace are defined either to be identical to, or to form subsets of, single ISIC categories. ATECO, Nace and ISIC codifications coincide almost exactly up to the fourth level of economic activity, which is beyond the one considered for the analysis. Therefore, in order to be able to compare the US and the Italian industries classifications, it was necessary to employ the concordance tables from NAICS to ISIC codes provided by the US Census Bureau Office

(<http://www.census.gov/eos/www/naics/concordances/concordances.html>).

The procedure delivered a list of 32 Traded Clusters and 18 Local Clusters, as summarised in **Table 1**.

- c. Finally, Strong Traded Clusters have been selected accordingly with the 3rd step of Porter's methodology (cf. § 2.1.1), exclusively for the province of Rome.

Table 1 - Italian Traded and Local clusters

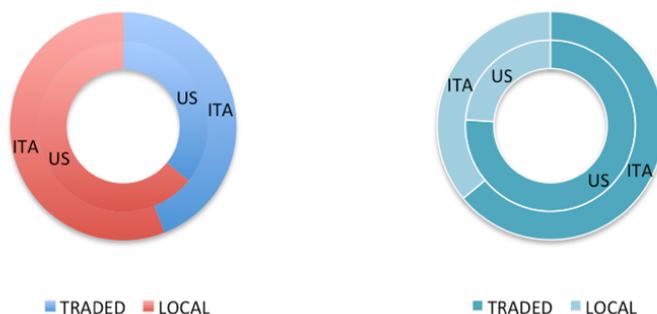
Traded clusters				Local clusters	
1	COAL MINING	19	OTHER MANUFACTURING	101	LOCAL FOOD PROCESSING AND MANUFACTURING
2	OIL AND GAS PRODUCTION	20	REMEDIAION SERVICES	102	LOCAL WOOD PRODUCTS
3	METAL MINING	21	WHOLESALE	103	LOCAL CHEMICAL PRODUCTS
4	NONMETAL MINING	22	WATER TRANSPORTATION	104	LOCAL CONSTRUCTION PRODUCTS AND SERVICES
5	BEVERAGES	23	AIR TRANSPORTATION	105	LOCAL COMMERCIAL SERVICES
6	TOBACCO	24	LOGISTICS	106	LOCAL UTILITIES
7	APPAREL AND TEXTILE	25	HOSPITALITY AND TOURISM	107	LOCAL ENVIRONMENTAL SERVICES
8	FOOTWEAR AND LEATHER	26	MARKETING AND PUBLISHING	108	LOCAL REAL ESTATE, CONTRUCTION AND DEVELOPMENT
9	PAPER AND PACKAGING	27	VIDEO AND MUSIC	109	LOCAL AUTOMOTIVE WHOLESALING
10	PRINTING	28	COMMUNICATIONS	110	LOCAL RETAILING
11	BIOPHARMACEUTICALS	29	BUSINESS SERVICE	111	GROUND TRANSPORTATION
12	PLASTICS	30	FINANCIAL SERVICES AND INSURANCE	112	LOCAL COMMERCIAL SERVICES
13	METAL MANUFACTURING	31	RESEARCH ORGANIZATIONS	113	LOCAL HOSPITALITY ESTABLISHMENTS
14	I.T. AND ANALYTICAL INSTRUMENTS	32	PERFORMING ARTS	114	LOCAL COMMERCIAL SERVICES
15	LIGHTING AND ELECTRICAL EQUIPMENT			115	LOCAL PERSONAL SERVICES
16	PRODUCTION TECHNOLOGY			116	LOCAL EDUCATION AND TRAINING
17	AEROSPACE VEHICLES AND DEFENSE			117	LOCAL HEALTH SERVICES
18	FURNITURE			118	LOCAL ENTERTAINMENT AND MEDIA

The charts showed in **Figure 8** compare Italian clusters, as resulting by the application of the aforementioned methodology on employment data, with US clusters. Consistently with the US context (Delgado et al., 2014), Italian Traded clusters, though larger in number (32 Traded Clusters vs. 18 Local Clusters), account for a smaller part of total employment (44%) as compared to Local Clusters (56%). However, as summarised in **Table 2**, US and Italian categorisations of traded and local clusters show some relevant differences, to be mostly attributed to specific peculiarities of the US industrial structure with respect to the Italian one:

- some US industries apparently benefit from specialisation economies in a greater account than the respective Italian ones, which in turn show evener

distribution patterns across the country. This is the case for “Food processing and manufacturing” and “Wood products”;

- other US industries, mainly related to advanced services, show a more accentuated outward orientation, in terms of capacity to sell their product in other regions or to serve a broader market than the one constituted by resident customers. This is the case for “Education and Training” and “Entertainment industry”.



EMPLOYMENT	US	ITA	CLUSTERS	US	ITA
TRADED	36%	44%	TRADED	76%	64%
LOCAL	64%	56%	LOCAL	24%	36%

Figure 8 - US vs ITA Distribution of Employment and Categorisation of Clusters.
Source: author's elaboration, 2016

Table 2 - Main categorisation differences between Italy and US.

Clusters	US	Italy
Food processing and manufacturing	Traded	Local (except for Beverages)
Wood Products (no Furniture)	Traded	Local
Remediation services	Local	Traded
Education and Training	Traded	Local (except for Private Research Organizations)
Entertainment industry	Traded	Local

The results for the Province of Roma are displayed in **Figure 9**. As shown, the four top ranking traded clusters, “Business Services”, “Financial services and Insurance”, “Communications Equipment and Services”, and “Hospitality and Tourism” belong to the main sector of “advanced services”. This is consistent with the employment distribution pattern of a large metropolitan area like Rome, which has long made its way towards an advanced, tertiary-led economy. In particular, “Hospitality and Tourism” reveals to be one of the strongest traded clusters, due to the presence of a fervent tourism industry in the city. With respect to manufacturing clusters, “Biopharmaceuticals” and “Video and Music” are undoubtedly two of the most peculiar economic specialisations of the area, the former being led by the

presence of big pharmaceutical companies in the province and the latter related to the presence of the most important and productive cinema industry of the country.

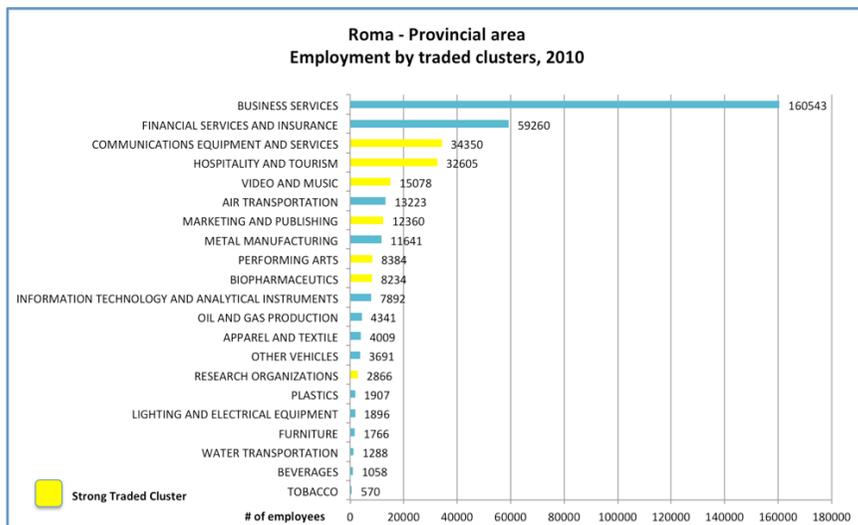


Figure 9 - Province of Rome's Traded Clusters.

Source: author's elaboration, 2016

4. Detection of sub-clusters and other specialization economies in the Province of Rome using exports data

In the last stage of the work, exports-based LQ indexes have been employed in order to identify additional or hidden specialization economies in the Province or Rome. The procedure entailed the application of the same three criteria adopted in the second stage of the work, even if the higher level of detail in terms of industrial classification provided by exports data (3-digit codes instead of 2-digit) allowed a narrower definition and a more comprehensive composition of each cluster. Indeed, with specific regard to the strong traded clusters of the Province of Rome, additional strong subclusters have been identified, by selecting those ones exhibiting exports-based LQs > 2. These findings have been summarised in **Table 3**.

Table 3 - Traded clusters and subclusters in the province of Rome based on exports

Sub-clusters (from stage 4)	Respective Cluster (from stage 3)	Rome (LQ)
LIBRARY, ARCHIVES, MUSEUMS AND OTHER CULTURAL ACTIVITIES	HOSPITALITY AND TOURISM	27,35
CREATIVE, ARTS AND ENTERTAINMENT ACTIVITIES	PERFORMING ARTS	13,98
WEAPONS AND AMMUNITION	METAL MANUFACTURING	10,18
SOUND RECORDING AND MUSIC PUBLISHING	VIDEO AND MUSIC	7,05

SOAP AND DETERGENTS, CLEANING, AND POLISHING PREPARATIONS, PERFUMES, AND TOILET PREPARATION	LOCAL CHEMICAL PRODUCTS	6,33
MOTION PICTURE, VIDEO AND TELEVISION PROGRAMME PRODUCTION ACTIVITIES	VIDEO AND MUSIC	5,41
COMMUNICATION EQUIPMENT	COMMUNICATIONS EQUIPMENT	4,89
MEASURING, TESTING, NAVIGATING, AND CONTROL	METAL MANUFACTURING	4,84
ARTICLE OF FUR	APPAREL AND TEXTILE	4,38
VIDEOGAMES AND OTHER SOFTWARES	SOFTWARE	3,54
OPTICAL INSTRUMENTS AND PHOTOGRAPHIC	VIDEO AND MUSIC	3,20
AIR AND SPACECRAFT AND RELATED MACHINERY	OTHER VEHICLES	2,84
PHARMACEUTICALS, MEDICINAL CHEMICAL AND BOTANICAL PRODUCTS	BIOPHARMACEUTICS	2,74
OTHER CHEMICAL PRODUCTS	LOCAL CHEMICAL PRODUCTS	2,73
MAGNETIC AND OPTICAL MEDIA	I.T. AND ANALYTICAL INSTRUMENTS	2,61
BASIC CHEMICALS	LOCAL CHEMICAL PRODUCTS	2,53
PULP, PAPER AND PAPERBOARD	PAPER AND PACKAGING	2,52
CONSUMER ELECTRONICS	I.T. AND ANALYTICAL INSTRUMENTS	2,37
COMPUTERS AND PERIPHERAL EQUIPMENT	I.T. AND ANALYTICAL INSTRUMENTS	1,83
IRRADIATION, ELECTROMEDICAL AND ELECTROTHERAPEUTIC EQUIPMENT	PRODUCTION TECHNOLOGY	1,75
BASIC PHARMACEUTICALS	BIOPHARMACEUTICS	1,07

Strong Traded clusters =	
Strong Traded clusters (NEW INCLUSION) =	

Within the present methodological framework, the additional information provided by the utilisation of the exports-based LQ does not pose any risk of overlapping with the definitions given in the third stage, since the groups identified in the third stage are still kept valid in order to allow comparisons with the US clusters. Nevertheless, this stage allows targeting two critical objectives:

1. Pointing out which Subcluster contributes the most in terms of exports magnitude within its respective Traded Cluster. For instance, this is the case of the “Motion Picture, Video And Television Programme Production Activities” and the “Sound Recording And Music Publishing” sub-clusters within the main cluster “Video and Music”, which notably represents one of the most important creative cluster in Italy (Lazzeretti et al., 2008).
2. Disclosing which Subclusters, though belonging to Local or Not-strong Traded Clusters, exhibit an outstanding performance in terms of exported goods or services. For instance, this is the case of the “Basic Chemicals” and the “Soap and detergents, cleaning, and polishing preparations, perfumes, and toilet preparation” sub-clusters within the Local Chemical Products. This sector, though categorised as “local”, is notoriously related in terms of shared competencies and technologies with the leading Strong Traded Cluster of “Biopharmaceuticals” (Boschma and Frenken, 2011), thus allowing future overarching assessments of the two sectors. Another relevant sub-cluster identified in this stage is the “Air and Spacecraft and Related Machinery”, which belongs to the cluster “Other vehicles”

previously categorised as Not-Strong Traded cluster; indeed, the Province of Rome hosts a Europe’s leading Aerospace cluster, which was likely to be overlooked without going through this stage of the analysis.

A final remark concerns the regional scale. The other four Provinces (Frosinone, Latina, Rieti, Viterbo) of the NUTS-2 Region “Lazio” host some of the leading manufacturing clusters in Italy, as shown in the **Table 4** below. Most notably, three of the four provinces displayed reveal an important presence of biopharmaceuticals (or related) clusters, which are likely to be strongly intertwined with the one identified in the Province of Rome, thus giving further evidence of the pivotal role played by this sector in the area.

Table 4 - Strong traded clusters in the other provinces of Lazio

Provinces	Employment-based analysis	Exports-based analysis
VITERBO	<ul style="list-style-type: none"> Other porcelain and ceramic products (1st in Italy, LQ = 4,5) 	<ul style="list-style-type: none"> Other porcelain and ceramic products (1st in Italy, LQ = 174,53)
LATINA	<ul style="list-style-type: none"> Biopharmaceuticals (1st in Italy, LQ = 11,26) 	<ul style="list-style-type: none"> Biopharmaceuticals, medical chemical and botanical products (1st in Italy, LQ = 15, 41)
FROSINONE	<ul style="list-style-type: none"> Biopharmaceuticals (3rd in Italy, LQ = 11,26) Paper and packaging (5th in Italy, LQ = 2,5) 	<ul style="list-style-type: none"> Biopharmaceuticals (3rd in Italy, LQ = 12,74)
RIETI	<ul style="list-style-type: none"> Biopharmaceuticals (11th in Italy, LQ = 2,20) Measuring, testing, navigating and control machineries (3th in Italy, LQ = 4,35) 	<ul style="list-style-type: none"> Biopharmaceuticals, medical chemical and botanical products (4th in Italy, LQ = 10,76)

3.2 The selection of clusters for the case studies analysis

The work described in § 3.1 delivered a detailed picture of the economic structure of the Province of Rome, though further analyses might still be needed in order to better specify the composition of each cluster. Comparing the findings obtained for the Province of Rome and the information downloaded from the Cluster Mapping

web platform for the Boston and San Diego MSAs, some research proposals for the forthcoming working packages of MAPS-LED project can be drawn. Indeed, the results for the province of Rome, compared with the US context, showed the presence of a similar economic-productive structure both in terms of advanced services (business services, financial services, marketing, research and development) and of industrial sectors, thus allowing multiple comparisons across the three areas to be feasible. **Table 5** summarises the main similarities between the three areas under exam.

Table 5 - Comparison table between the areas of Boston, San Diego and Rome

Top strong clusters	Boston	San Diego	Rome
Biopharmaceuticals	6 th in US ranking	7 th in US ranking	<ul style="list-style-type: none"> • Top strong cluster in Rome • Along with other provinces in Lazio, 1st cluster in Italy ranking • Strong relatedness with the Chemical Industry, another top cluster in the province of Rome
Medical devices	4 th in US ranking	8 th in US ranking	Top strong cluster in Rome (exports-based LQ = 1,75)
Aerospace and defence	10 th in US ranking	8 th in US ranking	<ul style="list-style-type: none"> • 7th in Italy ranking (exports-based LQ = 2,85) • Strong relatedness with Arms and Ammunitions, another top cluster in Rome
Other strong clusters	Boston	San Diego	Rome
Hospitality and tourism	-	9 th in US ranking	Top strong cluster in Rome
Video and music	-	Top strong cluster (12 th in the US ranking)	Top strong cluster in Rome (1 st in Italy ranking by employment and exports)
Research organizations	9 th in US ranking	2 th in US ranking	Top strong cluster (employment-based LQ = 1,74)
Marketing and publishing	6 th in US ranking	10 th in US ranking	Top strong cluster (5 th in Italy ranking)

Among the three top traded clusters that revealed to have a strong presence in all the three areas analysed, “Biopharmaceuticals” is by all means the most pervasive in terms of share of employment and exports magnitude. More in detail, the role of this cluster in the Province of Rome, as already mentioned (§ 3.1), is characterised by two important features:

1. The simultaneous presence of other Strong Traded “Biopharmaceuticals” Clusters in the areas surrounding the Province of Rome, which definitely ensures Lazio’s region to be ranked 1st in Italy for this sector.
2. The strong relatedness with the Chemical Industry, which is another major

specialisation of the Province of Rome and of surrounding areas (Latina, in particular).

Similar conclusions can be made for the “Medical devices” and the “Aerospace and Defence” clusters, which are the other two main specialisations that the three areas share.

Other suggestions include the “Hospitality and Tourism” and “Video and Music”, which are two leading specialisations in the areas of San Diego and Roma, as well as “Research Organisations” and “Marketing and publishing”.

Eventually, the *strength* of a specific cluster, in terms of its economic magnitude, and the cluster’s *relatedness* with other economic sectors in the area represent two of the most useful criteria to be adopted for the selection of the case studies. Furthermore, the clusters identified in this section show a potential connection with the six Key Enabling Technologies (micro and nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing technologies) that are largely acknowledged in Europe as one of the investment priorities in fostering the transition to a “smart, sustainable and inclusive economy” (European Council, 2010). Therefore, tracing back the emergence and the evolution of industries related to KET is pivotal to derive those factors that can drive their implementation in the European local economies, either as an emerging sector or as a means to modernise traditional sectors.

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4. The inception of a cleantech cluster: the case of Greentown Labs

Introduction. The chapter illustrates the inception of Greentown Labs, which is a public-private partnership initiative with the aim to become the largest incubator for clean technology start-ups in the USA and the first step in the formation of a cleantech cluster in the area. The case of Greentown Labs shows that the function of “clustering” entrepreneurs can also be performed by private developers (Chatterji et al., 2014), thus galvanizing the concept of entrepreneurial discovery and grassroots initiatives seeding.

The study will survey the urban and socio-economic context and the starting conditions of the area of Union Square where the initiative took place, focusing on the planning regulatory tools adopted by the Municipality of Somerville that fostered the settlement of Greentown Labs in the area, providing some final remarks.

4.1 Union Square, Somerville (MA): the territorial and urban context at that time

4.1.1 A Historical Perspective of Union Square

Union Square is situated 2.5 miles northwest of Boston, in the southern end of the City of Somerville, adjoining the City of Cambridge to the south, Park, Laurel, and School Streets to the west, Highland Avenue to the north, and McGrath Highway to the east. The neighbourhood started to be known as “Union Square” after it became a recruiting centre for Union soldiers during the Civil War.

The area was originally situated on marshland, but with the filling of the marsh, and heavy trading traffic, Union Square rapidly developed with commercial and residential growth, which initiated the change from a small rest stop on the way to Boston to a great commercial gateway. Traffic in and around Union square began to intensify after the development of the Medford Turnpike (Mystic Avenue) in 1803, and businesses, such as blacksmiths, wheelwrights and slaughterhouses, started to prosper. Regular routes to Boston started to be implemented, and a horse-drawn streetcar system was established in 1852 between Union and Harvard Square. The construction of row houses and apartment hotels along the streetcar line made Union Square an attractive area for Boston commuters to live: by the early 1900’s, electric streetcars made up 88 stops a day in Union Square, bringing resident commuters to their jobs in Boston and Boston and Cambridge commuters to the burgeoning industries in Union Square.



Figure 10 - Historic view of Union Square

Source: Union Square Revitalization Plan, 2012

As a result of the increased development of Union Square, farms began leaving the area and moving farther west. With the development of the automobile, a farmer could move his farm a greater distance from the city to where land was less expensive, and still be able to affordably transport his goods to Boston. On the other hand, the

widespread use of automobiles provided consumers with greater mobility and deeply modified their shopping patterns. As in many other commercial areas throughout the US, Union Square began to lose ground to newer, more competitive retailing establishments in outlying locations.

Due to new transportation model and public transit disinvestment over the course of the mid-20th century, Union Square slightly evolved towards a neighbourhood-serving square, burdened with a regional traffic problem. Highways (such as the McGrath Highway and Interstate 93) replaced streetcars in order to serve communities located north of the Charles River. When the light rail system was abruptly suspended, local economy collapsed. Property owners started removing top floors of their buildings in order to lower their commercial property law taxes, thus pauperising Union Square’s density and urban character. Stuck halfway from Boston and Cambridge with no fast connections, in 1980 the neighbourhood was designated as an “Urban Renewal area”, where issues such as storefront improvements, traffic flow, public parking and streetscape improvements came to be preeminent. On these purposes, new parking lots were developed, the public safety building constructed, new tenants filled old public facilities, roads were reconfigured, street trees planted, the public plaza was constructed, and the storefront improvement program evolved.

Union Square improvements in the 1980’s made noticeable differences in the commercial centre and the area. At the same time, people started to look at Union Square as an affordable place to live with accessibility to employment centres, especially artists, young professionals, entrepreneurs, and families.

4.1.2 The socio-economic conditions of the area

Demographics – The demographic data used in this report was obtained joining 2009 U.S. Census Block Group data and 2015 data provided by the City of Somerville. The Union Square Area intersects six Census Block Groups, which fan out radially from the centre of the Square and extend into some of the surrounding area, as shown in **Figure 11**.

Table 6 - Census Tracts

County [Middlesex]	Census Tract	Block
25017	3512	001
25017	3512	002
25017	3513	001
25017	3513	002
25017	3515	001
25017	3515	002

The Union Square Area Block Groups have an estimated *population* of 14,910. The area is a growing multi-racial, multi-ethnic neighbourhood with 5% Black, 12% Asian or Pacific Islander, and 77% White. The *age distribution* in Union Square indicates that 25-29 years old is the largest age group, representing 18.2% of the total

population, with the median age falling between 31-35. The social context pictured by these data is consistent with a relatively wealthy young neighbourhood, with more than 50% residents working in management, professional or related fields. The 2009 estimated *median household income* in Union Square is, indeed, \$36,359, about 4% higher than the median income for the City of Somerville as a whole (\$35,030). Of the 6,341 households, more than 43% are families, with an average size of 2,93 members. The Study Area had a 6.4% *unemployment rate* in 2015 and varying levels of *educational attainment*. Of the residents over the age of 25, 9% did not complete high school, 91% completed high school or higher, and 64% have a bachelors degree or higher.

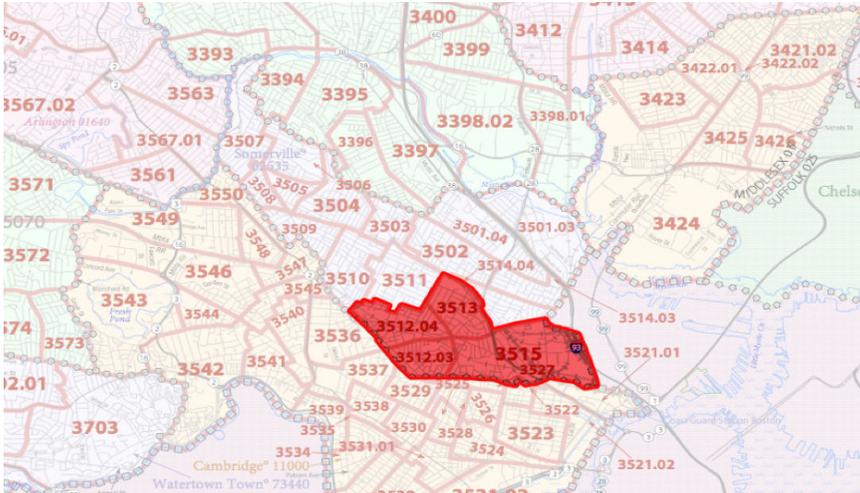


Figure 11 - Union Square Census Tracts Map

Source: author's elaboration, 2016

A closer look to census tracks data reveals that large pockets of unemployment fall within the areas labelled as 3512.04 and 3515, especially in the categories of middle aged people (23,9% of people of 45-54 years old are unemployed in census tract 3512.04), high school graduates (50% unemployed in 3512.04 and 27% in 3513) or Hispanic/Latino origin population (between 17,5% and 19,9% unemployment rate). On the other hand, low levels of labour force in census tract 3515 are largely due to the presence of a vast group of older residents (more than 21% is older than 60, compared to an average of 12% in the other census tracts), which also includes some relevant sacks of unemployment (above 14%). Therefore, the scenario pictured by these data reveals two main characteristics: on the one hand, the area closer to Union Square (the census tract 3512.03) is, on average, younger and wealthier than the other areas considered in the Study; on the other, demographics have been rapidly changing over the last years, most likely due to a process of gentrification of the neighbourhood that is becoming more and more attractive for young professionals looking for low rents and willing to live closer to a dynamic part of the City like East Somerville.

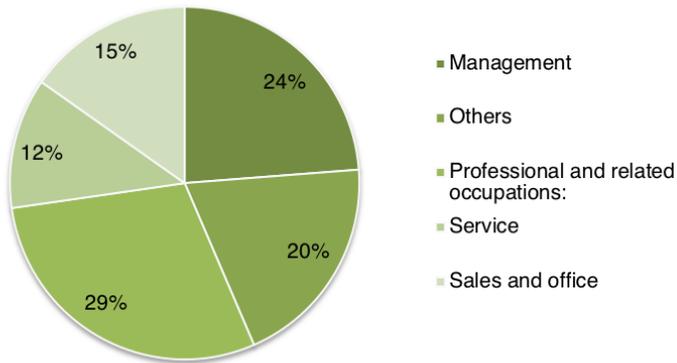


Figure 12 - Main occupations

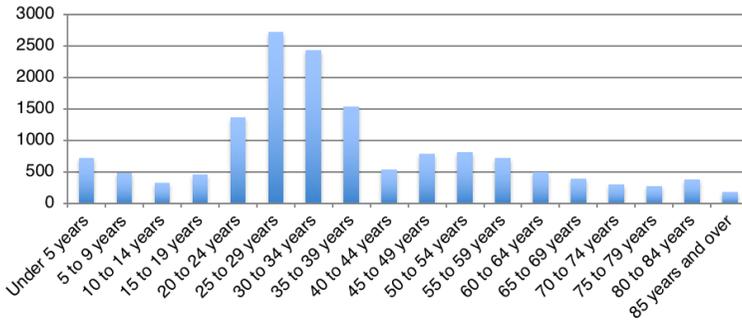


Figure 13 - Age distribution

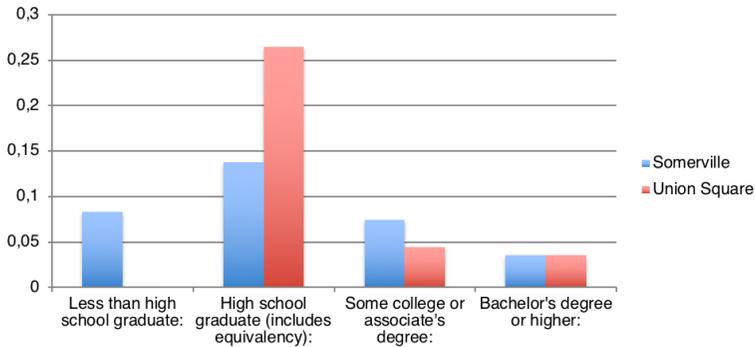


Figure 14 - Education attainment

Table 7 - Demographics detailed

Subject	Somerville		Census Tract 3512.03		Census Tract 3512.04		Census Tract 3513		Census Tract 3515	
	In labor force	Unempl. rate	In labor force	Unempl. rate	In labor force	Unempl. rate	In labor force	Unempl. rate	In labor force	Unempl. rate
AGE										
25 to 44 years	89,0%	5,2%	84,4%	3,1%	83,9%	7,8%	89,8%	9,5%	80,2%	0,0%
45 to 54 years	77,6%	8,4%	60,5%	12,1%	90,6%	23,9%	84,0%	0,0%	71,5%	0,0%
55 to 64 years	72,7%	8,7%	97,5%	14,7%	63,1%	3,7%	68,5%	7,0%	62,4%	14,5%
ETHN.										
One ethn.	74,4%	6,6%	76,1%	4,4%	78,2%	7,7%	76,8%	8,3%	65,3%	2,2%
White	75,6%	6,5%	79,0%	5,3%	78,4%	9,5%	77,9%	8,7%	69,8%	2,7%
Afro-American	66,3%	13,1%	86,0%	0,0%	98,8%	0,0%	65,7%	0,0%	52,0%	4,4%
Natives	67,8%	0,0%	100%	0,0%	0,0%	-	0,0%	-	-	-
Asian	71,6%	4,2%	63,7%	0,0%	82,7%	0,0%	63,6%	0,0%	65,8%	0,0%
Others	69,2%	4,2%	51,5%	0,0%	48,3%	0,0%	85,3%	14,8%	50,7%	0,0%
Two or more ethn.	77,0%	2,6%	100%	0,0%	74,3%	0,0%	56,6%	0,0%	80,0%	0,0%
Hispanic or Latino	73,0%	6,0%	54,7%	0,0%	64,3%	19,9%	75,0%	17,5%	47,3%	5,0%
White alone	75,3%	6,4%	80,5%	5,5%	78,9%	8,6%	77,8%	8,7%	70,4%	1,9%
EDUCATIONAL ATTAINMENT										
Population 25 to 64 years	85,2%	6,0%	84,6%	5,1%	81,5%	8,5%	86,0%	8,2%	76,4%	1,6%
< High school	67,0%	8,3%	75,1%	0,0%	64,0%	0,0%	67,0%	0,0%	44,0%	0,0%
High school	79,3%	13,8%	72,6%	8,6%	80,8%	50,0%	85,5%	27,2%	81,6%	8,3%
Some college or associate's degree	80,9%	7,5%	100%	5,9%	80,8%	3,9%	86,6%	6,6%	93,6%	0,0%
Bachelor's degree or higher	90,3%	3,6%	85,2%	5,2%	82,6%	2,4%	88,6%	3,9%	83,8%	0,0%

Business inventory – Generally, an area’s mix of stores is a major catalyst in determining the shopping patterns of local and non-local consumers. The more pleasant is the atmosphere and wider is the range of goods available, more strongly are the shoppers drawn to an area. Consequently, one measure of the attractiveness of a particular

commercial centre is the “retail mix.” According to the latest inventories available of businesses in Union Square, there are between 191 and 208 operating establishments, occupying approximately 988,460 square feet (s.f) of building space. The total count includes a large number of small ethnic restaurants and food stores, as well as business services and office spaces such as law offices, insurance, travel, and health services. Retail establishments include furniture, apparel, and jewellery. These censuses are helpful to identify several characteristics of Union Square’s commercial habitat: the *retail presence* and the *unbalanced uses mix*; the predominance of *services-related businesses*, and the lack of *auxiliary businesses*.

As one of the most important crossroads of Somerville, Union Square has the potential to be a natural attractor of a wide range of business types, and to increase its current foot traffic. Nevertheless, commercial to industrial uses ratio is markedly divergent from the standard ranges: automotive and industrial uses make up 10% of the leasable area, compared to the typical 2%. Traditional retail, instead, constitutes only 24% of the total square footage in Union Square, which is substantially less than what is typical for a healthy commercial centre (62% retail).

Moreover, 56% of the total commercial square footage in Union Square is devoted to the category of service-oriented business (e.g. insurance offices, check-cashing storefronts, and hair salons) compared to the typical 15%. However, the size of each office is relatively small, with an average space of 4,600 s.f.. Therefore, many of the service related uses are not large employers or taxpayers that could make a significant contribution to the non-residential tax base of the City of Somerville. These conclusions contrast with the idea of several observers who have indicated that Union Square could benefit from an increase in office use.

Finally, the 45 restaurants and food establishments create enough of a mix to constitute a restaurant and specialty food market that draw people to Union Square. Generally, the restaurants are small to moderate in size, with the average being 2,600 s.f.. Nevertheless, additional activities that are often associated with a dining experience – such as cafes or dessert places, culture or entertainment businesses like theatres, galleries or artist studios – are still lacking, thus not providing that kind of support needed by the existing activities or helping to boost pedestrian activity on the street.

4.1.3 The “urban texture”: settlement patterns and physical environment

Architecture and Streetscape – In spite of the fact that the historical backdrop of the Square began long time before Somerville turned into a town, just a single pre-Civil War building is standing today. The new wave of urbanism, started after the Civil War, boosted the evolution of the area into a noteworthy commercial hotspot and dramatically marked the overall cityscape of the neighbourhood. The extant few iconic historical buildings are concentrated in the Bow Street Historic District (originally known as the “Doctors’ Row” because of the buildings combined uses as a residences and doctors’ offices), but there are also three historical multi-unit houses in the Square: 1892 Richmond Building; 1898 Drouet Block; and the 1900 apartment building on the corner of Bow and Summer Streets.

Union Square has a significant residential structure in all directions from the heart of the Square. The character of the housing, however, is of the low-density variety: one-, two-, and three-family buildings. The Prospect Hill neighbourhood, at the north of the Square, hosts the highest property values, as it rises in elevation to provide views back to Boston, with well-maintained one- and two-family houses. More workmanlike residential accommodations can be found in the south and east of the Square, with several triple-decker houses. To the south of the Square, the houses are more scattered and less well-maintained, as the parcels become larger and more industrial.



Figure 15 - Building Vintage [Source: City of Somerville GIS]

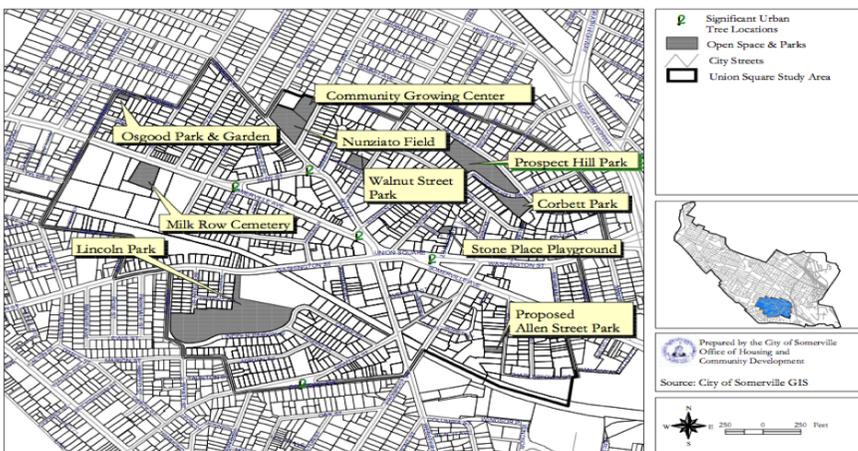


Figure 16 - Public Spaces [Source: City of Somerville GIS]

The area considered for the purpose of the present study extends west over Union Square, along the segment of Somerville Avenue that stretches from Park Street to Church Street. This segment was created around 1830 after marshlands were filled in and was intended to serve as a high capacity arterial road. The layout of the street and the characteristics of the infill buildings surrounding the area are markedly different from those in the Bow Street district, thus reflecting the original blueprint of the architectural style popular at the time of their construction in the late 19th and early 20th centuries. While, just after crossing Bow Street, Somerville Avenue turns into a slow moving, customer-friendly area that thrives with independent retail shops and restaurants, the one-way section of west Somerville Avenue has got more of an auto-centric design. Therefore, though this configuration undoubtedly helps fastening circulation of automobiles out of the Square, it also impacts the pace of revitalization of the area, reducing pedestrian activity and the ability of current businesses to increase the positive experience of users and therefore their chances of success.

The quality of life in the community is greatly enriched by urban open space areas, parks, and landscaping within the streetscape, providing both active and passive recreational opportunities. Open spaces and landscaping buffer the visual clutter and auditory clatter of the City; the trees and plants add greatly to the health of the City's people by cleaning the air, providing shade and wind protection, and by visually enhancing the area.

The Union Square plaza is the major public space in Union Square and is centrally located, but the overall area also contains several public parks, playgrounds, and community gardens. Several of these areas have been renovated or enhanced in recent years, while others are in need of improvement. **Figure 16** shows a map of the major public spaces in the area.

Housing – For the past 30 years, housing development opportunities in Somerville have been essentially limited to the rehabilitation of existing stock and the repurposing of former industrial sites, so that property values have been constantly rising due to shortage of supply since 1990. Moreover, the abolition of rent control ordinances in the adjacent communities of Brookline, Boston and Cambridge drove lower income residents from these areas to start competing with the incumbent residents of Somerville, determining a wave of gentrification that has brought new tensions and demands on the market as well as positive impacts on the City. While many poorly maintained properties benefited from restoration and renewal, the escalation of property values has made home ownership within the City very difficult for low- and moderate-income residents, and the resulting rise of rental costs inevitably displaced some of the most vulnerable communities.

Affordable housing is, indeed, a major issue for municipalities, and can be mainly addressed with two basic methods: direct expenditure of public resources and regulations requiring or encouraging the private sector to provide low-income housing. Currently, Somerville is primarily adopting the direct public subsidy strategy, using an array of federal, state, and local resources, but it also has been very proactive in implementing a variety of regulatory tools, such as:

- ❖ the Somerville Zoning Ordinance (Inclusionary Housing, Article 13), which dictates that any private developer wishing to develop eight or more market

rate housing units (home ownership or rental) must make a minimum threshold of 12.5% of the units available to low/moderate income households;

- ❖ the City's Condo Conversion Ordinance, which provides protection for elder, handicap and low-income tenants, far beyond what is dictated by state law.

According to a 2016 survey, the block groups within the Union Square area contain a total of 5,937 housing units, the majority of which is composed by 2-or-more unit structures, with a house density of 13.8 per acre. Of the occupied units in the strategy area, approximately 68% are renter occupied. Only 473 affordable units are recorded.

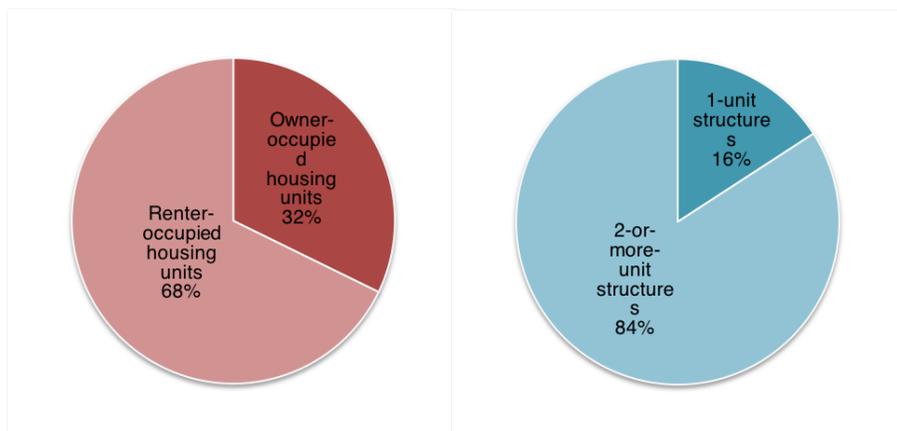


Figure 17 – Housing Tenure (left) and Units in structure (right)

Circulation and Traffic – The history of Union Square public transport was characterized by a flourishing of transportation options and facilities till the mid-nineteenth, followed by a systematic disinvestment during the 1960's, 70's and 80's. For a long time, residents and workers have benefited of highly walkable neighborhoods and efficient economical public transportation, centered on Commuter rail and streetcar lines. However, large-scale social and economic changes, such as counterurbanization and the widespread use of automobile, along with new Federal regulations, such as the Federal Highway Aid Act (FHAA) and the Federal Housing Administration (FHA), have ultimately steered investments away from cities, discouraging urban home buying. Private investment followed government incentives, and families and businesses migrated to the suburbs.

With the abolition of streetcar lines and the discontinuation of commuter rail service at the City's eight railway stations, public transportation in Somerville gradually collapsed. In 1950 the development of the Interstate 93, along with the existing McGrath Highway (which divided East Somerville and Brickbottom from Winter Hill and Union Square) contributed to the isolation of the neighborhood from the larger urban fabric, and the Somerville's culture of walking gave way to an emerging automobile culture.

Paradoxically, the development of Interstate 93 gave a substantial contribution

to a new era of public transport planning, which is mostly depending on the extension of the Green Line. Indeed, proposals for an extension of the service from Lechmere all the way to Wolburn started in 1945, with a recommendation of a state-level commission on mass transit. Nevertheless, though many core elements of this proposal were carried forward in subsequent studies during the 1960's, '70's, and '80's, the project of Green Line Extensions (GLX) had never come into effect until the environmental impacts and health burdens placed on residents of Somerville by the construction of the new highway started to be taken into consideration, and the Commonwealth consequently committed to several mass transit investments. However, the GLX was supposed to be completed by 2011, but then pushed back to 2014, and then again to 2018, and now to an uncertain but forthcoming date.

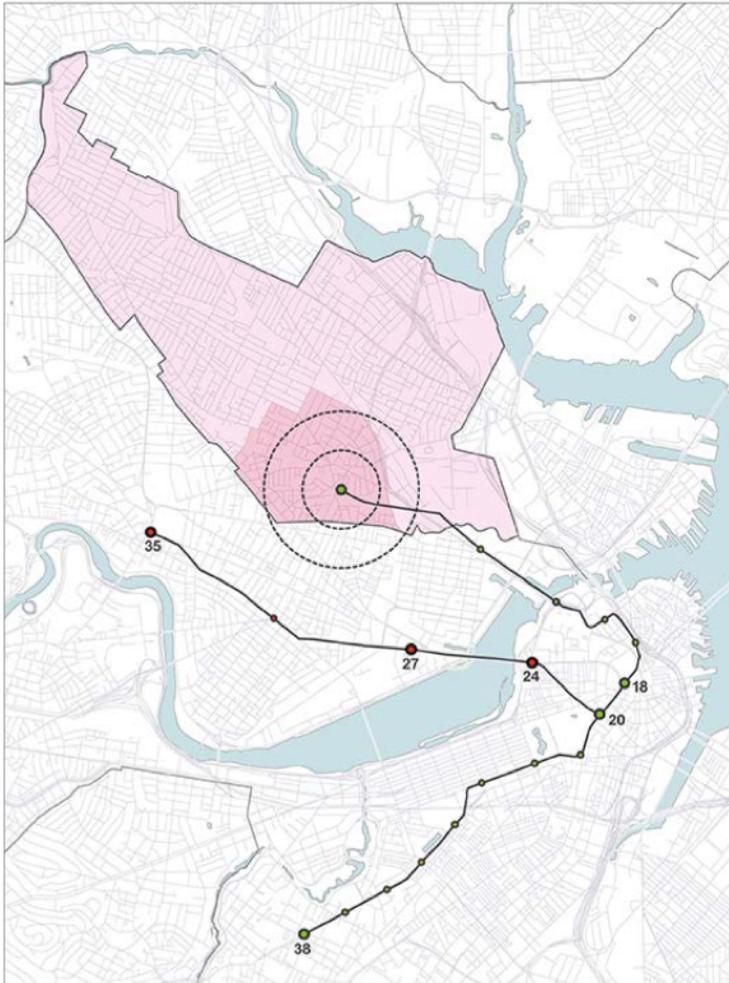


Figure 18 - Green Line Extension Project

GLX is definitely a matter of social, economic, and environmental justice. The Massachusetts Department of Transportation and the Massachusetts Bay Transit Authority have a commitment to enhance transit services in order to improve mobility and regional access for residents in the communities of Cambridge, Somerville, and Medford. The project is required by the State Implementation Plan and fulfills a long-standing commitment of the Central Artery/Tunnel (Big Dig) project to increase public transit. Moreover, the State must also safeguard air quality in urban areas by helping to reduce automobile emissions, as required by the Massachusetts Air Pollution Control Regulations.

4.2 The starting conditions of the area

In the following section, a thorough assessment of the pre-existing conditions of the neighbourhood will be provided, dating back to the period immediately preceding the revitalization process. Several problems have been afflicting the area for all over the last 30 years, determining an abrupt fall of private investment and accelerating the declaration of “decadent area” as defined in M.G.L. (General Law of Massachusetts) c.121B, §1. As such, it became eligible to be approved by the Commonwealth of Massachusetts Department of Housing and Community Development (DHCD) as an urban renewal area. Moreover, a closer look will be taken at the starting conditions of the area currently (and in the offing) occupied by the Greentown Labs facilities, which have been located within a former industrial site. The section will highlight the deep connection between the outdated planning regulatory tools of the area and the stagnation of private entrepreneurship that will lead to the development of SomerVision.

4.2.1 Union Square: finding of “decadence”

Over the past 30 years, Union Square hasn’t faced relevant development processes and a large majority (more the 80%) of the existing structure were built prior to 1940. Renovation has also been rather lacking and mostly occurred between 1975 and 1980, meaning that most of the structures would not be compliant with current building codes. This implies that during various changes in ownership and a number of real estate cycles – including a boom market – there has been little private capital investment and the ordinary operations of private enterprise, acting alone, are unlikely to reverse the economic conditions of the neighbourhood. The reasons for this are to be derived from chronic conditions in the area that have existed for decades, and have eventually led the Municipality to approve a declaration of

“decadence” under the M.G.L. in order to set up a proper renewal process. Along with endemic issues related to street patterns and soil/groundwater contamination, two other main obstacles actually prevented private redevelopment from achieving the goals of the community:

1. **Faulty parcelization**, given the plethora of small and oddly shaped parcels that makes land assemblage unusually challenging and expensive;
2. **Incompatible land uses**, which reflect outdated zoning requirements.

Indeed, parcel sizes within the Union Square area range from 70 s.f. slivers of land to 7+ acre sites. While the size of parcels of residential properties (averaging 3,000 s.f.) are typical and adequate for their use in Somerville, many of the commercial lots, instead, have a similar size and do not fit most commercial uses. In the 2009 rezoning ordinance, minimum lot sizes for the various zones, mapped as transformation areas, were set at 15,000 s.f., 25,000 s.f., and 50,000 s.f. in order to call for larger scale development, though over 40% of the parcels are under the minimum size required. In addition to this problem, puzzling arrangement have been set up by property owners by lease or other agreements to overcome oddly shaped parcels, thus jeopardising further options for development.

On the other hand, many of the land use types for commercial purposes that exist in the area today are a legacy of the former industrial characterisation of the neighbourhood, with several one-story buildings, warehouses and surface parking areas related to the presence of a major Ford Assembly plant in the past. These uses represent a disincentive for private investment and redevelopment. Specifically, parking lots, though somehow accessory for retail uses, mandated higher parking ratios than those currently in force. The proliferation of surface lots negatively impacts adjacent sites and over-serves the parking demand.

4.2.2 Setting the ground for a major cleantech incubator: location and previous uses

Historical narrative and economic use of the site – One of the most relevant examples of inadequate land use is the area south of Somerville Avenue at the crossing with Dane Street, the location of Greentown Labs starting from the fall of 2013. The site was formerly known as a leading industrial complex owned by the American Tube Works company, founded in 1851 after acquiring the patent for the production of seamless brass and copper tubes. The company is credited as being the first in America to manufacture seamless tubes that were originally used for locomotive, marine, and stationary boilers. In the late 19th and early 20th century, they expanded their production to include seamless tubes for domestic uses, such as indoor plumbing and heating fixtures. With more than 800 employees, it was reported to be one of the largest industries in the State of Massachusetts by 1912. Afterwards, the company remained one of the major regional producers of seamless tubes and was in operation until the Great Depression halted production in ca. 1933. The company remained in Somerville until 1934, the year after Walter O’Hara gained control of the organization. It is not listed in the 1935 Somerville City Directory, and in 1936 a Cambridge address is given for the company. Since the American Tube Works ended

its Somerville productions, the remaining buildings in the complex have been used for various commercial and industrial functions, such as metal fence manufacturers, a paper retailer, a boxing club, auto body repair shops, self-storage, and small commercial offices. A great portion of the industrial complex was acquired by the Ames Safety Factory, founded in 1919 to produce durable and tamper-proof envelopes. Later, Ames developed color-coded files to hold medical records and packaging for floppy disks. The company had grown to about 600 employees in the mid-20th century, making sturdy envelopes, boxes, and file folders for medical records. But as the world started going digital, its business shrank, and eventually Ames was bought by a Wisconsin company rolling up similar manufacturers. The last 150 jobs at Ames vanished in 2010. Ames had once been among the biggest employers in the city and was considered “an institution”. The task of filling the 290,000-s.f. complex with tenants was a big issue for the municipality. However, as the story of the Ames manufacturing company was coming to a close, a new era of innovation was initiated in the same location. In 2011, two major leases were signed with Winebow, a wine import-export distributor, and Artisan’s Asylum, a non-profit community fabrication site that offers members access to a machine shop and classes. These new incumbent businesses were highly consistent with the former industrial use, keeping alive the manufacturing characterisation of the area and paving the way for the location of Greentown Labs in 2013.

Urbanscape – By the time of the development of the new City’s Comprehensive Plan, the former American Tube Works Company Complex was in fair condition and formed an identifiable intact group of early 20th-century, traditional brick, industrial buildings, although the overall integrity of the area had been somewhat compromised by the demolition of a number of historic buildings and the intrusion of modern buildings. The first group of buildings was built in this location ca. 1850-1860, but they were all demolished when the production plant was expanded and modernized in the late 19th century. By 1933, the American Tube Works constructed 15 buildings in the area bounded by Somerville Avenue, Dane Street, the former Fitchburg railroad tracks, and Church Street. Seven of these original buildings are still in existence, while the remaining (specifically, two of the drawing mills, the foundry, the proving mills, the shipping mills, and a storage house) have been demolished. Despite the removal of these historic buildings, the heterogeneity of extant building forms undoubtedly express the function and use of the buildings as well as of the complex as a whole. Intrusions into the area included a modern grocery store set back from Somerville Avenue by a large parking lot and a low-scale office building and parking lot located just north of the railroad tracks. These intrusions changed the overall setting of the district by altering the relationship between the buildings within the complex and between the complex and the railroad. Nevertheless, the area retains its integrity of location, design, materials, workmanship, and association.

4.3 The Challenge

The policy framework that fostered the location of Greentown Labs in the neighbourhood of Union Square leveraged his success with a sound mix of instruments that range from new zoning regulations to the direct provision of funds or the partnership with relevant public agencies, as it will further explained in the following section of this study (see §B). For the purpose of this section, preference will be given to the urban planning side of the policy design adopted by the Municipality of Somerville, by looking at the main steps that guided the reorganization of city planning in the last 5 years and the significant re-zoning ordinance that abruptly changed the evolution of the area. Finally, the location of Greentown Labs will be assessed in terms of relationship with the overall planning redesigning.

4.3.1 Planning the new Union Square

Steps – Three major planning ordinances catalysed the redesigning of Union Square’s urban and economic structure.

1. 2012 Union Square Revitalization Plan

The Union Square Revitalization Plan is a 20-year plan approved by the Somerville Board of Aldermen in 2012. The plan was empowered by the declaration of the revitalization area as a “Decadent Area”, which led to the development of an “Urban Renewal Plan” for its rehabilitation. It mainly serves as an action plan for implementing specific planning goals, thereby encouraging the investment of state and federal funds towards reaching those goals. Two significant community processes, undertaken in the previous years, informed the actions proposed in the plan: the comprehensive rezoning of Union Square in 2009, and Somerville’s first comprehensive plan, known as the “SomerVision Comprehensive Plan”, which is intended to run concurrently to the neighbourhood revitalization plan.

2. SomerVision 2010-2030 – Comprehensive Plan

SomerVision is 20-year plan that identifies shared values, sets measurable goals for the creation of new jobs, open spaces, development of new dwelling units, and transportation options, but it also illustrates the areas of the city that should be conserved, enhanced, and transformed in Somerville. It’s simultaneously a plan for neighbourhood protection and a plan for growth. The major themes influencing the work of the steering committee in the organization of SomerVision are the following: neighbourhoods; commercial corridors, squares, and growth districts; resources; transportation and infrastructure; and housing. SomerVision also includes an implementation plan, which identified six priorities: station area planning, quality of life strategies, housing activities, sustainability programs, infrastructure and

transportation improvements, and a zoning code overhaul. As stated in the executive summary, SomerVision has been intended to:

- *“Celebrate the diversity of our people, cultures, housing, and economy.*
- *Foster the character of residents, neighbourhoods, hills, and squares, and the strength of our community spirit as expressed in our history, our cultural and social life, and our deep sense of civic pride.*
- *Invest in the growth of a resilient economy that is centred around transit, generates a wide variety of job opportunities, creates an active daytime population, supports independent local businesses, and secures fiscal self-sufficiency.*
- *Promote a dynamic urban streetscape that embraces public transportation, reduces dependence on the automobile, and that is accessible, inviting, and safe for all pedestrians, bicyclists, and transit users.*
- *Build a sustainable future through strong environmental leadership, balanced transportation modes, engaging recreational and community spaces, exceptional schools and educational opportunities, improved community health, varied and affordable housing options, and effective stewardship of our natural resources.*
- *Commit to innovation and affirm our responsibility to current and future generations in all of endeavours: business, technology, education, arts, and government”.*

Table 8 - SomerVision Highlights

SomerVision Numbers	
30,000	New Jobs
125	Acres of New Public Space
6,000	New Dwelling units
1,200	New Affordable units
50%	Trips by Non-Automobile

3. Union Square Neighbourhood Plan (2016)

Table 9 - Union Square Neighbourhood Plan Highlights

Union Square Neighbourhood Plan Numbers		% SomerVision
15,465	New Jobs	51.55%
12.32	Acres of New Public Space	9.86%
2,349	New Dwelling Units	39.15%
470	New Affordable Housing units	39.17%
50%	Trips by Walking, Biking, or Transit	(same)

A neighbourhood plan (NP) embodies how each neighbourhood uses the framework of SomerVision, and in 2016 the residents of Union Square released their

NP following the examples of Gilman Square and Lowell Station Area. It details the programs and policies that will foster the achievement of the goals for economic development, equity, public realm, housing, development, and mobility, as they were stated in the City's Comp Plan. The main rationale behind the NP is, indeed, to scale down the objectives set for the entire municipality, such as 85% of development in 'transform' areas, or 30,000 jobs, specifying in which measure they will be pursued by the neighbourhood, which policy tools will be deployed and which area will be interested.

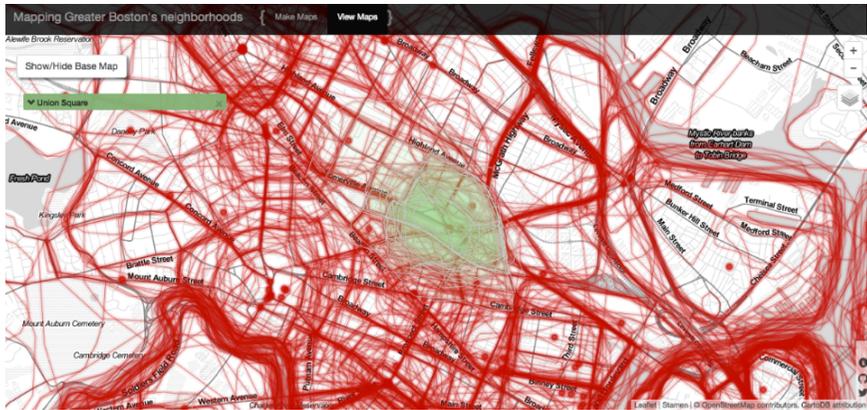


Figure 19 - FOCUS ON NEIGHBOURHOODS BOUNDARIES DEFINITION

A closer look to the website Bostonography.com, which helped to map the neighbourhoods of Boston, Cambridge and Somerville online by letting citizens draw their own boundaries and name each neighbourhood themselves. A bottom-up, 'crowdsourced' mapping effort that was used to identify the many neighbourhoods that community members recognize today.

Zoning – In order to address specific issues and to overcome outdated planning regulatory tools (outlined in the previous section), the Municipality has gone through a deep process of re-zoning of the area since 2009. Specifically, two new zoning districts have been created:

1. The **Corridor Commercial District (CCD)**, which mainly concerns the properties along corridors such as Somerville Avenue and McGrath Highway. The district recognizes that these areas may represent an important opportunity for an active mix of uses while also helping to address development challenges posed by faulty parcelization and the development of residential buildings in the surrounding, as well as the need to be accessible by multiple transportation options. The major objectives of the district are to:
 - a. Encourage active mid-rise commercial and residential uses that contribute to a multimodal-friendly street;
 - b. Increase commercial investment in high-profile, accessible areas;
 - c. Preserve and complement historic structures;
 - d. Discourage inappropriate auto-oriented uses along transit

- e. Promote pedestrian and bicycle activity.
2. The **Arts Overlay District (AOD)** is a subordinate zoning area with the aim of supporting the preservation and enhancement of Arts-Related Uses, particularly within Union Square. The district is also intended to enhance the area as a hotspot for a variety of uses such as retail, business services, housing, and office uses and to promote a strong pedestrian character.

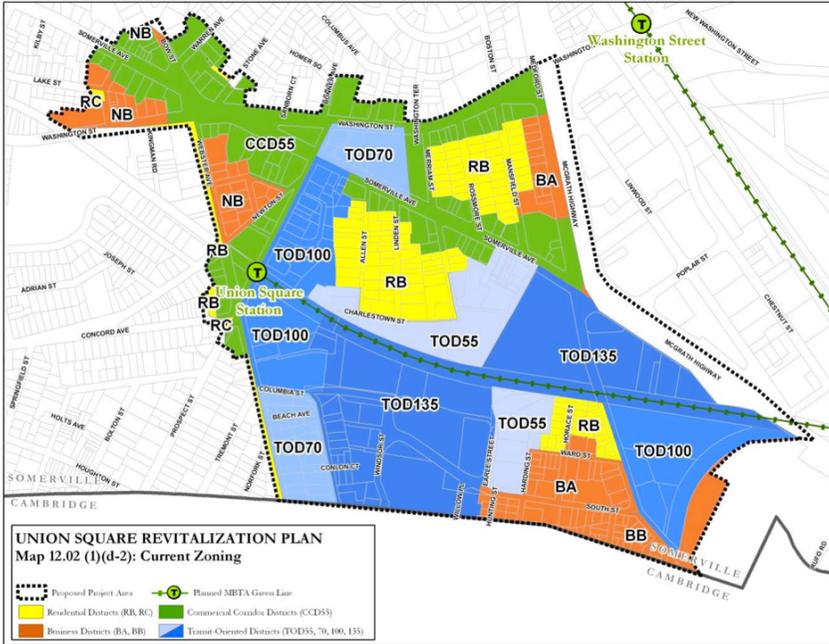


Figure 20 - SomerVision Map
Source: Union Square Revitalization Plan, 2012

Moreover, SomerVision provided the identification of three areas, which overlap with the aforementioned zoning districts: Areas to Conserve, Areas to Enhance, and Areas to Transform. Areas for conservation (shown in green in **Figure 21**) are primarily residential and little or no change in land use or structures is expected. Areas for enhancement (shown in blue) are mostly coincident with the new CDC district and include parcels fronting Somerville Avenue and Washington Street. Although the sites included in these areas are particularly appropriate to contribute to SomerVision redevelopment goals, significant physical change is not expected, though transportation and other public infrastructure will undergo a deep renovation process. Finally, areas for transformation (other colors) are areas where large scale redevelopment is expected to occur in phases over time.

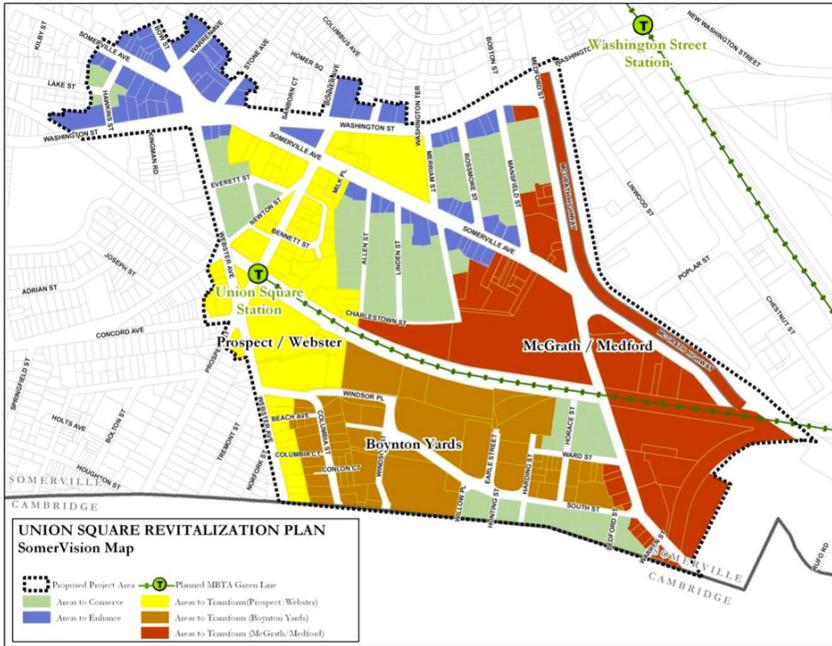


Figure 21 - SomerVision Map
Source: Union Square Revitalization Plan, 2012]

4.3.2 Greentown Labs: a key actor for SomerVision

The location of GTL in the area is consistent with the purpose of the AOD district, which is “to encourage the preservation and enhancement of Arts-Related Uses, particularly within Union Square”. The area has been also identified as “Area to Enhance” in the SomerVision map, and the initiative actively contributes to the promotion of a new “innovation system” in the area. The use proposed increases jobs, commercial tax base, and the expansion of the innovative, creative, green technology company is consistent with the CCD district’s purposes. The changes to the building are also consistent with the purpose of the district, since they enrich its character and the pedestrian experience with opening up the façade to have a view of the interior of the space along the sidewalk. Goals, policies, and actions of SomerVision plan that Greentown labs complies with include the following:

- ❖ Preserve and enhance the character of Somerville’s neighbourhoods;
- ❖ Transform key opportunity areas;
- ❖ Make Somerville a regional employment centre with a mix of diverse and high-quality jobs.

It also meets several social and economic development goals of SomerVision. One of the goals is to invest in the talents, skills and education of people to support

growth and provide opportunities to residents of all social and economic levels. A key action item under this goal is to establish new collaborations to train residents for medical, laboratory and new technology jobs. The Greentown Labs fits this type of business. The company creates a space in which innovation and technology is created in a collaborative and educational environment. Another goal is to ensure that the infrastructure for all utilities is sufficient in capacity and quality, of the best available technology, redundant, and supportive the desired level of future growth. The building will use green technologies and systems monitoring to ensure that the building is energy efficient and will bring visibility of these technologies to Somerville Avenue. Finally, SomerVision calls for 30,000 new jobs in the City by 2030 for residents and entrepreneurs. This proposal will bring 240 new jobs to help meet this goal in the research and development industry that will contribute significantly to Somerville's creative economy.



Figure 22 - Aerial picture of the location



Figure 23 - Greentown Labs - Parcels (current in red and forthcoming in blue)

4.4 Externalities and the function of “clustering”

The case of Greentown Labs provides several strands of analyses, by means of territorial outcomes implications, institutional texture, and policy implications. The rationale behind the persistent interest in this project by local policy-makers is threefold: on one side, local governments typically target fields that appear to have long-standing comparative advantages in the city (Chatterij et al., 2014), and the policies tend to reflect the new ideas and human capital that can be fostered by these sectors. Public support for clean-tech is seen, by these means, as a tool for dealing with the negative externalities, like carbon emissions, associated with traditional energy sources, which have been dominating the innovation scenario over the past two decades. In accordance with the theoretical model of urban economics developed by Duranton (2007), cities grow or shrink are strongly related to the movement of industries across cities, which is highly determined by where past breakthrough inventions occurred. That is saying, in a nutshell, that industries follow innovation, and not vice versa. As remarked by Chatterij et al. (2014, p. 10): “Boston will be home to the mousetrap industry while Boston is the site of the latest frontier of mousetrap inventions, but should a better mousetrap be invented in Memphis, the model [of Duranton, A/N] predicts that the industry would migrate from Boston to Memphis”.

On the other side, local municipalities acknowledge the importance of “seizing” industries and strategic actors within their own territorial domains. Since the work of Rosenthal and Strange (2003), knowledge spillovers and branching-off processes have been proved to attenuate rapidly across the city, even over just few blocks, as showed for the case of Manhattan in Arzaghi and Henderson (2008). This is why policymakers have initiated several programs that seek to increase the supply of entrepreneurs in specific neighbourhoods.

In terms of policy implications, the case of Greentown Labs shows that the function of “clustering” entrepreneurs can also be performed by private developers (Chatterji et al., 2014), thus galvanizing the concept of entrepreneurial discovery and grassroots initiatives seeding. Public policies can, thus, layer over privately-founded initiative and anchor them to broader economic or territorial initiatives, as in the case of the City of Somerville. The 20-year program “SomervilleVision”, by these means, provided a fertile ground for the development of Greentown Labs, and benefited from multiple positive externalities thanks to its location: among the others, the creation of new job opportunities, the requalification of a mature industrial area, and the establishment of a vibrant community of entrepreneurs, who are also encouraged and sponsored to pilot their green innovation in the city under the Somerville Green Tech Program.

By these means, Greentown Labs constitutes a convergence point of a complex network of public policy initiatives that act a different scale and with different objectives. Along with the municipal level, different federal public agencies, like the NSF and the SBA, are involved in the initiative in order to enable the production of

radical innovation in the cleantech and foster sustainable transition, while at the State level, institutions like MassCEC, are primarily focused on encouraging start-up formation and growth, spurring knowledge transfer across various organizational boundaries, and creating a regional hub for the specific clean-tech sector. Therefore, a sound policy mix, at the state and local level, aiming at building and supporting clusters can be consistent with a leading role of private initiatives and should encompass a territorially-led vision in order to internalize the externalities that can come from innovation and new start-ups.

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