Revamping growth in an advanced country: the case of Milano[1]

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Abstract

In this paper, we provide a narrative of the return of Milano to the world spotlight and present the reasons behind Milano's revival. In doing so, we put special emphasis on the role played by the Life Sciences, to draw lessons on why and how growth may be revamped and sustained in a big city of a country that went through a prolonged crisis and only gradually started its recovery.

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Introduction

In 2009 the *Financial Times* labelled Milano "Europe's Cinderella" because its urban setting unfavorably compared not just against Paris and New York, but also with smaller and less renowned places such as Lyon. Since then, things have changed. The Expo fair brought to the city 21 million visitors - one third of which from abroad. The perception of its allure changed so much that, in 2015, *The New York Times* used quite a different headline to introduce the former Cinderella: "Milan, a place to be. A revitalized city welcomes the world". Now the glitter and the gold of Expo 2015 is gone, but the sense that Milano is living vibrant times is still there.

In this paper, we document the return of Milano to the world spotlight and present the reasons behind Milano's revival. In doing so, we underline the importance of Milano's economic model. Milano indeed boasts a key strength in its entrepreneurial ecosystem. The city's distinctive economic features are those of a knowledge economy with a strong international vocation, in which both a varied manufacturing and service production, as well as large medium and small firms coexist in the urban space. Long identified as Italy's business and financial capital, and traditionally renown for fashion and design, through time Milano was able to nurture and invest in excellences in other domains, from mechanics to chemistry, from agrifood to the Life Sciences. Also, Milano's distinctive economic structure keeps together a strong network of foreign multinational companies (4.2 thousand of 13 thousand in Italy overall), large firms (as many as 90 with a turnover of over 1 billion euros), medium firms (strongly internationalized), but also and especially small enterprises (many family-owned) and startups. Relevantly to this paper, Milano's model as such provides the right premises to the development of sectors that build on and further enable cross-industry interactions, flows of knowledge and capital, innovation, growth and wellbeing beyond the single industry, sectors among which the Life Sciences is the prime example.

Based on both qualitative evidence and the latest available data, in this paper we hence build a narrative on the Life Sciences and the role it plays in Milano's economy, to draw lessons on why and how growth may be revamped and sustained in a big city of a country that went through a prolonged crisis and only gradually started its recovery. In doing so, we also briefly recall the importance of the adoption of better regulation.

The paper is structured as follows. Section 1 introduces Milano and its distinctive features as a global city. Also, it presents Milano's key figures that testify to its revived strength on the international

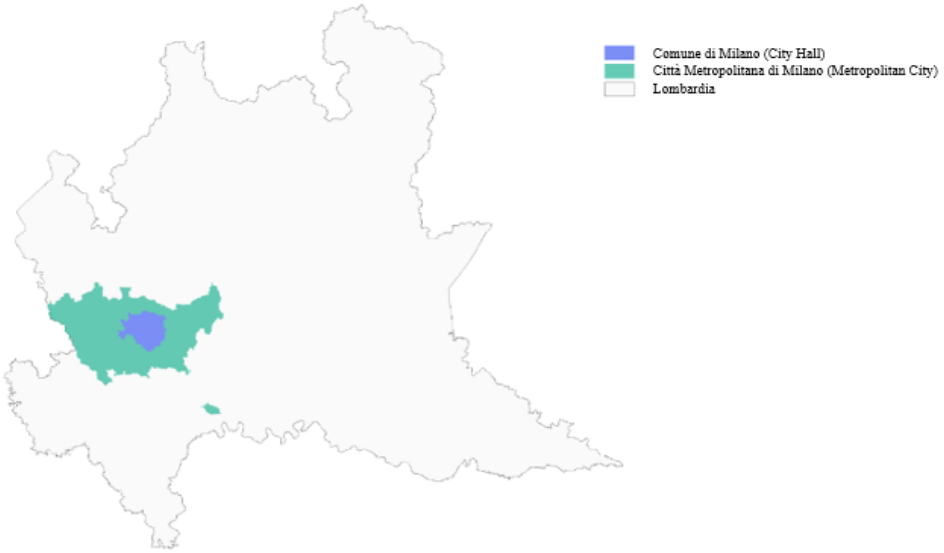
arena. Section 2 describes the essential facts about the productive and demand linkages that made the Life Science industry one of the driving forces of the growth revival in Milano. Section 3 indicates the main areas of further development. Section 4 concludes with an attempt to draw general lessons from Milano's revival that may - in our opinion - be seen as a blueprint for other urban settings.

1. Milano, from “Europe’s Cinderella” to “a place to be”

1.1 What we mean when we say “Milano”

It is preliminarily useful to spell out what we mean when we say “Milano”. For the purpose of this paper, unless otherwise specified, Milano coincides with its Metropolitan City, a urban setting of 3.2 million inhabitants which spans 1,576 square km[2].

Figure 1. Milano on the map



Source: Centro Studi PIM

When speaking of the Life Sciences in Section 2, though, at times we broaden the analysis to include Lombardy as a whole, with its 10 million inhabitants and 24,000 square km. We do this for two reasons. First, the Life Sciences concern actors and inter-industry relations mainly located in, but not at all exclusively confined to Milano, for in some cases they extend to the entire region. In turn, the Life Sciences radiating from and gravitating around Milano reach and impact not only people in the city, but spill over to the surrounding territory. Second, in Italy, regions, not cities, are responsible

[2] When talking about Milano as a global city, it is indeed inappropriate to limit the perimeter of the analysis to the City Hall (Comune di Milano). The Italian Presidency of the Council of Ministers (2017:7) claims this connotation today is largely obsolete, since the corresponding administrative boundaries are based on a distribution of political and administrative power which does not reflect recent people flows, novel connections between towns, changes in study and work activities and daily routines. It is hence relevant to broaden the analysis to the Metropolitan City of Milano (the institutional entity consisting of the Milano City Hall plus 133 surrounding towns).

for the provision of incentives and norms and, more generally, for the governance of the Life Sciences.

1.2 Milano's known assets: finance, fashion, design

Before moving onto describing the fall and resurgence of Milano and the role of the Life Sciences within it, it is also useful to introduce the city's known assets. As described in the next paragraphs, those include most notably finance, fashion and design. However, most broadly the city gains a competitive advantage from having a strong diverse and international manufacturing base. This connotation of Milano's economy provides relevant insights as to the development and relevance of the Life Sciences, as this paper will later explore in Section 2.

Milano is counted among the so-called "global cities", hubs where technologies, finance, multinational corporations, information and, more in general, power gather and radiate. Those cities play a pivotal role in the world economy: the majority of jobs will be located in cities, given that 70 percent of the world's population is projected to live in urban areas by 2050 (UN Habitat, 2010).
As other global cities, Milano is extremely powerful in the global network because it concentrates a growing share of the global components in its national economy. Milano has long been referred to as Italy's business capital, but it also boasts other titles, strong of three known assets: finance, fashion, design.
Starting with finance, the city headquarters the two biggest Italian banks, Intesa Sanpaolo and Unicredit. Dynamic branded companies such as Yoox Net-a-Porter and Kering-owned Gucci have chosen Milano to establish their new corporate headquarters. Being also home to the country's stock exchange Borsa Italiana, Milano is indeed Italy's financial capital.
Yet the city is also a well-known global capital of fashion and design. Its "Fashion Week" - an event hosted in Milano twice per year since 1958 and rivalling in importance (though not in sheer size of visitors and revenue) those taking place in Paris, New York, London - typically receives some 22,5 thousand unique visitors twice per year with overall revenues of some 50 million euros for the city and the business. In April 2018 its "Salone Internazionale del Mobile", an annual design fair now at its 57th edition, attracted over 430 thousand attendees from 188 countries in six days, i.e. +26 per cent compared to the 2017 edition. Waiting for visitors one could find over 1,841 exhibitors, about one fourth of which foreigners from 33 countries, with 650 designers under 35 featuring in a parallel fair.

Altogether, the city conference center Milano Congressi (MiCo), run by Fiera Milano, is the largest in Europe (54,000 sqm of exhibition space hosting 500 events per year, "Call us and this will be the last nuisance you will have to worry about") and one of the top in the world.

1.3 Milano's model

Unlike the hundreds of cities that locate on global circuits though, Milano does not limit itself to few specializations. Underpinning Milano's success is a model that is unavoidably and intrinsically different from that of a global financial hub (e.g. New York, London, Hong Kong) or a political hub (e.g. Paris, Beijing). Milano is instead powerful in the world network because, in the likes of Chicago and Barcelona, it secured a specialized global advantage in producing certain types of financial, legal and accounting instruments which had to be developed to handle the needs of its diversified and international industrial base. In addition, Milano boasts an advantage also in other sectors (notably cultural and creative industries, concentrating 10 per cent of the Italian creative industries' value added and workforce).

To be specific, we argue that Milano's model is that of a knowledge economy with a strong international vocation, boasting two main features:

1) A broad manufacturing base flanked with innovative services and arts and creative industries;
2) A network able to put together multinational corporations and large firms (which act on international markets and are integrated in Global Value Chains) with local SMEs (which, although in some cases have a global outreach, most often limit their stance to the domestic market).

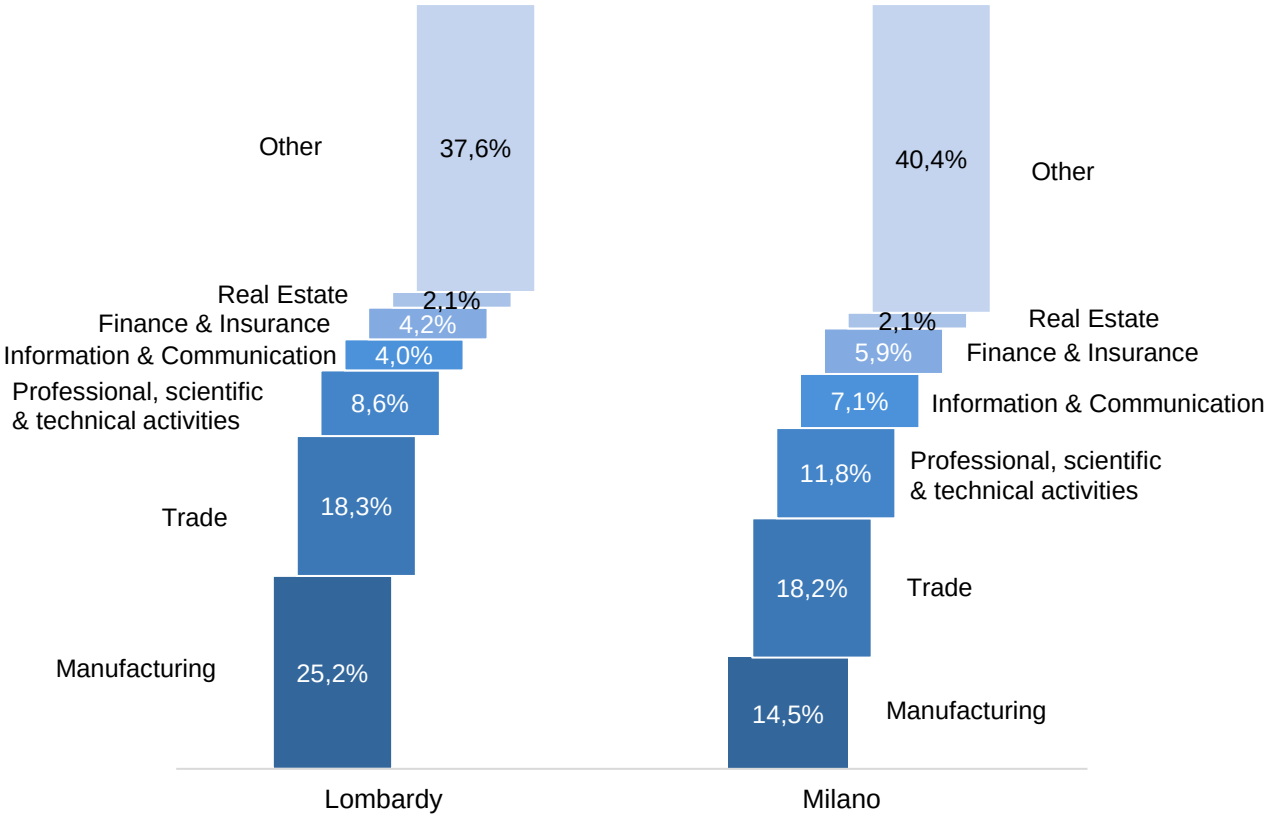
It is important to stress that diversity is the keyword. All in all, diversity endows Milano with the necessary mix of resources to manage and service the global operations of firms and markets[3], especially being on two levels: industries and firm structure.

Concerning diversity by industries, as illustrated in Figure 2, professional and scientific services together with information and communication employ almost 20 per cent of the workforce in Milano, financial and insurance activities some 6 per cent of the total. Though concentrating such knowledge-intensive services, hence serving as reference point for the surrounding region (in Lombardy, the same figures fall to 13 and 4 per cent, respectively), Milano did not reject but rather built on its

[3] Also, a diverse set of industries is on the one hand one enabling factor of creativity, innovation and "new jobs" (i.e. jobs that did not exist before), in turn contributing to the economic success of cities (e.g. Moretti, 2015). On the other hand, the diverse activity of an area might be seen as an infrastructure for integration and inclusiveness, as income and profits get captured by a broad range of industries (from manufacturing to services, from advanced to backward) rather than concentrating into one (Sassen, 2015).

manufacturing core. The traditional manufacturing sector still employs around 15 per cent of the total workforce in Milano, with metal, engineering and technology-based industries and pharmaceuticals and chemicals being the leaders.

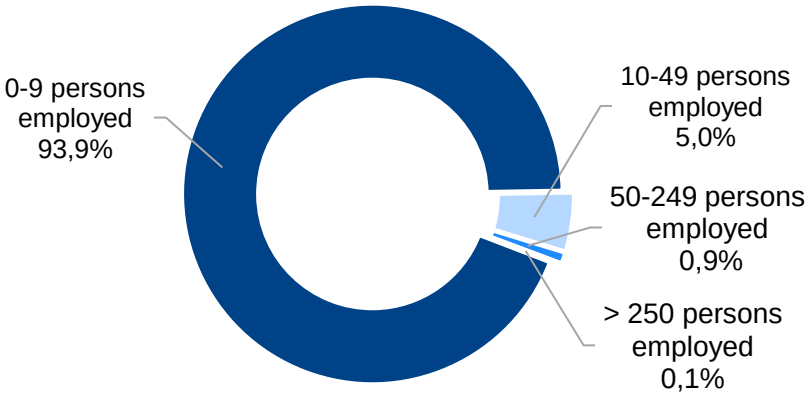
Figure 2. Employment by sectors



Note: the numbers refer to local units.
Source: Assolombarda on Istat data, 2015.

Other than by industries, Milano has also a diversified business structure by size (Figure 3). To get the peculiarity of Milano in such sense, the most significant and correct comparison is that of Milano with its closest peers by size and industrial weight, identified with the capital cities of the most productive European regions, namely Barcelona (Cataluña, Spain), Lyon (Rhône-Alpes, France), München (Bayern, Germany) and Stuttgart (Baden-Württemberg, Germany).

Figure 3. Firms by size class - total economy



Note: the numbers refer to local units.
Source: Assolombarda on Istat data, 2015.

As to large firms, as many as 90 companies - both national and international - with a turnover of over one billion euros chose to have their head offices in Milano. This compares with 61 in München, 39 in Barcelona, 24 in Stuttgart and 13 in Lyon. Interestingly, these large firms are not concentrated in a handful of industries as in Lyon especially, but also München and Stuttgart. Instead, they appear to mirror the diversity of Milano's economy in terms of industries. Taking the turnover of those 90 firms altogether, 52 per cent of the total can be attributed to manufacturing, 20 per cent to trade and transport, another 20 per cent to finance, insurance and real estate and information and communication.

Concerning foreign enterprises, Milano is also Italy's gateway for multinationals and foreign direct investment (FDI). In terms of foreign brownfield investments, as of 2017, Milano is home to around 4.2 thousand multinational companies with a turnover of 208 billion euros and a workforce of around 431 thousand people. Plus, Milano attracts over 30 per cent of total greenfield FDIs to Italy in 2016. The only European peer with a comparable role is Barcelona, which attracts 20 per cent of total greenfield investment to Spain, while München (10 per cent), Lyon (4 per cent) and Stuttgart (3 per cent) all lag behind.

Milano also hosts a large number (and fraction of Italy's total) medium-sized enterprises. According to Mediobanca-Unioncamere data, Milano and Lombardy respectively host 250 and 1 thousand of them - about 7 and 31 per cent of Italy's total of 3.3 thousand firms that account for approximately 15 per cent of domestic manufacturing value added and Italian exports. Similarly to Lombardy, also

Cataluña, Baden-Württemberg and Bayern concentrate a large share of national medium-sized enterprises. Yet, Lombardy is unrivalled by its European peers. Baden-Württemberg counts 248 firms, covering 20 percent of the German total, while Bayern 213 firms, that is 17 percent. Cataluña concentrates fewer firms, but a higher share than German benchmarks (187 medium firms, 24 per cent of the Spanish total). Instead, the distribution of medium-sized companies is more spread in France: 139 firms for 13.1 per cent of the national total are enough to place Rhône-Alpes as the second region behind Île-de-France (152 firms, 14.3 percent of the national total).

Finally, as to micro and small firms, the startup phenomenon - to be broadly intended as new entrepreneurship - deserves special attention. Of particular interest within the startup world are knowledge-intensive startups. The latter broadly encompass high potential new entrepreneurship that base their competitive advantage on the development and commercialization of advanced, high-value products and services and on highly skilled human capital. They are drivers of knowledge and innovation. Over 15,300 knowledge-intensive startups were born in the last eight years and they grew to represent 13 per cent of new corporations in Lombardy, up from 10.2 per cent recorded in 2007 (the same figure for Italy is lower and steady at 9 per cent). Focusing on the period 2012-2014, the number of knowledge-intensive startups born per 100 thousand inhabitants grew by +22 per cent, an impressive performance compared to Cataluña (-3.0 per cent), Rhône-Alpes (+4.8 per cent), Bayern (+1.4 per cent) and Baden-Württemberg (+9.7 per cent).

This contributes to picture Milano (and Lombardy) as particularly innovative and knowledge-driven territories. While extremely lively a context, Milano still has some way to go as to “cocooning” its startups. If for startups in Bayern and Baden-Württemberg the risk of not surviving decreases already from their third year of life, approaching zero in the seventh, in Lombardy the same risk increases up until the fifth year and levels at around 6 per cent after. Also, by growth performance startups in Lombardy are in line with their German peers in the first to four years of economic life, but unlike them they tend to slow down later. Still, the probability that knowledge-intensive startups are attractive enough to get acquired grows with firm maturity from 0.5 per cent at the first year of age to 5.6 per cent in the seventh, in line with German peers (from 0.9 to 6.1 per cent) and way ahead of Spanish peers (from 0.5 to 1.1 per cent).

Table 1. Milano and its European benchmarks

	Milano	Barcelona	Lyon	München	Stuttgart
Manufacturing workforce *(% of total, 2015)*	14.5% (Milano) 25.2% (Lombardy)	19.0% (Cataluña)	26.1% (Rhône-A.)	29.4% (Bayern)	34.6% (Baden-W.)
	Source: Istat, Eurostat				
Firms with turnover > 1 billion euros *(2015)*	90	39	13	61	24
	Source: Assolombarda, Comune di Milano				
Foreign owned companies - brownfield investments *(2015)*	9,036	5,520	1,316	10,247	2,969
	Source: Assolombarda, Comune di Milano				
Greenfield Foreign Direct Investment projects (% of the national total)	30.8%	20.4%	4.3%	11.0%	2.8%
	Source: fDi markets				
Medium-sized enterprises *(2015, *2013)*	250 (Milano) 1,000 (Lombardy)	187* (Cataluña)	139* (Rhône-A.)	213* (Bayern)	248* (Baden-W.)
	Source: Mediobanca, Unioncamere, Confindustria, Ricerche e Studi				
Knowledge intensive startups born between 2017 and 2014	15,351 (Lombardy)	19,910 (Cataluña)	14,034 (Rhône-A.)	17,994 (Bayern)	11,444 (Baden-W.)
	Source: Assolombarda, Politecnico di Milano				
Knowledge intensive startups born *(per 100,000 inhabitants, var. % 2014-2012)*	22.0% (Lombardy)	-3.0% (Cataluña)	4.8% (Rhône-A.)	1.4% (Bayern)	9.7% (Baden-W.)
	Source: Assolombarda, Politecnico di Milano				
Survival rate of knowledge intensive startups *(as of 2015, % of total startups born 2007-2014)*	79.6% (Lombardy)	80.7% (Cataluña)	81.9% (Rhône-A.)	89.3% (Bayern)	88.9% (Baden-W.)
	Source: Assolombarda, Politecnico di Milano				
Takeover rate of knowledge intensive startups *(as of 2015, % of total startups born 2007-2014)*	3.5% (Lombardy)	0.9% (Cataluña)	2.2% (Rhône-A.)	3.7% (Bayern)	3.7% (Baden-W.)
	Source: Assolombarda, Politecnico di Milano				
High growth knowledge-intensive startups *(as of 2014, % of total startups born 2007-2014)*	4.3% (Lombardy)	4.8% (Cataluña)	n.a.	5.5% (Bayern)	5.9% (Baden-W.)
	Source: Assolombarda, Politecnico di Milano				

1.4 Milano's resurgence

Today, Milano is the richest city in Lombardy, Italy - with Lombardy being Italy's richest region and Italy the eighth country in the world by economic size. Milano's value added per capita in 2017 has been estimated to be 47.4 thousand euros: hence much higher than in Lombardy (whose per capita GDP is 37.7 thousand euros), Italy (28.5 thousand euros), the Euro area (32.7 thousand euros) and the European Union (29.9 thousand euros).

Based on the model described, Milano owes such prominence to being at all effects a knowledge economy strengthened by the presence of a diverse network by industry and firm size. However, while long having been (and still being) characterized by diversity, most recently Milano got to experience a turnaround, currently proving more dynamic than in the past. Such dynamism is not only perceived, but also substantiated by numbers. As described in this section, the explanation stems from the relatively new looks Milano acquired throughout the Great Recession on the one hand, and in Milano's model on the other.

One way to capture Milano's turnaround is first the shifting regulatory and narrative approach on the city. Almost a decade ago, back in 2009, the *Financial Times* labelled Milano "Europe's Cinderella" - a city failing not just against Paris and New York but also unable to compare with smaller and less renowned places such as Lisbon and Lyon. As the FT posed it, the failure was clearly not stemming from the almost unchallenged concentration of fashion brands and home accessories and furniture powerhouses located there but rather from (lack of appropriate) urban planning and vision. «Despite its industriousness - Emily Backus, the FT correspondent, wrote - many attractive assets and heavy lifting on behalf of the Italian economy, Milan remains saddled with a surfeit of obsolete and ugly architecture, scarce greenery, old infrastructure barriers, intractably tangled traffic and some of the continent's most polluted air. (...) Its residential stock is also in a dire state: whether charmingly traditional or semi-modern eyesores, most homes are at least 30 years old and, even then, in short supply». Relatedly, at the time, obtaining a building permit would take an average of 151 days.

Since then, though, times have changed thanks to the combination of better regulation and injection of public and private investment. The new rules that came into force in 2010 made development rights tradable assets. The city was divided in areas with either a conservation or a construction destination. All areas were assigned a theoretical amount of "allowed building", whose type and use was to be determined by market forces. In this way, international investors were offered a clearer picture of what they could get in exchange for their money.

The change of rules came in parallel with injection of public funds enabled by the victory to host an international fair named Expo 2015. This posed a credible deadline for the much-needed infrastructure overhaul so that the city government and the Italian State eventually committed to spend some 13 billion euros of public funds for the makeover of the city's transport infrastructure. Three fourths of this sum had already been allocated to this purpose even before, but before Expo they had been sitting in a limbo for decades. Thanks to this injection of money, urban plans could be implemented, and the city underground system doubled its reach while expressway ("Passante") and railway connections were added as well.

All in all, again as the FT posed it, Milano was transformed from «a bottleneck city revolving around a tiny downtown into (---) an integrated network of epicenters of activity, each endowed with shops, public services, such as libraries and schools, transport and parks».

In 2015, with renovation works going on until the very last minute and beyond, the city was ready for Expo. From May to October 2015, the Expo world fair - centered on food, nutrition and sustainability practices and organized around 60+ pavilions from over 130 nations - brought to the city 21 million visitors, one third of which coming from abroad. And while this event was in full swing it became clear that the international perception of the city had radically shifted. This change of perception has been epitomized by the fact that *The New York Times* put Milano at place number one in its Travel Guide to worldwide tourists for 2015, titling "Milan, a place to be. A revitalized city welcomes the world".

Statistics undergird Milano's fall and resurgence. We report the comparative evidence on a variety of indicators taken from many sources in Table 1. In the analysis, Milano is compared with its "peers", the capital cities of the most productive European regions, namely Barcelona (Cataluña, Spain), Lyon (Rhône-Alpes, France), München (Bayern, Germany) and Stuttgart (Baden-Württemberg, Germany). The general pattern from comparing such indicators is that GDP, export, labor market variables all testify that the legacy of the 2008-17 crisis is still visible in the data, but also that current prospects may be seen as improving fast.

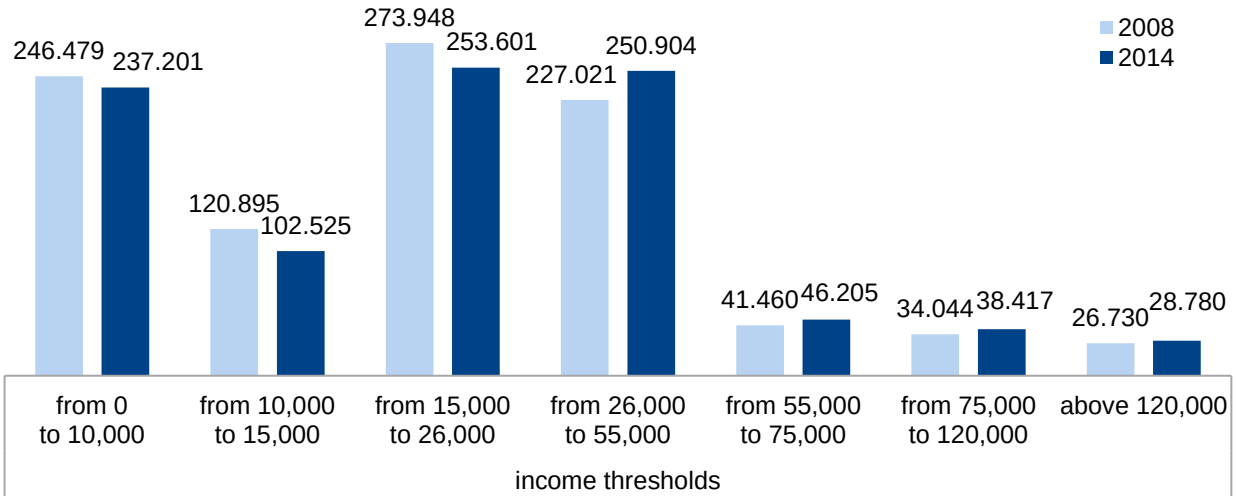
Starting with GDP, the latest estimates project Milano's GDP to grow by +2.2 cent in 2017, higher than Italy's (+1.6 per cent). The recovery, which started in 2014, is hence gaining momentum. If one looks at the recovery period (2014-2017) as a whole, Milano cumulatively grew by +6.5 per cent, faster than Lombardy (featuring a smaller +5.1 per cent) and almost twice as much as Italy - where recovery delivered a cumulatively more modest +3.8 per cent. As result of this faster growth,

Milano's real GDP is now +3.4 per cent higher than in 2008, in stark contrast with Lombardy and Italy especially - still stuck, respectively, at -1.0 per cent and -4.2 per cent below 2008 levels.

Exports proved to be the main driver of this recovery. In fact, exports from Milano reached a new high at 41 billion euro in 2017 and account for 34.2 per cent of the total exports from the Lombardy region. The 2017 record data exceed 2016 numbers by +7.7 per cent. The equivalent figure for Lombardy is +7.5 per cent and compared to 2008 the region records a whopping +15.6 per cent. Such booming trends also came in parallel with a major shift of destination towards the most dynamic, extra-EU markets. In 2008 approximately one half (49.5 per cent of the total) of Milano's exports were being shipped to EU countries. In 2017, the share of exports channeled to the European Union is down to 38.8 per cent. This may be seen as a tangible sign that Milano - with a traditional European bent - is confirming itself a truly global city.

The recovery is also delivering benefits for the labor market. Milano counted slightly less than 1.5 million persons employed in 2017, about one third of the regional total. Its employment rate nears 70 per cent (69.5 per cent) in 2017, up from 68.4 per cent in 2016 -12 percentage points higher than Italy's average of 58 per cent. In parallel, the share of the unemployed fell to 6.5 per cent, down by a full percentage point from 2016 and again well below Italy's average of 11.2 per cent.

Figure 4. Taxpayers by income thresholds



Source: Comune di Milano

The increased affluence associated to such much improved labor market outcomes is also visible when one looks at the distribution of taxpayers' earnings. According to data reported from the Comune di Milano, in 2008-2014, namely during the years of the crisis, the number of taxpayers declaring incomes above the 26 thousand euro threshold increased, while the number of those

declaring incomes below this threshold decreased. So income inequality probably increased but at least the number of less well-off Milanese decreased, in spite of the fact that during this period of time Milano has received a large number of low-income immigrants.

Milano is back also on a more global scene for it appears to be gaining attractiveness for people, capital and firms, both over time and compared with similar urban settings by economic structure. As to people, Milano attracted almost 7 million foreign tourists in 2016. While slightly below the 2015 peak due to Expo (7.4 million), the number remains much higher than pre-Exhibition levels. Milano hence outperforms Lyon and Stuttgart, while shortening the distance from Barcelona, which in the same year was able to attract as many as 12 million tourists.

Milano also increasingly attracts talents. The number of foreign students in universities has grown by +11.3 per cent in two years, from 13,288 in 2014 to almost 15,000 in 2016. This is a marked improvement compared to the past, although Milano's performance still falls short of that of München (+13 per cent over the same period, from 17,661 to 19,961 foreign students). Similarly, the number of researchers being awarded funds from the European Research Council of the European Union with an affiliation with Milano's universities has increased to 37 in 2014-2017, up from the 26 recorded in the previous three years (2014-2016). In this respect, Milano is second only to München (which counted 56 researchers in 2014-2017), whereas Barcelona, Lyon and Stuttgart lag behind with respectively 33, 8 and 4 researchers.

As to capital and firms, according to the Financial Times's fDi markets Milano attracted 364 greenfield Foreign Direct Investment (FDI) projects between 2008 and 2016, estimated to have totaled around 8.1 billion euro and created over 15.6 thousand jobs. These data favorably compare with Lyon and Stuttgart (which respectively stopped at 162 and 220 projects over the same period for around 2 billion euro and 5 thousand jobs in the case of Lyon, even fewer for Stuttgart). In terms of projects, Milano still has a gap to fill with Barcelona (519) and especially München (615). However, the gap with the two shrinks when considering the estimated value of the projects: while Barcelona totals over 9 billion euro and 30 thousand jobs, München arguably attracts relatively smaller projects, which create around the same number of jobs (some 15 thousand), yet total half as many euro (almost 4 billion) as those in Milano. Milano economic attractiveness is also evident on the real estate market: according to JLL, Milano ranks 22nd over 650 global cities based on cross-border real estate investments over the past three years (close to Munich, 18th, and high up above Barcelona, 54th). Also, Milano stands out compared to its peers based on prime rents, which further hint at the dynamism of the market: according to Cushman & Wakefield, the price per square meter for high-

end real estate is twice as much as in Barcelona in the case of offices, four times as much in the way of high street retail.

Together with statistics, perception is starting to shift. The Globalization and World Cities (GaWC) Research Network[4] founded by urban analyst Peter J. Taylor has long included Milano in the top third of global cities since the year 2000. Milano is hence constantly classified as Alpha city, that label being awarded to very important world cities that link major economic regions and states into the world economy. In particular, Milano ranks 12th Alpha city in 2016. None of its peers might compare: Barcelona is third-to-last Alpha city, with an overall 47th place; München (56th), Stuttgart (96th) and Lyon (111th) are Beta cities. Milano sets way ahead, figuring just below top tier Alpha cities London and New York and few other financial and political powerhouses such as Singapore, Hong Kong, Paris, Beijing and Tokyo.

More recently, Milano also proved to be able to gain prominence onto the world stage by projecting an image of positivity well after the end of Expo 2015. In the *2018 City RepTrak* provided by the Reputation Institute, Milano rose to the 14th place, up from the 21st position occupied in the 2016 ranking. Such performance places it elbow-to-elbow with Barcelona (15th) and well above economic powerhouses such as London and New York (which rank respectively 17th and 24th).

Not only it is more reputable, Milano is also increasingly "searched for". By frequency of searches on the main search engine Google, Milano fares well alongside München in relation to business, finance and shopping in 2017, whereas it was less searched for than both Barcelona and München back in 2008.

This upward trend in perceptions spills onto expectations. Milano is arguably to hold a key spot in global networks still for years to come. Looking at GDP data, McKinsey (2016) places Milano among the top 75 richest and most economically powerful cities in the world in 2015, alongside Barcelona, München and Stuttgart, and together with Roma, London, Berlin, Paris. The same study projects Milano to be a hot spot for growth still in 2025, together with Paris, London and Berlin, whereas Roma, Barcelona and Stuttgart lose prominence against Asian and African cities' uptick in the world economy.

[4] The Globalization and World Cities (GaWC) Research Network publishes *The World according to GaWC*, a city-centered world of flows assessing cities in terms of their advanced producer services using the interlocking network model (for details see Taylor, 2001). The results are based upon the office networks of 175 advanced producer service firms in 707 cities. These 175 firms are made up of the top firms in five service sectors: 75 financial services firms (including insurance); and 25 each from accounting, advertising, law and management consultancy. The offices of these firms have been scored from zero to five across the cities depending on the importance of offices within cities.

When thinking about the change in Milano's urban setting and subsequent revaluation of the city on the global stage though, the answer cannot just be Expo 2015 and the change in regulation it fostered. While relevant, Expo just turned the spotlight onto Milano. More precisely, it played a relevant role in improving both the national and international perception of the city especially thanks to the assets already present in Milano's economy. The dynamism now so apparent in the data might rather be traced back indeed to the economic structure and history of the city. In particular, the recent boost in reputation and attractiveness sparked by Expo 2015 takes roots into Milano's knowledge-based ecosystem.

In other words, the economy bounced back arguably because, despite the crisis, Milano was able to nurture and capture its high innovation and knowledge potential, as evident for instance in the liveliness of knowledge-intensive startups mentioned in Section 1.2. Another example is the improvement in technological transfer: in 2017, the number of patents has grown by 14 per cent with respect to 2014. This increase is even faster than the one recorded in Bayern, the leader in Europe for patent applications based on European Patent Office (EPO) data.

Moreover, the knowledge economy models favors those realms which build on and in turn further enable cross-industry interactions and integration, flows of knowledge and capital, creation of innovation. Through such dynamics, those realms ultimately produce benefits in terms of growth and wellbeing that exceed the single industry and rather spread across the broader local economy. Perhaps the best example of one such realm based on networks and knowledge are the Life Sciences, which have found in Milano a fertile ground and have in turn most recently helped revamp its economy, as explored in Section 2.

1.5 Future challenges

Summing up, in recent years Milano has arguably evolved into a new identity and shape, in terms of boundaries, attractiveness and reputation. As a by-product of this changes, Milano has further risen to prominence.

It is important to note that the largely positive picture painted so far should not distract from the inevitable challenges that Milano faces as a global city. Together with being outward-looking, i.e. attracting, capturing, trading at an international level, a global city must be inward-looking, thus learn how to retain, include, integrate. In the case of Milano this second process ought to happen on two levels: within the city and with respect to the surrounding territory and the national economy even. As to the latter, Milano plays a role as international hub and economic powerhouse to Italy operating

by an economic model which makes the city a privileged platform for economic integration and creation of synergies in the surrounding area. As such, Milano is arguably responsible for and at the same time gains from ensuring that its economic success trickles down and spreads, avoiding the risk of flying solo.

As to the former, all global cities and Milano as well «concentrate both the leading sectors of global capital and a growing share of disadvantaged populations (immigrants, many of the disadvantaged women, people of color generally, and, in the megacities of developing countries, masses of shanty dwellers)», thus becoming «a strategic terrain for a whole series of conflicts and contradictions» (Sassen, 2005:39). There is hence the need to envision mechanisms to share the fruits of economic progress with the whole of society, not just the elite and professional end of the socioeconomic spectrum. In other words, to be inward-looking entails fighting inequalities, integrating the many and different social groups, learning how to be a socially sustainable multicultural metropolis; because the economic fortunes of global cities are ephemeral, unless rooted in equivalent progress on the social, environmental and human front.

Milano in particular is confronted with two main issues: poverty and the integration of young people. As to poverty, according to the latest census on the homeless (Fondazione Rodolfo Debenedetti, 2018) one can count two homeless people every 1,000 inhabitants, a number which remained constant over the past five years. Somehow reassuringly, some three fourths (77 per cent of the total) of the homeless are in night shelters, a high percentage nationally and internationally. In this respect, it is worth noting that Milano is strong of the presence of a developed no profit sector, which counts over 12.2 thousand institutions and more than 241 thousand volunteers dedicated also to assisting those in need (Caritas Ambrosiana, 2017).

Regarding the youth, despite recent improvements those neither in employment nor in education and training (NEET) are still a reason for concern. In 2016, the NEET amounted to about 70 thousand people in their 15-29 years, about 15.6 per cent of the population of the same age - a much lower number than the national number for Italy (24.3 per cent of the total) but still higher than in the Euro area, where the share falls short of 15 per cent (14.5 per cent).

In the next few years, Milano is thus called to keep and expand its global role and reach, but also to increase its effort and focus on local needs, keeping its social balance and acting as a support to and a driver of the Italian economy. In this respect, being a knowledge-economy featuring a diverse set of industries and firms, furthermore with a specialization in the Life Sciences, might provide a competitive advantage, as argued in the next sections.

Table 2. Milano and its European benchmarks

	Milano	Barcelona	Lyon	München	Stuttgart
Population *(2017)*	3,218,201 10,019,166 (Lombardy)	5,474,482 7,441,284 (Cataluña)	1,860,112 6,621,564 (Rhône-A.)	4,633,323 12,930,751 (Bayern)	4,098,278 10,951,893 (Baden-W.)
	Source: Eurostat				
Land area *(sqkm, 2017)*	1,576 23,864 (Lombardy)	7,728 32,090 (Cataluña)	3,249 43,698 (Rhône-A.)	17,531 70,550 (Bayern)	10,557 35,751 (Baden-W.)
	Source: Eurostat				
GDP per capita *(thousand euros, 2017, *2016, **2015)*	47.4 37.7 (Lombardy)	27.8** 28.8* (Cataluña)	43.4** 32.8* (Rhône-A.)	54.6* 44.2* (Bayern)	50.0* 43.8* (Baden-W.)
	Source: Prometeia, Eurostat				
GDP *(million euros, current prices, 2017, *2016)*	377,979 (Lombardy)	213,766* (Cataluña)	216,502* (Rhône-A.)	594,447 (Bayern)	493,265 (Baden-W.)
	Source: Prometeia, Eurostat, Statistischen Ämtern des Bundes und der Länder				
GDP *(2017, annual % growth)*	2.2% (Milano) 1.9% (Lombardy)	3.4% (Cataluña)	n.a.	2.8% (Bayern)	2.3% (Baden-W.)
	Source: Prometeia, Idescat, Statistischen Ämtern des Bundes und der Länder				
GDP *(var. % 2017/2008)*	3.4% (Milano) -1.0% (Lombardy)	4.1% (Cataluña)	n.a.	18.5% (Bayern)	13.0% (Baden-W.)
	Source: Prometeia, Idescat, Statistischen Ämtern des Bundes und der Länder				
Exports *(billion euros, 2017)*	41 (Milano) 120 (Lombardy)	71 (Cataluña)	60 (Auvergne-Rhône-A.)	192 (Bayern)	201 (Baden-W.)
	Source: Istat, Idescat, Direction générale des douanes et droits indirects, Destatis				
Export *(var. % 2017/2016)*	7.7% (Milano) 7.5% (Lombardy)	8.7% (Cataluña)	5.3% (Auvergne-Rhône-A.)	5.4% (Bayern)	5.6% (Baden-W.)
	Source: Istat, Idescat, Direction générale des douanes et droits indirects, Destatis				
Export *(var. % 2017/2008)*	15.6% (Lombardy)	40.2% (Cataluña)	13.6% (Auvergne-Rhône-A.)	24.5% (Bayern)	34.9% (Baden-W.)
	Source: Istat, Idescat, Direction générale des douanes et droits indirects, Destatis				
Employment rate *(2017)*	69.5%	n.a.	n.a.	n.a.	n.a.
	Source: Istat				
Unemployment rate *(2017, *2016, *city)*	6.5%	12.5%*	n.a.	4,6%*	5,3%*
	Source: Istat, Idescat, Bundesagentur für Arbeit				
Tourists *(2016)*	6,945,829	11,709,411	2,663,248	16,170,287	6,080,359
	Source: Assolombarda, Comune di Milano				
Foreign university students *(2016)*	14,787	28,210	n.a.	19,961	9,233
	Source: Assolombarda, Comune di Milano				

	Milano	Barcelona	Lyon	München	Stuttgart
ERC grant winners in universities *(2014-2017)*	37	33	8	56	4
	Source: Assolombarda, Comune di Milano				
Greenfield Foreign Direct Investment projects (*2008-2016)*	364 *8.1 bn euros* *15,626 jobs*	519 *9.1 bn euros* *32,482 jobs*	162 *2.3 bn euros* *5,599 jobs*	615 *3.9 euros* *14,719 jobs*	220 *0.8 bn euros* *2,606 jobs*
	Source: fDi markets				
Rank in the GaWC global city ranking 2016 *(rank over 707 cities)*	12°	47°	111°	56°	96°
	Source: GaWC				
Rank in the City Rep Track 2017 *(rank over 56 cities)*	14°	15°	n.a.	9°	n.a.
	Source: Reputation Institute				
Google searches for shopping *(index based on the number of international queries, 2017)*	45.2	44.4	23.8	47.9	19.6
	Source: Assolombarda, Comune di Milano				
Google searches for business, industrial and finance *(index based on the number of international queries, 2017)*	48.8	43.3	28.6	55.3	24.8
	Source: Assolombarda, Comune di Milano				
EPO patents applications *(per million inhabitants, var. % 2017-2014)*	14.2% (Lombardy)	30.0% (Cataluña)	8.0% (Auvergne-Rhône-A.)	3.3% (Bayern)	-9.3% (Baden-W.)
	Source: EPO				
NEET 15-29 year old *(% total population 15-29, 2016)*	15.6%	n.a.	n.a.	n.a.	n.a.
	Source: Camera di Commercio, Industria, Artigianato e Agricoltura di Milano				
NEET 15-24 year old *(% total population 15-24, 2017)*	14.2% (Lombardy)	13.7% (Cataluña)	8.9% (Rhône-A.)	4.3% (Bayern)	5.0% (Baden-W.)
	Source: Eurostat				

2. The Life Sciences as another engine of Milano's revival

As mentioned, the return of Milano to growth and its reputational gains in the international arena find their roots in a variety of causes. There is little doubt that the enacted changes in urban setting rules together with the injection of public funds unleashed new energy in the construction and housing industry, which is good for propelling inward growth. When thinking of what drove the regain of international allure, one cannot omit mentioning the interplay between food, fashion and design as another likely important growth factor.

However, the model underpinning the city's role in the global economy based on the productive interplay between various industries and firms is arguably the main reason why one-off measures and events – such as Expo and the injection of public investment and image boost that followed – can actually drive economic performance. In the narrative of the revival of Milano's economy, we hence deem fundamental to consider the role played by the Life Sciences, a prime example of district driven by cross-industry interactions, hence enabling flows of knowledge and capital beyond the single industry and favoring growth and wellbeing spillovers to the broader economic system.

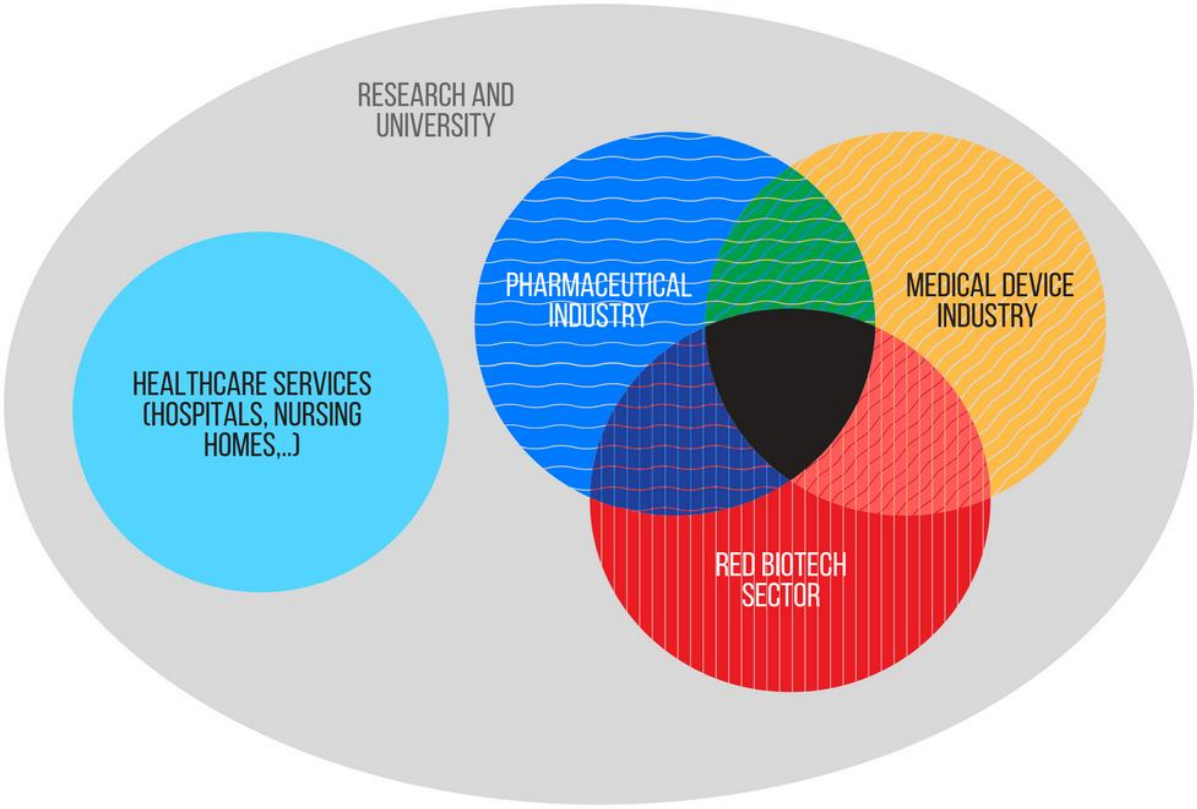
In particular, based on qualitative evidence and original data, this paper posits that the present and future positive footprint of the Life Sciences on Milano and its economy owes to their being the mirror image of Milano's diverse (in terms of firm networks) and diversified (in terms of sectors) economic structure described in Section 1.3. To show this, Section 2.1 looks at the Life Sciences' diversified value chain, while Section 2.2 describes the local network where the Life Sciences are embedded. Then in Section 3 we look at the prospects of the district.

2.1 The diversified value chain of the Milanese Life Sciences cluster

In order to describe what the Life Sciences cluster looks like in Milano, it is useful to look in detail to its value chain. As illustrated in Figure 5, broadly speaking there are three main participants: the industrial segment upstream, the healthcare services downstream and the high-quality health research system on the background.

Overall, Milano lies at the core of the articulated Life Sciences cluster which stretches over the entire Lombardy and, considering satellite and commercial activities as well, totals more than 45 billion euros in value added, hence contributing some 12.4 per cent of regional GDP (Assolombarda, 2018).

Figure 5. The Life Sciences cluster



Source: Assolombarda

The industrial segment - i.e. pharmaceuticals, red biotech[5] and medical devices - represents the bulk of the cluster and is estimated to generate a turnover of about 12 billion euro in Milano alone. Unfortunately, pharmaceuticals, red biotech and medical devices are economically and financially integrated to such an extent that it is impossible to break this figure down with precision (the very same firm may be simultaneously classified in all three segments). However, pharma companies might be estimated worth 10.4 billion euro, roughly 88 per cent of the total industrial segment. Such high figure should not surprise, being Milano the gravitational center of the region's pharma system, a field where Lombardy in turn reaches highs of excellence at the European level. In terms of value

[5] *Red biotech* is the branch of biotechnology applied to human health, i.e. use of modern biotechnological methods for the development of therapeutic products, vaccines, drug delivery technologies, molecular diagnostic methods, drug discovery and cosmetics). Red biotech should be distinguished from: a) *white biotech*, or industrial biotechnology, which refers to the use of biotech methods for the production and processing of chemicals, materials and fuels, including technologies for environmental bioremediation; b) *green biotech* or agri-food biotechnology, which indicates the use of biotech methods for the production of plants and plant crops for applications in the food, chemical, and manufacturing field (National Database of Biotechnological and Lifescience Patents).

added indeed, pharmaceuticals weigh about 2.2 per cent of the region's total, the highest percentage after Cataluña's 2.5 per cent.

Moving downstream in the cluster one finds healthcare services, which include all those facilities providing therapy and treatment, possibility of admission and diagnosis, such as: Scientific Institutes of Care and Treatment (IRCCS),[6] hospitals, nursing homes, rehabilitation institutes, hospices, laboratories, day hospitals. Healthcare services strongly engage with the industry, and vice versa. If the industrial segment is notable for its significance, the sheer numbers of the healthcare services bit of the cluster are quantitatively bigger. Considering Lombardy, healthcare services generate 23.3 billion euro in turnover and 14 billion in value added and employ 250 thousand professionals.

Finally, there is the broader research ecosystem involving a combination of publicly and privately run and financed institutions. Generally, the research ecosystem powerfully gathers high-skilled human capital and efforts to research, development, technology transfer. It spans from the laboratory to the clinic and the university, including research centers, hospitals, companies, universities, and other (private, public and no-profit) entities. Also in light of its public-private nature, it is somewhat hard to quantify the economic value and output of such an ecosystem. Nevertheless, one clue is provided by the quantity and the quality of scientific publications on the Life Sciences. In this realm, Milano and the region do not compare unfavorably to their peers. In 2016 Lombardy produced more than 6.3 thousand scientific articles (627 per million inhabitants). These numbers are in line with Cataluña's, although lower than in other benchmarks (in particular the 731 counted in Baden-Württemberg). Focusing on quality, Lombardy boasts a good share of high-level publications: as many as 2.2 per cent of the total are considered among the top of the field by number of citations worldwide,[7] a percentage substantially in line with that recorded in all European peers (Baden-Württemberg excelling with 3.1 per cent). When assessing the research ecosystem's relevance and excellence, one can also mention the number of clinical trials (660[8] in Italy in 2016, more than half of which in Lombardy) and advanced therapies (6 in Europe, 3 of which developed in Milano). Finally, considering their key role within the research ecosystem, universities and their performance in international rankings might provide some insights. Milano counts three universities with a specialization in medicine, plus a good number of other faculties focused on Life Sciences-related subjects. Altogether, these faculties obtain a total score of 256 in the 2018 QS World University

[6] These represent a special kind of hospitals named so by the Ministry of Health due to the high level of medical research they conduct.
[7] Highly cited articles are those ranked among the top 1 per cent of the most cited articles worldwide by research field and year of publication.
[8] AIFA (2017).

Ranking, the highest among European benchmarks (second best in this ranking is Barcelona with a score of 203).

Although their contribution is somewhat hard to quantify, by its ability to combine diverse scientific capabilities the Life Sciences' open research and innovation model produces multi-disciplinary knowledge, promoting a proliferation of techniques and specialties, in turn creating economic opportunities for firms from various sectors, both as to disciplines to be activated (e.g. mechanics, ICT, (bio)chemistry, electronics, robotics) and as to sectors and activities to which innovation applies (e.g. instrumentation, drug discovery and delivery, diagnosis) (Quéré, 2008:413).

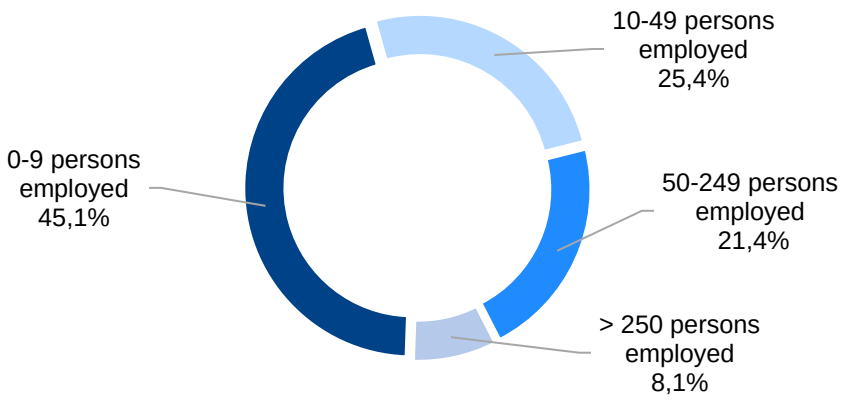
Furthermore, the Life Sciences' R&D process importantly roots the district in the territory. Based on current global value chain and technology trends, a company is generally expected to source components and knowledge across the globe (World Bank, 2019). We would argue that companies in the Life Sciences are partly an exception, for two reasons. On the one hand, given that no partner is more critical to clinical and medical R&D than patients, a pivotal moment in the life of a potential new therapy are clinical trials, i.e. the period of gradually-expanding tests on human volunteers, which ideally requires interlinkages with local hospitals. On the other hand, the research process is increasingly open, consequently requiring the involvement not only of large firms, but also of a wide spectrum of smaller ones, which tend to be local.

2.2 The local network of the Life Sciences cluster

The Life Sciences cluster provides a fitting example also with reference to the local network pillar of the "Milano model". In fact, coherently with the structure of the cluster described above, firms differing by size and ownership flourish and interweave. One finds multinational corporations and large firms (especially in the pharmaceutical industry and the strongly-related red biotech sector). But there is also a network of leading-edge domestic (but not only) actors in healthcare services, red biotech and medical devices as well as a network of smaller firms and startups.

Starting from pharmaceuticals, which have long been part of Milano's economy, they feature more than 170 local units and over 12 thousand persons employed. Compared to the total economy reported in Figure 3, Milano's pharma industry exhibits a disproportionate significance of large and medium firms (Figure 6). Also, pharmaceuticals are distinctively a highly concentrated and international industry: the top 10 companies by turnover account for half the total revenue of the industry (4.9 over 10.4 billion euro), and 7 out of them are foreign-owned large multinationals.

Figure 6. Firms by size class - Pharmaceuticals



Note: the numbers refer to local units.
Source: Assolombarda on Istat data, 2015.

The co-existence of firms of different size and the uncommon presence of large firms also apply to the other manufacturing segments of the Life Sciences cluster. In particular, red biotech is a relatively younger sector if compared to the pharmaceutical industry, yet it boasts a growing number of firms conducting cutting-edge research. In Milano it currently counts 63 firms (one third of which also active in pharmaceuticals): this sector is dominated by micro and small firms (54 per cent of the total), but still medium firms are 25 per cent and large firms 21 per cent (Assobiotec, 2017). Finally, medical devices encompass more than 330 companies which can be segmented as follows: micro and small are about 70 per cent, medium enterprises 20 per cent and large firms 10 per cent (Assobiomedica, 2017).

It is worth noting that larger companies are embedded in a network of small and medium enterprises, comprehensive of a blooming number of innovative startups. Focusing on the manufacturing segment of the Life Sciences, as many as 234 knowledge intensive startups were born in Lombardy between 2007 and 2014 (313 in Bayern in the same period). As of 2015, 80.4 per cent of those had survived (89.2 per cent in Bayern) and 12.2 per cent showed high performances (meaning they either perform high turnover growth or they got acquired).

The interactions among players of different sizes is particularly relevant when it comes to research: while large firms keep the advantages in downstream activities (production, distribution, marketing and sales), specialized SMEs and knowledge-intensive, science-based startups are crucial as far as upstream activities are concerned (Quéré, 2008:414). Indeed, the above mentioned open innovation

model and the subsequent fragmentation rather than vertical integration of R&D processes create a series of upstream niche submarkets which might explain why in the Life Sciences there is a rather small group of dominant firms (especially in pharmaceuticals), yet at the same time a low degree of concentration contrary to other R&D and knowledge-intensive industries (e.g. Malerba and Orsenigo, 2015:670-671).

To complete the picture, the industrial segment of the district has a strong international outreach. Most notably, almost 50 per cent of the companies operating in the territory are foreign-owned and pharmaceutical exports account for 9.2 per cent of Milano's total manufacturing exports.

Healthcare services providers, for their nature, are instead essentially local. Milano offers a state-of-the-art healthcare system through a comprehensive network of 76 public and private healthcare facilities, including prestigious institutes such as the Mario Negri Institute, Humanitas, the Nerviano medical sciences research facilities, the European Institute of Oncology (IEO), the IFOM-Institute of Molecular Oncology, the San Raffaele Institute, the Milano Polyclinic, the Molecular Genetics Institute and Niguarda Hospital.

In general, healthcare services mostly count large entities. Among those, Milano's 13 IRCCS (27 per cent of the national total) have to be mentioned, that is top-level hospital-based science centers with a strong specialization in research. Still, in Milano and its region there are also other hospitals, together with a myriad of small and medium laboratories, nursing homes, rehabilitation institutes, hospices and clinics[9].

Before concluding it is worth mentioning that there are relevant efforts to foster and further boost the Life Sciences in Milano. A first initiative is "Città della Salute e della Ricerca", a project of regeneration of a large former industrial area in the north of Milano, which aims at bringing together the best hospitals and research centers on neurology and oncology. Most recently though, in 2017, the Italian Government started the development of the Human Technopole, a large-scale international research infrastructure in the field of the Life Sciences and Big Data to be located within the area that hosted EXPO 2015. Human Technopole's mission is to develop both medical and nutritional personalized approaches, focusing on cancer and neurodegenerative diseases, setting at the forefront of research by using tools such as genomics, the analysis of increasingly large data sets, and new diagnostics techniques. At its completion, the facility will involve about 1,500 people and will include 30,000 sqm of cross-disciplinary laboratories. Open innovation initiatives have also been launched

[9] Such broad and varied set of healthcare services is partly the reason why over 50 per cent of all Contract Research Organizations (CROs) in Italy, i.e. entities that support drug manufacturers by covering some activities in the development of new drugs (such as data research, project management, tests, trials that are run post approval, pre-clinical and clinical), have found fertile ground in Milano (AIFA, 2011).

by the private sector. Altogether these initiatives are helping position Milano, and Lombardy at large, as an attractive Life Sciences hub of national and international breadth and relevance, which concentrates already 20 per cent of hospital discharges related to foreign patients in Italy.

Table 3. Milano and its European benchmarks

	Milano	Barcelona	Lyon	München	Stuttgart
Pharmaceutical turnover *(billion euro)*	10.4	n.a.	n.a.	n.a.	n.a.
	Source: Assolombarda				
Pharmaceutical value added *(% of total, 2015, *2014)*	2.2% (Lombardy)	2.5% (Cataluña)	1.2%* (Rhône-A.)	0.6%* (Bayern)	1.9% (Baden-W.)
	Source: Assolombarda, Comune di Milano				
Healthcare services turnover *(billion euro, 2015)*	23.3 (Lombardy)	n.a.	n.a.	n.a.	n.a.
	Source: Assolombarda				
Healthcare services value added *(billion euro, 2015, *2014)*	14.0 (Lombardy)	6.5 (Cataluña)	10.5* (Rhône-A.)	22.9* (Bayern)	18.3 (Baden-W.)
	Source: Assolombarda				
Healthcare services value added *(% of total, 2015, *2014)*	4.3% (Lombardy)	3.5% (Cataluña)	5.6%* (Rhône-A.)	4.8%* (Bayern)	4.4% (Baden-W.)
	Source: Assolombarda				
Articles in the field of life sciences *(per million inhabitants, 2016)*	627 (Lombardy)	606 (Cataluña)	n.a.	792 (Bayern)	731 (Baden-W.)
	Source: Assolombarda, Comune di Milano				
Highly cited articles in the field of life sciences *(% of total articles, 2017)*	2.2% (Lombardy)	2.7% (Cataluña)	n.a.	2.9% (Bayern)	3.1% (Baden-W.)
	Source: Assolombarda, Comune di Milano				
QS World University Ranking by Faculty "Life sciences and Medicine" total scores *(2018)*	256	203	67	155	0
	Source: Qs World University Ranking				
Pharmaceutical local units *(2015)*	173 (Milano) 266 (Lombardy)	150 (Cataluña)	147 (Rhône-A.)	233 (Bayern)	207 (Baden-W.)
	Source: Istat (Milano, Lombardy), Eurostat (other regions)				
Persons employed in Pharmaceuticals *(2015)*	12,121 (Milano) 20,692 (Lombardy)	20,684 (Cataluña)	18,841 (Rhône-A.)	8,872 (Bayern)	31,591 (Baden-W.)
	Source: Istat (Milano, Lombardy), Eurostat (other regions)				
Red biotech firms *(2016)*	63	n.a.	n.a.	n.a.	n.a.
	Source: Assobiotec				
Medical device firms *(2016)*	333	n.a.	n.a.	n.a.	n.a.
	Source: Assobiomedica				
Life sciences startups born between 2017 and 2014 *(industrial segment)*	234 (Lombardy)	156 (Cataluña)	219 (Rhône-A.)	313 (Bayern)	301 (Baden-W.)
	Source: Assolombarda, Politecnico di Milano				
Survival rate of life sciences startups *(as of 2015, % of total startups*	80.4% (Lombardy)	80.5% (Cataluña)	n.a.	89.2% (Bayern)	86.8% (Baden-W.)

born 2007-2014, industrial segment)					
	Source: Assolombarda, Politecnico di Milano				
High growth or acquired life sciences startups *(as of 2014, % of total startups born 2007-2014, industrial segment)*	12.2% (Lombardy)	n.a.	n.a.	8.9% (Bayern)	13.1% (Baden-W.)
	Source: Assolombarda, Politecnico di Milano				

3. Engines and prospects for the Milanese Life Sciences cluster

The rapid development of the Life Sciences district has not occurred by chance, but was at least partly the result of some enabling policy measures. Among such measures one should mention the reform of the Regional Healthcare System (RHS) of the late Nineties, when Lombardy[10] opted for a quasi-market "choice and competition" model of healthcare delivery. Based on the principle that "money follows the patient", this model widened patients' free choice by boosting competition between public and private accredited healthcare providers and separated healthcare purchasers from providers (e.g. Bosio and Meroni, 2002; Mapelli, 2012; Nuti et al., 2016). Among the valuable positive consequences of such model one might count a better control of healthcare expenditure through budget constraints and tariff caps on planned budget. This happens in a frame of good quality of services driven by repeated outcome measurements and development and dissemination of organizational best practices (e.g. Brenna, 2011; Berta et al., 2013), guaranteed also thanks to the Ministry of Health setting a «Livello Essenziale di Assistenza (minimum level of assistance)[11] monitoring system» tracking regional healthcare performance. This setting stimulated interest and involvement of public and private[12] healthcare stakeholders in Milano and Lombardy, eventually fostering excellence in the building and performance of the overall healthcare system and broader Life Sciences cluster.

A more recent reform has been implemented to manage the increase in chronic conditions related to the population ageing phenomenon. In this respect, Lombardy launched in 2012 the Creg (Chronic Related Groups) pilot project in order to re-engineer the system for specific chronic patient categories and introduced in 2015 other measures in order to design a tailor-made pathway for each patient assigning a "manager" to each chronic patient.

Moreover, in 2015 the regional government decided to emphasize the difference between organizations for the management of the healthcare system (so-called ATS «Agenzie per la Tutela della Salute») and those for healthcare provision (so-called ASST «Aziende socio sanitarie territoriali», de facto hospitals) and to reduce their number. The reform improved the coordination between the two types of organization, and produced 300 million euro of savings (1.6 per cent of the regional public health expenditure in 2016) to be re-invested in the Regional Healthcare System (Ghetti, 2016).

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[10] With the Regional Law n. 31 of 1997, Lombardy was the first Italian region to apply the national decrees 502/92 and 517/93. Those transferred the ownership of most public-sector hospitals from the municipal to the regional level, with only research hospitals (and to a limited extent teaching hospitals) remaining under the direct oversight of the Central Government.

[11] Such monitoring system consists of a set of indicators collected at regional level measuring mainly quality and cost of healthcare. (Ministry of Health, 2017).

[12] For instance, private healthcare providers in Lombardy have risen to account for 35 per cent of hospitalizations (9 percentage points above the national average) (Cergas, 2017).

Besides being one of Milano's distinctive features, the Life Sciences also represent an area where it may be worth investing for the future prosperity of the territory, because of the social role they play, the economic value they move, the innovation they promote.

First, the Life Sciences produce wealth and wellbeing by impacting on health. This makes the Life Sciences an ever-green policy field: health has most recently been included as Sustainable Development Goal 3 («Ensure healthy lives and promote well-being for all at all ages») in the United Nations' 2030 Agenda for Sustainable Development. In thinking about human welfare and economic growth, improvements in health almost go hand in hand with improvements in income. While «higher incomes promote better health through improved nutrition, better access to safe water and sanitation, and increased ability to purchase more and better-quality health care» (Bloom and Canning, 2008:1), the relationship might work the other way around, with health being also a cause of high income through a series of mechanisms which relate to labor productivity, education and savings (e.g. Barro, 2013; Bloom and Canning, 2008; López-Casasnovas et al., 2005).

Second and relatedly, the Life Sciences are a driver of sustainable economic and future job growth, even in a mature country and city. Indeed, they are extremely resilient in the face of ever changing global scenarios. In particular, the Life Sciences are directly and positively impacted by two of the current growth catalysts - rising incomes and ageing populations, which both determine an increase in the demand for healthcare and in turn require an investment in its quality (e.g. McKinsey, 2018). Between 2017 and 2030, the worldwide population of people over the age of 60 will grow from 962 million to 1.4 billion consisting in an increase of 44 per cent (UN Population Statistics). Over the last decade healthcare spending in percentage of GDP increased across OECD economies, regardless of the ups and downs in the economic cycle (from 8.2 per cent in 2008 to 8.8 per cent in 2017). For instance, in Italy the overall expenditure on health accounts for 8.9 per cent of GDP in 2017, up from 8.6 per cent in 2008 despite the double-dip recession[13] (OECD data).

Still in the way of economic opportunity, another positive factor related to the Life Sciences concerns the low level of automatability of jobs in healthcare, which is an element of concern elsewhere. Considering current demographic trends, jobs in healthcare may hence represent one of the safest career choices in the future. «Even when medical diagnostics have been taken over by computers, doctors will still play a vital role offering empathy, managing information, and negotiating difficult situations humanely» (World Bank, 2019). According to the World Health Organization (2016), by

[13] The increase is significant considering that in 2017 the Italian GDP was still -4.2 per cent below 2008 levels.

2030 global aggregate demand for health workers will reach 80 million; with a current stock of just 43 million health care workers worldwide, this forecast opens up the possibility of 40 million new jobs.

The previous considerations hold true also when focusing on Milano and its region. With reference to demand and growth drivers, Milano is a rich territory having to face the challenge of an ageing population. As previously stressed, Milano's value added per capita is comparatively high, in the Italian and the European setting. At the same time, Milano is no exception to current demographic trends. In Milano the share of people over the age of 60 is already 28.2 per cent of the total population in 2017 (versus an equivalent figure of 12.7 per cent at world level) and is expected to grow further (overall in Lombardy by 25.5 per cent in 2030). In parallel, life expectancy has increased in Milano from 80.4 in 2002 to 83.6 in 2016, above the Italian average (from 80.0 to 82.8). In particular, life expectancy is 81.5 years for men and 86 years for women (respectively +0.92 and +0.77 years compared to the Italian average). Besides, as indication of how healthcare quality in Milano positively impacts wellbeing, people's profile is healthier than the national average: those in good health affected by chronic conditions are 48.8 per cent (versus a national average of 42.3 per cent) (Istat, 2018).

With reference to resilience to the economic cycle and sustainable future growth, it has to be pointed out that in biopharmaceuticals and medical devices[14], according to the European Commission's Joint Research Center, Lombardy might identify and seize unique opportunities for structural change and for a smart, inclusive and sustainable growth in light of their competitiveness and innovative drive (Vezzani et al., 2017).

Last but not least, the Life Sciences are a science-driven knowledge-economy industry, distinctive both in terms of the emergence of knowledge and its transformation into innovation and economic opportunity. Relevantly, the industry has switched its research and innovation paradigm. While in the recent past research activities were primarily developed in firms' own internally-managed laboratories, nowadays the Life Sciences' innovative drive relies on an open innovation model, i.e. on the development of a strong knowledge and market network, whereby research happens through collaborative exploration and exchange of knowledge linking science and firms across sectors and all business sizes (e.g. OECD, 2012:32-43; Wang et al., 2015). Over the last decades pharmaceutical companies started to actively capitalize on external innovation to lower R&D costs and create more transformative portfolios. For instance, pharmaceutical standards changed so much that R&D portfolios are now at least 50 per cent externally generated (e.g. Palmer, 2008:6; David et al., 2012:13;

[14] Two of the ten "emerging industries" identified by the European Cluster Panorama based on overall size and growth dynamic.

Schumacher et al., 2013:1134). In this process, also universities get recognized as a key stakeholder in research and innovation: even, it is suggested that universities and research institutes, rather than firms, have driven scientific advances in sectors like biotechnology (Cookson, 2007).

By means of such an innovation framework and network, the growth benefits generated by the Life Sciences arguably spill onto the larger economy and do not concentrate in a limited set of firms. Considering that worldwide pharmaceutical R&D expenditure is expected to grow by 2.4 per cent per year to $181 billion in the period 2017-2022 (Evaluate Pharma, 2017) and open innovation is to remain the drug development paradigm, the Life Sciences will continue to play a positive role for the broader economy.

4. Conclusions

After a prolonged period of lack of dynamism, in the last few years Milano made a comeback that lays the ground for faster future growth and development. The sustainability of the development might however be hindered by a lack of social cohesion, the highest risk being the creation of "two cities": together with consolidating the recent growth, Milano will be called to face the higher inequality outcome of the crisis.

Nevertheless, the comeback has taken advantage of some existing assets of the city. Milano has always been a capital of fashion, design and food, and there is no doubt that the regained momentum of these well-known assets has been instrumental to the return to growth for the city. Milano's recent revival has also benefited from the adoption of smarter regulation which helped propel a better urban development – both more balanced and more respectful of the environment. Yet the main contribution of this paper lies in documenting the nitty gritty of a less well-known channel of development, namely the rapid growth of the Milanese Life Sciences cluster. We have seen how this cluster developed taking advantage of an ecosystem made of a diversified industrial base of pharma, red biotech and medical devices companies, health care service providing and research institutions. Within this system, small and large firms, domestically and foreign owned enterprises managed to coexist and flourish.

Although our data do not allow us to provide evidence as to which of the emphasized channels – asset endowment, regulation or the development of the Life Sciences cluster – is the most important one, we find the description of the interplay between these various components of the Milanese comeback a useful illustration of the mechanism that may be put in place to relaunch growth in a big city of a mature country.

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