

TARGETED ANALYSIS //

IMAGINE

Developing a metropolitan-regional imaginary in the Milan-Bologna urban region

Scientific annex // Key maps and accompanying text following the structure of the ESPON OnlineMapFinder

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Table of contents

| | | |
|----------|---|-----------|
| 1 | Regionalization of the urban | 7 |
| 1.1 | Teaser..... | 7 |
| 1.2 | Observations for policy | 7 |
| 1.3 | Policy context..... | 7 |
| 1.4 | Map interpretation | 7 |
| 1.5 | Concepts and methods | 8 |
| 1.6 | Key words | 8 |
| 1.7 | Theme..... | 8 |
| 2 | Regionalisation of mobility | 10 |
| 2.1 | Teaser..... | 10 |
| 2.2 | Observations for policy | 10 |
| 2.3 | Policy context..... | 10 |
| 2.4 | Map interpretation | 10 |
| 2.5 | Concepts and methods | 11 |
| 2.6 | Key words | 11 |
| 2.7 | Theme..... | 11 |
| 3 | Regionalisation dynamics | 13 |
| 3.1 | Teaser..... | 13 |
| 3.2 | Observations for policy | 13 |
| 3.3 | Policy context..... | 14 |
| 3.4 | Map interpretation | 14 |
| 3.5 | Concepts and methods | 14 |
| 3.6 | Key words | 15 |
| 3.7 | Theme..... | 15 |
| 4 | Regional competitiveness | 17 |
| 4.1 | Teaser..... | 17 |
| 4.2 | Observations for policy | 17 |
| 4.3 | Policy context..... | 17 |
| 4.4 | Map interpretation | 17 |
| 4.5 | Concepts and methods | 18 |
| 4.6 | Key words | 19 |
| 4.7 | Theme..... | 19 |
| 5 | Transitioning like a region: mapping environmental fragility | 21 |
| 5.1 | Teaser..... | 21 |
| 5.2 | Observations for policy | 21 |
| 5.3 | Policy context..... | 21 |
| 5.4 | Map interpretation | 21 |
| 5.5 | Concepts and methods | 22 |
| 5.6 | Key words | 22 |
| 5.7 | Theme..... | 22 |

List of maps, figures, charts and tables

List of maps

| | |
|--|----|
| Map 1 - RP 1.1 Regionalization of the urban | 9 |
| Map 2 - RP 2.1 Regionalisation of mobility | 12 |
| Map 3 - RP 3.2 Regionalization dynamics (change) | 16 |
| Map 4 – RP 4.1 Regional Competitiveness | 20 |
| Map 5 – RP 7.1 – Environmental fragility | 23 |

1 Regionalization of the urban

1.1 Teaser

- Overall relevant urban potential in a polycentric region where two subsystems are visible: the Milan metropolitan region and the via Emilia
- Density remains high along the corridor, among the highest all over EU
- The Po river course, located between the two urban macro-regions Turin-Milan-Venice and Milan-Bologna, marks an apparent break in urban continuity but shall also be read for its specific nature of an “operational landscape”

1.2 Observations for policy

The map “Map 1 - RP 1.1 Regionalization of the urban” shows the enormous urban potential of the entire Via Emilia (and beyond, up to the Adriatic coast of the Marche region) which copes well with that of the Milan urban region where many intermediate municipalities between the capital cities have lower levels of digital connection. The overall image also shows how the Po river course, located between the two urban macro-regions Turin-Milan-Venice and Milan-Bologna, marks an apparent break in urban continuity but shall also be read for its specific nature of an “operational landscape” (Brenner, 2014), as one of the most historical cultivated and anthropized plans in the country, essential to its urban dynamics. On the other hand, this agricultural and naturalistic territory works as a cultural and landscape resource for the entire macro-region. In this respect, it cannot be read as a simple void or rupture, rather it should be taken in consideration as a complex and integrated anthropized natural landscape.

1.3 Policy context

Density, complexity, and diversity are key features of urban milieux. Nevertheless, many differences can be observed between single urban systems due to geographical, cultural, and social specificities. Besides human density and diversity, several theories of urban growth emphasize the importance of service industries, innovation capacity, connectivity, and productivity in defining what is urban. Moreover, urban regions are dense, polycentric, interconnected urban formations, where strategic economic functions are widely distributed and the traditional urban features localization do not respect the traditional density gradients (higher in the core, lower in the peripheries).

1.4 Map interpretation

This map explores the Milan-Bologna region and its urban regionalization dynamics thanks to the overlapping of three indicators elaborated at LAU level. In choosing these three indicators, in addition to considering their temporal updating, we have favored stock indicators capable of expressing the urban potential of each municipality regardless of administrative or functional centrality or land-use factors. It was also decided not to use data related to foreign population as a proxy for urban diversity since, in recent decades, the foreign population has consistently grown even in rural areas. We found other data on the social mix to be either too dated or unable to deterministically express urban potential in a positive sense.

A closer look to the indicators producing the synthetic map allows to highlight how the density gradients are conform to a regionalization pattern: in fact, if we analyze the overall density gradient (expressed as the ratio between density and distance from the central city) considering as outliers the largest cities of Milan and Bologna we can clearly notice that density remains high along the corridor, among the highest all over EU (Eurostat, 2011). The same can be noticed observing the density gradient for each city (between 200 and 400 inhabitants/km²). We can even observe high levels (more than 500 inhabitants/km²) between Parma and Modena – this latter characterized by the high densities of its urban belt. Furthermore, along the Via Emilia, it can be noticed a sort of asymmetry between the less densely populated southern Apennines margin (less than 100 inhabitants/km²) and the northern Pianura Padana which stretches with discrete densities to the edges of the Po river.

In terms of connectivity, the second indicator, *number of households served by high-speed Internet connection*, somehow confirms the previous image: the Milan-Bologna axis appears one of the most equipped with

fast internet connections. This axis appears better infrastructured than the Milan-Venice urban region, whereas the provincial capitals, particularly Bergamo, stand out for significantly higher values than the in-between territories. Even the Milan urban region appears less cohesive and homogenous, while there is a good, albeit "subtle", continuity along the Milan-Turin corridor. As for the previous indicator, the entire Via Emilia is decidedly more cohesive than the Lombard agricultural territory south of Milan.

Finally, the regionalization pattern is only partially confirmed by the localization quotient of business services, which elaboration returns a more fragmented and complex image. However, it is possible to recognize a better distribution and a more explicit continuity between Milan and Bologna than between Milan and Venice. In fact, along the Milan-Venice corridor, the capital cities show a stronger role than their surrounding areas, and the Milan area shows a post-metropolitan behavior where it is not only the central city that stands out but also the intermediate territories. Along the Milan-Bologna corridor we can find a more balanced and regionalized pattern, with a better symmetry between the Apennines towns and the towns on the plain. It is also interesting to note that along the Po river, there are peaks in the belt towns of the provincial capitals (Alessandria, Piacenza, Cremona, Mantua) rather than in the centroids. This fact is probably an effect of the growing logistical appeal of these areas and their traditional agro-food vocation, which determines the localization of tertiary activities in highly productive rural areas.

1.5 Concepts and methods

The map is composed by three indicators

- **RP 1.1.1 – Population density**, as a traditional indicator of spatial concentration of people and activities that can also work as a proxy for other urban features
- **RP 1.1.2 – Number of households served by high-speed Internet connection**, as an infrastructural indicator related to innovation capacity and connectivity requested to competitive urban spaces. This indicator maps theoretically expected max speeds connection faster than 500 Mbps, which is enough to support buffer-free video streaming and multiple device connection at once
- **RP 1.1.3 – Business services location quotient**, as an economic indicator correlated to economic heterogeneity, dynamism, and productivity. Location quotient has been calculated comparing the concentration level of business services in every municipality to that registered at the national level

In the synthesis map "Map 1 - RP 1.1 Regionalization of the urban" based on these indicators, the warm tones represent the municipalities with at least two of the three indicators with values higher than the median (calculated in the LAU domain of the whole of Northern Italy with the addition of Tuscany and Marche regions). The deepest red is reserved for municipalities with values above the median for all three indicators ("+++").

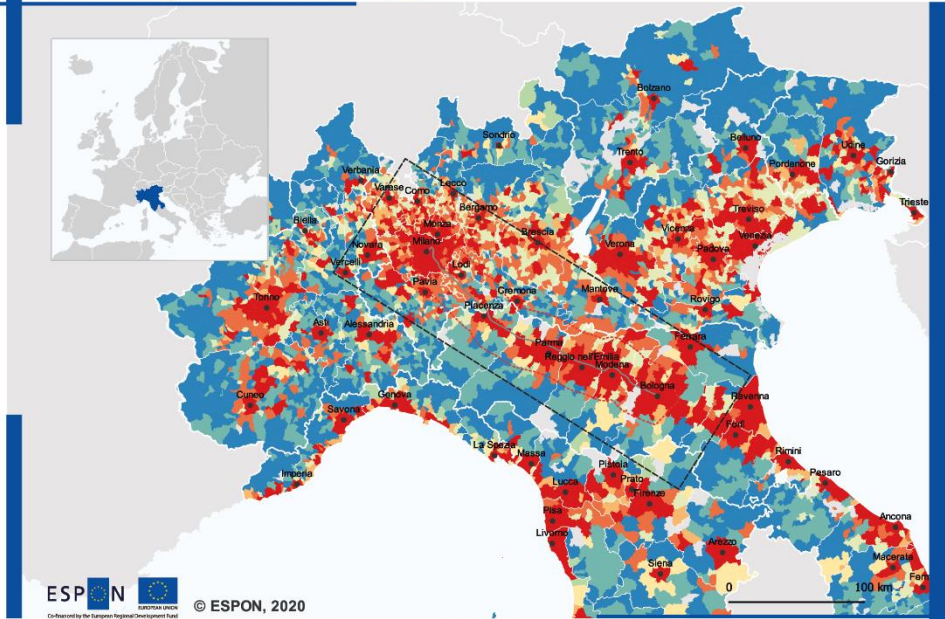
1.6 Key words

Regionalization, Urban regions, polycentrism, corridor

1.7 Theme

Regional Economy

RP 1.1 – Regionalisation of the urban



Territorial level: LAU2 (version 2011)
 Source: ESPON IMAGINE, 2020
 Origin of data: ISTAT, 2019, AGCOM, 2018, ISTAT-ASIA, 2015
 © ISTAT for administrative boundaries

Urban potential

- + + + very high
- + - + high with lower internet speed
- + - - high with less business services
- - + + high but less densely populated
- + - - low but densely populated
- - + - low with higher internet speed
- - - + low with more business services
- - - - very low

- Provincial/Metropolitan Capital
- ▭ Milan-Bologna frame (300x100 km)
- ▭ HSR Milan-Bologna (30 km buffer)
- ▭ Sea / Lakes
- ▭ no data / area not included in the analysis

RP 1.1.1 – Population density 2019 (> median)
 RP 1.1.2 – Households served by fast internet 2018 (> median)
 RP 1.1.3 – Business service location quotient 2015 (> median)

Map 1 - RP 1.1 Regionalization of the urban

2 Regionalisation of mobility

2.1 Teaser

- The corridor Milan–Bologna is perfectly recognisable and somewhat different from other potentially similar corridors (the Milan-Venice in particular).
- The Milan Bologna corridor shows signs of regionalization, due to a highly networked pattern of mobility services
- The high-speed rail opening has worked as an accelerator of connectivity at national level but at the same time has limitedly improved the regional connectivity and produced a hierarchisation on certain cities, at the expenses of others, working like a pipeline rather than a backbone

2.2 Observations for policy

Rail transport can have a structural role for a urban corridor or region, especially when distances between cities are in the range of dozens of km and infrastructure is adequate. But, at the same time, the infrastructure alone is not sufficient to measure the effectiveness of the system and its attractiveness.

This dipolar structure, clearly focusing on the two capitals (both of regional and faster trains), is relatively young and possibly a result of the evolution of the historical corridor due to the introduction of the HRS opening (but not necessarily unique consequence of it). In general, Milan and Parma-Bologna extended their leading role in terms of accessibility, as a clear strategy especially of long-haul segment. More in particular, the accessibility of the second circle of towns around Milan is due to the extension of the S-lines system and the line Parma-Bologna, thanks to the capacity freed up of the traffic moved to the HRS line, has been strengthened. The in-between areas of Piacenza and Cremona, instead, saw their role further reduced, making them more marginal than twelve years ago.

We could observe that, on the one hand, the Milan Bologna corridor shows signs of regionalisation, due to a highly networked pattern of mobility, on the other that the high-speed rail opening has worked as an accelerator of connectivity at national level but at the same time has limitedly improved the regional connectivity and produced a hierarchisation on certain cities, at the expenses of others, working like a pipeline rather than a backbone (at least in its initial phase).

2.3 Policy context

Regions are social practices, they are produced by behaviours and lifestyles that are structured upon a regional scale, often based on infrastructures that allow the organisation of everyday life. Networks, practices, discourses, relations, connections, can produce a region, going beyond boundaries, through history. Of course, it is quite complicated to map and analyse such factors. This chapter investigates people mobility as an indicator and a proxy of an integrated functional urban space.

Mobility is a multidimensional phenomenon, made of origins, destinations, timing, travel purposes, modal choices, etc. To work in this dimension, we have analysed three characteristics: the level of mobility, the level of interconnectedness and the level of non-private transport, which is typical of cities, also at the territorial scale and we have identified three clusters, which interpretation is not strictly “from best to worse”, as the three indicators have different meanings according to the context.

2.4 Map interpretation

The first group (+++ / active-interconnected-sustainable) typically includes main cities and sometimes their surroundings. These places have a higher mobility, and this mobility is not limited to the local commuting area they belong to but spread outside of it. They also have higher shares of public transport and active modes. They are somewhat similar to group ++-, where the only difference is that mobility and connectivity rely more on car than in the previous group. Mountain and remote areas tend to belong to the groups of “inactive”. In this case a “+” for the second indicator should be interpreted more in the sense of dependence from other local commuting areas rather than from a positive belonging to a network of interconnected local commuting areas. A third group is that of the “active” but “locked” (+-+ and +-+). These places generate many

working trips, but these trips are mostly directed to their local commuting area and consequently to their main local attractors. They are the territories of work, but with a typical local dimension.

The geography of Northern Italy resulting from the analysis is quite interesting and not completely obvious. The corridor Milan–Bologna is perfectly recognisable and somewhat different from other potentially similar corridors (the Milan-Venice in primis). All cities of the corridor, except Pavia and Lodi, which are “active” and “sustainable”, but with very low values of interconnectivity. Some of the towns surrounding Emilian cities are “active” and “interconnected” like the main cities and have just a higher car use, which is not surprising in a sparse territory. Along the Milan – Venice corridor, on the contrary, the cities (except Verona) have a lower number of generated working trips/population with respect to the Emilian corridor. Moreover, the commuting areas of all main cities are “locked”, which means that they tend to work near hometown. Except the Trentino Alto Adige area (which is completely different in terms of orography and population), the via Emilia corridor is the only large and nearly continuous area made of +++ and +- municipalities.

In conclusion, the analysed corridor is characterised from a ratio of working trips over mobility and interconnectivity of local commuting areas (local commuting area) well above the median. The extra urban areas, typically characterised by high working trips ratio but of local scale, are here less present than in the rest of Northern Italy. Which can confirm the hypothesis under which the Milan Bologna corridor is the backbone of a regionalised profile of mobility, less dependent from the main regional cities and based on a thick network of mobility relationship stretching beyond the local mobility systems.

2.5 Concepts and methods

The map is composed by three indicators

- RP 2.1.1 – Ratio between generated trips and resident population: The ratio between the generated trips for working reasons of a municipality and the total population. The indicator represents how active is the population of the municipality. Areas with high shares of elderly or high unemployment will have a low value, while areas with a high share of active and employed population will be high.
- RP 2.1.2 – Share of generated trips directed outside the local commuting area (local commuting area): The share of working trips going out of the local commuting area. The more a commuting area is self-contained, the lower will be the indicator. Interconnected job markets will have instead a high value as workers are not directed solely to internal attractors. Consequently, the indicator may represent how an area is interconnected or locked in terms of commuting.
- RP 2.1.3 – Share of generated trips with public transport or non-motorized: The share of sustainable mobility (public transport plus non-motorized). This indicator is expected to be the highest in cities where public transport is used and the lowest in extra urban areas where car dominates the mobility. Intermediate values might characterize remote areas, where walking trips are significant but public transport is scarce.

The indicators of every municipality are normalized using the median of the study area (Northern Italy plus Tuscany and Marche) and eight clusters are composed and mapped. In the synthetic map based on these indicators (Map 2 - RP 2.1 Regionalisation of mobility), the warm tones represent the municipalities with at least two of the three indicators with values higher than the median (calculated in the LAU domain of the whole of Northern Italy with the addition of Tuscany and Marche regions). The deepest red is reserved for municipalities with values above the median for all three indicators (“+++”).

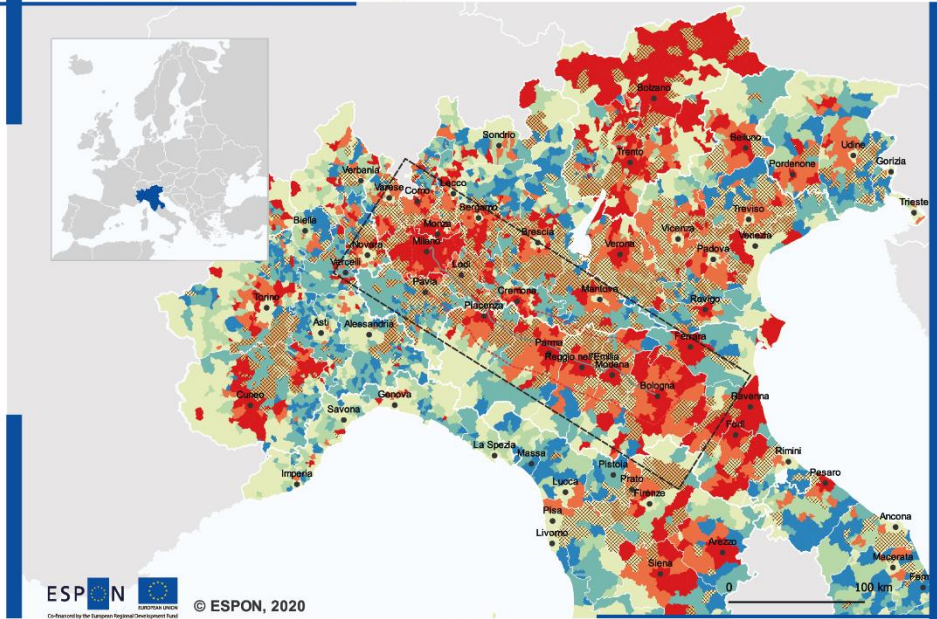
2.6 Key words

Regionalization, mobility, corridor, High speed, pipeline

2.7 Theme

Regional Economy

RP 2.1 – Regionalisation of mobility



Territorial level: LAU2 (version 2011)
 Source: ESPON IMAGINE, 2020
 Origin of data: ISTAT, 2011
 © ISTAT for administrative boundaries

Mobility behaviours (commuting to work)

- + + + active-interconnected-sustainable
- + + - active-interconnected-unsustainable
- + - + active-locked-sustainable
- + - - active-locked-unsustainable
- - + + inactive-interconnected-sustainable
- - + - inactive-interconnected-unsustainable
- - - + inactive-locked-sustainable
- - - - inactive-locked-unsustainable

- Provincial/Metropolitan Capital
- ▭ Milan-Bologna frame (300x100 km)
- ▭ HSR Milan-Bologna (30 km buffer)
- ▭ Sea / Lakes
- ▭ no data / area not included in the analysis

RP 2.1.1 – Generated trips / Population (+ if higher than median)
 RP 2.1.2 – Trips going out of their SLL (+ if higher than median)
 RP 2.1.3 – % of pub. transp. + non motor. (+ if higher than median)

Map 2 - RP 2.1 Regionalisation of mobility

3 Regionalisation dynamics

3.1 Teaser

- Milan Bologna area is apparently characterised by a certain homogeneity of socio-demographic trends, but more in-depth research unveils patterns of socio-economic differentiation that can contrast with its territorial cohesion.
- On the one hand, there is no linear continuity along the Milan–Bologna corridor, on the other hand, the socio-demographic trends appear continuous and consistent around the axis itself, with a substantial symmetry of intensity on both sides.
- Three main poles clearly emerge: i) the Milan pole, clearly characterized by a strong growth of all indicators; ii) the territorial system organized around the cities of the Via Emilia which reveals a certain concordance of growing indicators as regards income and population; iii) the area that develops around the river Po and includes the provinces of Piacenza and Cremona (and in part also the area north / west of Parma), characterized by a generalized decrease in real estate values and population where only in some cases, relative income growth can be observed.

3.2 Observations for policy

General sociodemographic dynamics seem to follow different behaviours along the Milan-Bologna axis, where three main poles clearly emerge.

- The first is the Milan pole, the only one clearly characterized by a strong growth of all indicators in the city and with a capacity to influence the metropolitan area and beyond, particularly in the area south of the city, up to the provinces of Lodi and Pavia.
- The second is the territorial system organized around the cities of the Via Emilia which, although behaving differently depending on the indicator, reveals a certain concordance of growing indicators as regards income and population, but not the real estate market. It should be noted here that the peripheral areas have shown a faster growth than the provincial capitals, and in particular the dynamism of the peri-urban area of Modena, characterized by strong growth, is observed. These can be considered as wealthy territories but still with an accessible cost of living, and in this sense as spaces with a significant potential growth and where relocation dynamics could be expected.
- The third element is the area that develops around the river Po and includes the provinces of Piacenza and Cremona (and in part also the area north / west of Parma), characterized by a generalized decrease in real estate values and population where only in some cases, relative income growth can be observed.

If, on the one hand, there is no linear continuity along the high-speed rail corridor, on the other hand, the socio-demographic trends appear continuous and consistent around the axis itself, with a substantial symmetry of intensity on both sides. Without willing to generalize and anticipate conclusions with respect to the spatial coherence of the socio-demographic transformations observed, it is however worth emphasizing that in the Milan-Bologna urban region these same phenomena can be visualized with a greater continuity than in the other "macroregions" of northern Italy (Milan-Turin and Milan-Venice), which appear much more fragmented and discontinuous.

In this respect, an important conclusion is related to the fact the Milan Bologna area is apparently characterised by a certain homogeneity of socio-demographic trends, but more in-depth research unveils patterns of socio-economic differentiation that can contrast with its territorial cohesion. Certain territories in fact have been benefitting more than others from the reinforcement of the infrastructural corridor. Others have been suffering from further peripheralization. Finally, we can clearly notice an intermediate space which is characterised by the availability of wealth at individual level, with reduced living costs. We can expect that these areas can play a central role in the future growth of the area, as well as that they could show potential frictions between request and offer of quality of living conditions and integration in the urban region.

3.3 Policy context

Infrastructural corridors can be conceived as “operational landscapes”, where infrastructures are vectors of dynamics of socio-economic transformation at the regional scale. A space that produces space, because of their technological function and modify societies. This map explores trends and dynamics over the last 20 years, exploring key socio-economic dynamics and trends. It focuses on the socio-demographic transformation of the Milan-Bologna urban region observing trends and dynamics that have been consolidating along the last decade, trying to understand, on the one hand, if there are continuity patterns referable to a macro-regional scale, and, on the other hand, to what extent these have been influenced and conditioned by the establishment of the high-speed rail corridor.

3.4 Map interpretation

In a context of general growth of the population in almost the entire area around the buffer (30km), we observed a significant demographic growth in the city of Milan and (to a lesser extent) its southern metropolitan municipalities, with a trend that extends to include the provinces of Lodi and Pavia. On the other side, a slower demographic growth is shown by the cities that form the heart of the Emilian urban system, which appears stronger in Parma, average in the municipalities and cities of Bologna and Reggio, and weaker in Modena, where it is however balanced by the growth of the population in the peri-urban area. Finally, an area of demographic degrowth can be detected in the provinces of Piacenza and Cremona, where, except for the provincial capitals, it is possible to observe decreasing population in the municipalities along the river Po.

All in all, we can clearly notice a polarization trend, even more evident when we refer to change in house prices, where it appears evident that the whole region has suffered from a generalized decrease in values, but with consistent territorial differences. The city of Milan and the southern area of the metropolitan city, with relevant growth in real estate values, are the main exception to the generalized decline, together with the peri-urban area of Modena. A relevant decrease characterizes indeed the municipality of Piacenza, Parma and the surrounding municipalities, and the cities in the north/west area of Bologna’s metropolitan area. A symmetric path is visible with respect to the corridor axis, where on both sides of the 30km buffer is observable a general decrease at least in the part between Piacenza and Bologna, which is stronger in the side oriented towards the Apennines.

Analysing the percentage change in personal average income, with very few exceptions, the buffer and the entire macro-region, as well as northern Italy itself, are characterized by a generalized growth, with a consistency and continuity along the high-speed rail corridor axis that is not possible to detect in any of the other macro-regions observable in the map (i.e., along the axis Turin-Milan or Milan-Venice). Nonetheless also in this case it is possible to observe some differentiations, which are also worth interpreting while considering the data related to the distribution and concentration of wealth on the territory. Income growth is distributed evenly around the axis but not along it: indeed, the Milan metropolitan area is characterized by a weak growth that increases starting from the province of Piacenza and along the whole via Emilia. The provincial capitals often behave in contrast with the relative province, as in the case of Milan, where average incomes have been growing to a greater extent than in the peri-urban municipalities. Parma and Piacenza are the cities of the axis with the lowest growth rates (and with a behaviour like the cities of Lodi, Cremona, and Pavia).

3.5 Concepts and methods

Three key indicators at the municipal level are considered and analysed in their correlation, in order to obtain a synthetic map of the main socio-demographic trends of the macro region.

- **3.2.1 - Population change** concerns the percentage change of the population between 2011 and 2019.
- **3.2.2 Change in house prices:** it explores the percentage change in real estate values in the period between 2012 and 2019.
- **3.2.3 Percentage of change in personal average income** between 2012 and 2018.

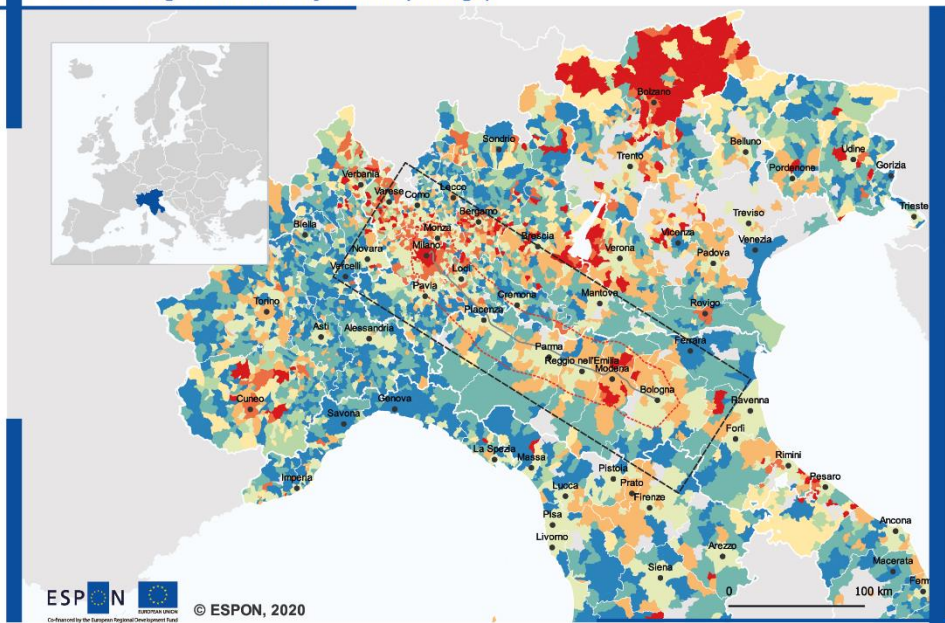
3.6 Key words

Regionalization, Demographic change, Real estate prices, Personal income

3.7 Theme

Regional Economy

RP 3.2 – Regionalisation dynamics (change)



Territorial level: LAU2 (version 2011)
 Source: ESPON IMAGINE, 2020
 Origin of data: ISTAT, 2011, 2019, AdE, 2012, 2019, MEF, 2012, 2018
 © ISTAT for administrative boundaries

Socio-demographic dynamics

- + + + overall growth
- + + - population and real estate growth
- + - + population and income growth
- - + + real estate and income growth
- + - - population growth only
- - + - real estate growth only
- - - + income growth only
- - - - overall decline

- Provincial/Metropolitan Capital
- ▭ Milan-Bologna frame (300x100 km)
- ▭ HSR Milan-Bologna (30 km buffer)
- ▭ Sea / Lakes
- ▭ no data / area not included in the analysis

RP 3.2.1 – Population change 2011-2019 (+ if higher than 0)
 RP 3.2.2 – Change in house prices 2012-2019 (+ if higher than 0)
 3.2.3 – Income change 2012-2018 (+ if higher than median)

Map 3 - RP 3.2 Regionalization dynamics (change)

4 Regional competitiveness

4.1 Teaser

- For all the considered variables, the weight of the provincial city capitals and of the metropolitan city capitals of the corridor is often higher than the values of the surrounding areas.
- A polycentric competitiveness of the Milan metropolitan area and of the neighbouring provinces emerges, while at the other side of the corridor it seems that higher degrees of competitiveness are mainly visible within the linear axis of Emilia Romagna's provincial capitals.
- Although it is evident that the Milan-Bologna corridor exhibits higher competitiveness if compared to the other Italian corridors, something more should be done to foster the competitiveness of outer border areas, that are lagging under multiple perspectives, if compared to the main pole areas.

4.2 Observations for policy

This map provides a synthetic graphical representation of the Milan-Bologna corridor's competitiveness. It appears quite evident that, within the 30km boundary from the HRS line, there is a spatial discontinuity when the provinces of Lodi, Pavia, Piacenza, and Cremona are considered, where the overall competitiveness is broadly lower than the other provincial and metropolitan capitals of the corridor. Moreover, a polycentric competitiveness of the Milan metropolitan area and of the neighbouring provinces emerges, while at the other side of the corridor it seems that higher degrees of competitiveness are mainly visible within the linear axis of Emilia Romagna's provincial capitals of Bologna, Modena, Reggio Emilia and Parma. In the latter case are also visible decreasing levels of competitiveness, both at the eastern and at the western side of the high-speed rail, and this is basically due to the closeness with the inner areas (in particular for what concerns the Apennine hillside) that are characterised by lagging development dynamics as described by the Strategia Nazionale Aree Interne (SNAI), the national urban strategy for Inner Areas.

4.3 Policy context

According to the literature, urban regions are substituting cities on the economic scene. They are competitive actors, made of dense networks of relationships: companies, clusters, short and long-distance chain link materially and immaterially the territories along the Milan-Bologna corridor with the rest of the country and to a wider global scale. This is crucial a resource for competing under current capitalistic organisation of economy. The Regional Portrait tries to map the degree of competitiveness that characterise Milan-Bologna urban region and adds some general reflections about the role of Industrial districts within the area.

4.4 Map interpretation

Most large firms are in the pole areas of Bologna, Milan, Reggio Emilia, Modena, and Parma, which host over 50 big firms each. On the other hand, a lower intensity of big firms characterises other provincial capitals (Cremona, Piacenza, Lodi, and Pavia), falling within the 30km buffer of the corridor, which host from 20 to 50 big firms each. Data show that it is not possible to identify a real continuum within the corridor in terms of big firms' location. Specifically, while the Bologna-Parma axis almost shows a spatial continuity, also including the second-order municipalities, the same does not happen in the rest of the corridor, both considering the 30km buffer, and the larger frame, where the presence of big firms is often lower than 5, or even absent, especially in the western side of the corridor.

In terms of *value added per employee*, the value added is commonly considered as an appropriate proxy to describe the degree of productivity of a certain area and, considering the macro-regional urban corridor of Milan-Bologna, high levels of productivity arise. As opposed to what happens for the big firms' dynamics, a clear continuum within the whole Milan-Bologna corridor emerges, except for the municipalities of Pavia, Lodi and Piacenza. In this case, the role of high-speed rail was also essential to encourage a sprawl of economic activities that is not only circumscribed to the pole metropolitan and provincial capitals, but that is also a prerogative of smaller surrounding municipalities that are located both within and beyond the 30km buffer of the corridor line. Moreover, the intensity of high values for the added value indicator in the corridor is very noticeable if compared to the other high-speed rail corridors in northern Italy, such as Turin-Milan,

Milan-Venice, or Bologna-Venice. In other words, the productivity of the Milan-Bologna axis is very high, and this acts as activator of further heterogenous spill overs for the interested areas.

Both the presence of large firms and labour productivity is related to the location along the corridor of the Italian Industrial Districts (IDs), specialised in the *Made in Italy* sectors. The latest classification of the Italian IDs by ISTAT¹ identifies 141 IDs specialising in 11 macro sectors. IDs represent about a quarter of the Italian productive system in terms of local labour systems, jobs, and local units; and IDs' manufacturing employment represents more than a third of total Italian employment. Specifically, Lombardia hosts 29 (20.6%) IDs and Emilia-Romagna 13 IDs (9.2%) (together about 30% of the Italian IDs). As concerns the district sectors both regions are mainly specialised in mechanical industry (11 IDs in Lombardia hosting 45.5% of total employment of Italian IDs in this sector, and 7 in Emilia Romagna, hosting 15.7% of total employment of Italian IDs in this sector) and Lombardia also in textile and clothing (7 IDs, hosting 42.3% of total employment). It is worth underlying that the mechanical industry, which absorbs more than 60% of the ID's employment in Emilia-Romagna and 68% in Lombardia, showed the better performance in terms of growth and profitability, if compared to other district industries. Moreover, the IDs in the mechanical industry exhibit a high innovation capacity also concerning the adoption of 4.0 technology: about one fifth of the district firms patent, thus showing a higher value than that of non-district firms in 2018. These IDs in the mechanical industry are mainly composed by small and medium size firms collaborating with big players, able to significantly influence the areas in terms of internationalisation and innovation.

The value related to the *percentage of employees in the high-tech sectors* allows to analyse the degree of technological specialisation that a certain area may have regarding the two pillar sectors of Italian economic system, meaning manufacturing and services. Similarly to what happens to large firms, the high-tech specialisation is mainly a trait of larger areas, which often correspond to the provincial capitals of the corridor, with Milan in the top position. However, partial differences can be glimpsed by the larger Milan metropolitan area, which exhibits several municipalities within the Milan-Monza-Lodi triangle with elevated percentages of highly specialised employees, which are mainly related to the location of Italian and foreign multinational enterprises (MNEs), in the suburban area of the Milan metropolitan city. Specifically, Milan and Lombardia region are specialised in medium-high and high technological intensity sectors (pharmaceutical, chemical, mechanics, electric, electronic and optics), in rubber and plastic products and in the publishing industry. Moreover, Lombardia region and Milan exhibit the higher internationalisation degree in Italy in terms of inward Foreign Direct Investments (FDIs) (45.6% in 2019) – undertaken by foreign MNEs in these areas – and of Outward FDIs (32.7% in 2019) – undertaken by MNEs having the headquarters located in Lombardia and Milan –. Among the first forty foreign MNEs investing in Italy, according to the number of workers employed in their affiliates, seventeen have the head office settled in Lombardia, and, among those, eleven in the Milan Metropolitan Area.

4.5 Concepts and methods

The degree of competitiveness of the Milan-Bologna corridor is presented by summarizing the following three key dimensions at LAU-2 scale:

- **RP 4.1.1 – Number of active big firms:** number of big firms with 250 employees or more (2018 as reference year); data are retrieved by the database of local units of active firms from the Italian Statistical Institute (ISTAT).
- **RP 4.1.2 – Value added per employee:** value added per employee (labour productivity) in thousands of € (2016 as reference year); are retrieved by the ISTAT data warehouse and the economic activities total was considered.
- **RP 4.1.3 – Employees in high-tech sectors:** percentage of employees in the high-tech sectors over the total employment (2015 as reference year). The value related to the percentage of employees in the high-tech sectors comes from an experimental database of the ISTAT and it is computed by considering some NACE Rev. 2 subsectors of manufacturing and services macro-categories

¹ ISTAT (2015). 9° Censimento dell'Industria e dei Servizi e Censimento delle Istituzioni Non Profit: I Distretti Industriali 2011. ISTAT, Rome, Italy.

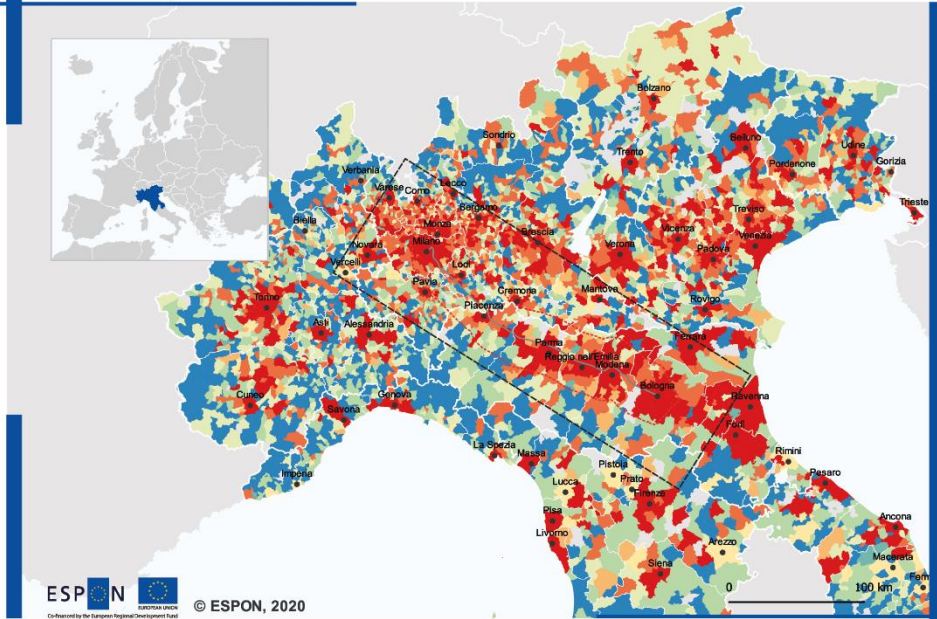
4.6 Key words

Regionalization, Competitiveness, Active Big Firms, Value Added, Employment in High-Tech Sectors

4.7 Theme

Regional Economy

RP 4.1 – Regional competitiveness



Territorial level: LAU2 (version 2011)
 Source: ESPON IMAGINE, 2020
 Origin of data: ISTAT, 2015, 2016
 © ISTAT for administrative boundaries

Competitiveness

- + + + big firms - productive - hi-tech
- - + + no big firms - productive - hi-tech
- + + - big firms - productive - non hi-tech
- + - + big firms - less productive - hi-tech
- - - + no big firms - productive - non hi-tech
- - - + no big firms - less productive - hi-tech
- + - - big firms - less productive - non hi-tech
- - - - no big firms - less productive - non hi-tech

- Provincial/Metropolitan Capital
- ▭ Milan-Bologna frame (300x100 km)
- ▭ HSR Milan-Bologna (30 km buffer)
- ▭ Sea / Lakes
- ▭ no data / area not included in the analysis

RP 4.1.1 – Number of active big firms (+ if higher than 0)
 RP 4.1.2 – Value added per employee (+ if higher than median)
 RP 4.1.3 – Employees in high-tech (+ if higher than median)

Map 4 – RP 4.1 Regional Competitiveness

5 Transitioning like a region: mapping environmental fragility

5.1 Teaser

- Maps represent a critical situation for the Milan-Bologna urban region for several variables, but in particular in terms of air pollution, even if the phenomenon of atmospheric pollution recurs with similar characteristics over most of northern Italy.
- Air pollution, soil consumption, hydrogeological risks, agricultural pollutants, etc. are intertwined challenges that cannot be tackled without a transcalar strategy of ecological transition
- Even if Milan's metropolitan area represent a peak, the soil consumption level remains high along the entire corridor and only on its western side, towards the Apennines, it falls decisively.

5.2 Observations for policy

The regional environmental ecosystem is undergoing several threats originated both internally and out of the region itself. Air pollution, soil consumption, hydrogeological risks, agricultural pollutants, etc. are intertwined challenges that cannot be tackled without a transcalar strategy of ecological transition. In this picture, regions can play a pivotal role and deploy development trajectories aiming at maximizing intra-regional cohesion and construct more resilient regions.

The map seems indeed to identify clear environmental challenges of the macro-region. In fact, risk factors of human origin and closely linked to the intense urbanization of this territory and its crossing by a dense infrastructural corridor are grafted onto the hydrogeological fragility that natively characterizes the macro-region. Even with internal differentiations, it is evident that common environmental challenges cross the entire macro-region, posing a demand for transition strategies that require adequate medium and long-term planning and governance tools. In this respect, it must be mentioned that the environmental challenges associated to the whole Pianura Padana, are major concerns at both EU and local level: on the one hand the Pianura Padana is one of the Italian regions, identified at EU level for their infraction to EU directives on quality of air; on the other side this urgent policy problem has been the object of a peculiar initiative, a sovranational agreement, signed by regional institutions of the Pianura Padana (among which Lombardia and Emilia Romagna) aimed to sharing of methodologies and tools for tackling with the problems of quality of air. However, the problem remains as one of the most urgent to be addressed.

5.3 Policy context

If there is a policy dimension that needs to be handled on a wider scale, it is the environmental dimension. If on the one hand the issue of ecological transition has entered increasingly forcefully on the political agendas of European governments in recent years, both the specialized literature of environmental sciences and scholars of spatial planning have highlighted the inadequacy and weakness of environmental policies overly localized, in the face of the enormous challenges posed by phenomena often originating on a different scale than the municipal or provincial one, when not a consequence of choices made in other territories. In particular, the literature dedicated to urban metabolism has shown the need to consider the complex interplay that provides the ground for contemporary urban world; at the same time, the debate on ecosystem services, has highlighted the need to consider sustainability from a transcalar perspective.

5.4 Map interpretation

This map approaches the topic of ecological transition by observing the deployment of different environmental phenomena with the lenses of the macro-region, analysing the way in which environmental challenges are shared within the whole territory between Milan and Bologna.

The first indicator *Consumed soil* focuses on soil consumption and provides a relatively predictable picture, with metropolitan areas having significantly higher indexes than in-between areas. In particular, the metropolitan area of Milan has a high degree of soil consumption, although contained in the south by the Parco

Agricolo Sud Milan which represented a recent barrier to further consumption with its institution in the nineties. It is also evident how the consumption index remains high along the entire corridor and only on its western side, towards the Apennines, it falls decisively. It is worth underlining how this map represents a picture of the state of the art (and therefore more congenial to portrait the state of the environmental ecosystem of the region), while the observation of the increase in land consumption in recent years would probably show different results, for example by accentuating the weight of consumption in the most virgin areas.

The second and third indicators (*Air Pollution (NO₂)* and *Air Pollution (PM₁₀)*) are closely related and can be commented together as they both refer to the concentration of air pollutants (mg / m³). Both maps represent a critical situation for the Milan-Bologna urban region, even if the phenomenon of atmospheric pollution recurs with similar characteristics over most of northern Italy and with an even greater concentration on the axis looking at the east of Milan. It could be useful to remind the different nature of these two pollutants. Nitrogen dioxide (NO₂) is produced by all high temperature combustion processes (heating systems, vehicle engines, industrial combustion, power plants, etc.), by oxidation of atmospheric nitrogen and, to a small extent, by oxidation of nitrogen compounds contained in fuels. PM₁₀ is a composite pollutant made of particles, solid and liquid, with a great variety of physical, chemical, geometric, and morphological characteristics. The sources can be natural (soil erosion, marine spray, volcanoes, forest fires, pollen dispersion, etc.) or anthropogenic (industries, heating, vehicular traffic, and combustion processes in general)². Consequently, the correlation between polluting NO₂ and the infrastructural corridor appears more evident.

The third indicator *Population in medium flood hazard zones*, represents the hydrogeological risk factor, calculated on the percentage of the population resident in areas considered at flood risk. While the Lombard part of the macro-region does not present significant risk, this increases exponentially along the via Emilia from Piacenza onwards, drawing on the map a sort of cone that also includes the provinces of Ferrara and Ravenna. As the map emphasizes, this high-risk factor, although not having a direct correlation with the infrastructural corridor, appears as a characterizing element of the whole macro-region that is unique in the panorama of northern Italy.

5.5 Concepts and methods

The map on environmental fragility is built upon four different indicators:

- **RP 7.1.1 – Consumed soil:** reports the % of the administrative area of each municipality that has been urbanized. The data refers to 2018 and is calculated upon ISPRA data
- **RP 7.1.2a – Air Pollution (NO₂):** refers to the amount of air pollutant nitrogen dioxide (NO₂) detected in the atmosphere, calculated in mg/m³. The data has been collected in 2016 and data source is the EEA
- **RP 7.1.2a – Air Pollution (PM₁₀):** refers to the amount of air pollutant particulate matter 10 (PM₁₀) detected in the atmosphere, calculated in mg/m³. The data has been collected in 2016 and data source is the EEA
- **RP 7.1.3 – Population in medium flood hazard zones:** refers to the percentage of population at risk located in medium flood hazard zones, as of 2017 and is calculated upon ISPRA data

5.6 Key words

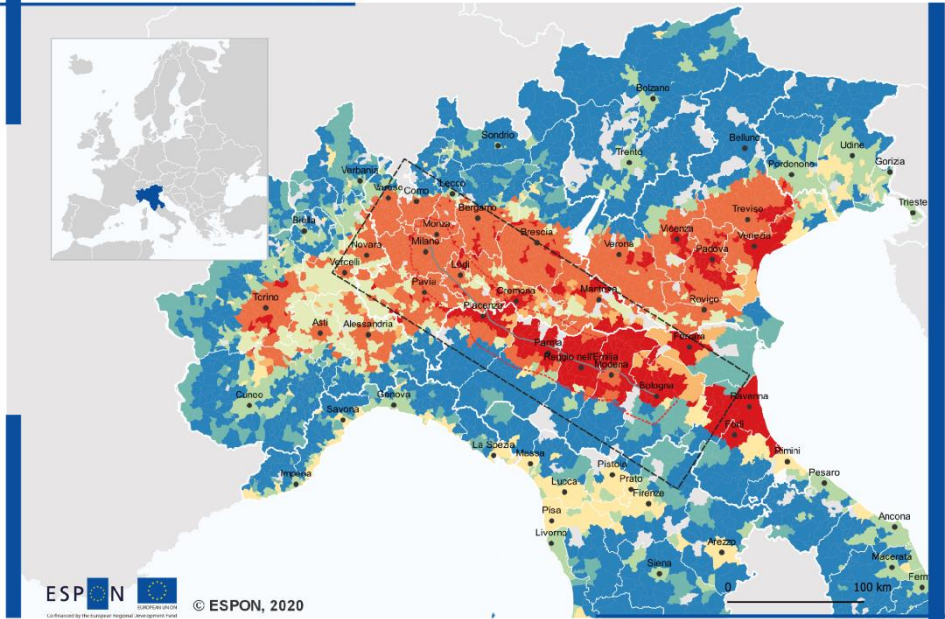
Regionalization, Environment, Pollution, Green Deal

5.7 Theme

Environmental challenges

² <https://www.arpalombardia.it/Pages/Aria/Inquinanti.aspx>

RP 7.1 – Environmental fragility



Territorial level: LAU2 (version 2011)
 Source: ESPON IMAGINE, 2020
 Origin of data: ISPRA, 2017, 2018, EEA, 2016
 © ISTAT for administrative boundaries

Environmental fragility



Consumed soil (%) of the administrative area 2018 (> median)
 Air pollution (NO2+ PM10) 2016 (> median)
 Population (%) in medium flood hazard zones 2017 (> median)

- Provincial/Metropolitan Capital
- ▭ Milan-Bologna frame (300x100 km)
- ▭ HSR Milan-Bologna (30 km buffer)
- ▭ Sea / Lakes
- ▭ no data / area not included in the analysis

Map 5 – RP 7.1 – Environmental fragility



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