State of the Art of Sustainable Development of Railway Nodes: The High Speed Rail (HSR)

Paola Panuccio(✉)

Università Mediterranea di Reggio Calabria, 89100 Reggio Calabria, Italy
paola.panuccio@gmail.com

Abstract. High Speed Rail (HSR) is a new mode of transport and has a significant impact on the territory. The urban plan, in respect of the technical standards set by the rules, does not provide any indication for the inclusion of an important node in the territory, such as a station of an HSR line. Even the Sustainable Urban Mobility Plans (SUMPs) designed for metropolitan areas, in their strategic choices, often do not give indications on the HSR. It therefore happens that the territories are distorted by the effects caused by the location of such an important infrastructural node. Furthermore, the stations of the HSR are designed by "archi-star" architects who give a significant formal and visual mark on the territory. The paper underlines the importance of HSR through the analysis of two case studies, the effects that HSR cause on the territory. The first case of the Mediopadana High Speed Rail station in Reggio Emilia analyses the impact caused on a moderately anthropized territory. The second case of the High Speed Rail station of Naples Afragola analyses the impact caused on a highly anthropized territory. The analysis of these two projects concludes with considerations regarding the opportunity of an integrated urban and transport planning.

Keywords: Integrated urban planning · sustainable mobility · landscape quality

1 Introduction

The territory is the visible expression of the transformations that man has planned over time; it tells the story of history. On it, the signs that have characterized the various socio-economic periods remain, demonstrating the fact that the territory is a great re-gister of economic dynamics, dictated by history [1].

It happens to observe buildings that remain on the territory, to testify the past reality (what was). These, at present, have lost the functions for which they were built: they are the disused areas. These abandoned areas, like the new infrastructural nodes, are the objects of interest of modern urban planning. The new focal points of urban regeneration plans [2].

In Italy, the territory is planned, mainly by means of legal instruments: urban plans and urban plans for sustainable mobility (SUMPs) [3, 4]. These tools ensure the best development, applying the law and indicating the project actions to be carried out. They

O. Gervasi et al. (Eds.): ICCSA 2024 Workshops, LNCS 14822, pp. 202–216, 2024.
https://doi.org/10.1007/978-3-031-65318-6_14

are some of the main references for maximum integration between strategic choices and actions.

In recent years, important infrastructures, with a strong transformative impact, not only environmental, but also economic and social, have been realized after superior decisions respect to the local decision-makers. Examples include: infrastructure nodes, major urban projects, business center, service infrastructures, public services; sports structures, etc. As a result, territories are forced to change suddenly and do not follow the indications programmed by urban plans [5, 6].

These top-down choices, allowed by international and national directives; cause irreversible transformations, not planned by local urban communities [7]. Decisions to build huge infrastructures are generally made top-down. The territory is forced to host them. It must accept impactful and overwhelming actions. Ordinary structures are upset. The territory receives the infrastructure, without having time to metabolize the insertion, in compliance with the several compatibilities. The impact would be different if the infrastructure was decided by a regular strategic planning process [8]. Instead, the project will cause unexpected transformations. The systems will be disturbed; the reactions of urban development will be unpredictable; socioeconomic responses will be variable.

Cities are the result of transdisciplinary interactive processes. They have evolved over time: from the city of Ippodamo, the first model of urban structure, planned according to the orthogonal scheme (Cardo: North-South and Decumanus: East-West); up to the contemporary smart city, a system of interconnected systems [9]. The European Union (EU) defines "Urban Transport and Mobility" as one of the three fundamental pillars for the smart city [10]. The EU assigns a priority role to transport infrastructure to achieve sustainable development and pursue the 2030 Agenda goals [11].

In the past, transport infrastructures were designed exclusively with numerical calculations and quantitative evaluations. Now, in order to make strategic choices and pursue the goals of sustainable development, the quantitative evaluation is insufficient. The quantitative data must be integrated, by the qualitative data [12]. The logical scientific result will be linked to the markers on the quality of life for social well-being.

The various dimensions of urban life (environmental, economic, social and cultural) are interlinked and success in urban development can only be achieved through an integrated approach. The European Commission (EC) has adopted a number of proposals to improve quality of life. It is a new approach that focuses on the impact of new indicators for well-being. It captures real social progress by looking at the quality of life, social development and the improvement of citizens well-being [13].

The High-Speed Rail (HSR) line, which connects cities with adjacent areas, and with the rest of the country, is a substantial change, which has significant implications for the evolution of cities [14]. The HSR has become a decisive connection tool, both for innovation and development of the national territory and local systems. HSR is the indispensable connection of areas to determine social development and increase economic development [15]. Transport networks increase connectivity, stimulate economic growth and reshape the geographical distribution of economic activity inside and outside the cities. In Italy, at the moment, numerous HSR lines are being built and planned [16]. The location of the HSR stations is important, and it makes a difference to the host territory.

It can be said that the success or failure of investments on the HSR line depends on city-region-nation integration and station-city dynamics [17]. A further important element is the intermodal integration, in order to guarantee continuity solutions, between the HSR mode-service, the other transport mode (air, car, bus), the territory and the citizens [18, 19]. The construction of the HSR station has important impacts on the cities to which it is easily and quickly connected.

In the literature, the traditional urban plan does not have the elements for a global vision, to manage at the same time, the physical and functional characteristics of large infrastructures. The strategic planning for HSR fosters the interaction between local planning and multi-level governance [20].

The HSR station should become an integral part of the development process, and never be a 'white elephant project' or just a transit hub [21]. The significant elements that generate the attractiveness of the HSR station are: internal and external accessibility on a regional scale; intermodal interchange hub; functional interconnections with the territory system; connections with infrastructures services, facilities and urban equipment; presence of urban regeneration projects and smartness projects of potential development; the presence of a productive and proactive socio-economic background.

This paper will focus on the analysis of two cases of high-speed railway stations in Italy: 1) the Mediopadana station of Reggio Emilia; 2) the Afragola station of Naples.

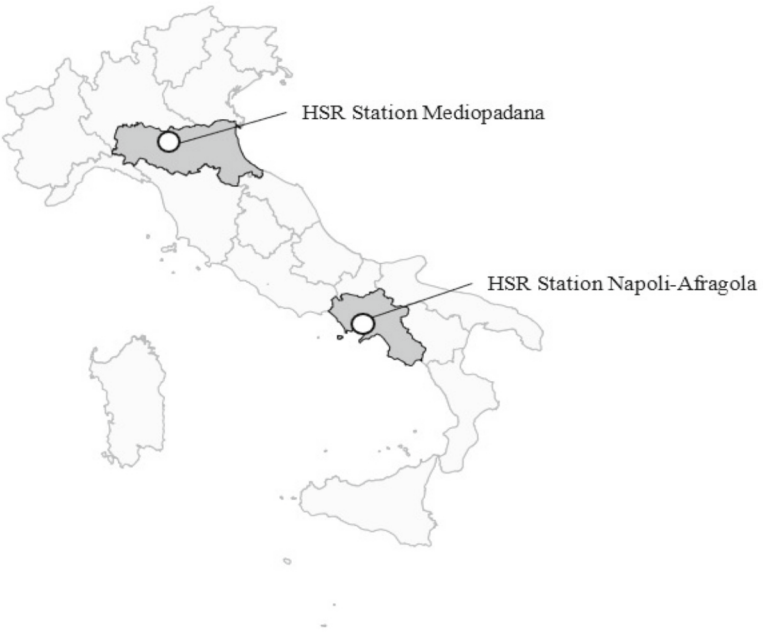

Fig. 1. Italy with the location of the HSR Station Mediopadana in Emilia Romagna and the HSR Station Napoli-Afragola in Campania

These two case studies were chosen because they are two modern stations, both designed by archistar, but located in socially and economically different territories. In

fact, the first station is in northern Italy, in the region with the highest Gross Domestic Product (GDP) per capita. The second station is in southern Italy, in the region with low GDP per capita. Figure 1 illustrates the location of the two stations in Italy.

The paper, through the two case studies, aims to confirm the importance of integrating urban planning choices with those of transport infrastructures, in a single integrated urban plan.

The construction of a new HSR station, if planned, fosters local economic growth. A comprehensive and integrated plan benefits innovation, the transformation of cities into smart cities, and the sustainable development of territories [22].

The structure of the paper is as follows. Section 2 illustrates the importance of HSR nodes. Section 3 illustrates the role of the HSR station Mediopadana for the national and local territory. Section 4 illustrates the role of the HSR station Napoli-Afragola for the national and local territory. Lastly, Sect. 5 shortly draws some conclusions.

2 HSR Stations: Architectural Design and Territorial Attractiveness

2.1 History of Urban Planning and Railway Stations Design

The railway system has always played the role of activator of urban development.

The first railway lines were built close to the mines during the Industrial Revolution of 1760, for the transport of coal. In 1801, the Surrey Iron Railway was launched, the first freight rail. In 1830 the first railway was opened, connecting Manchester to Birmingham. The development of the railway was the cause of the transformation of the territories. The new transport system was the beginning of the real change. The railway system, with its railway network, designed new plots on the territories and caused the foundation of new urban poles. The origins of urban planning are recognized in this period [23]. In fact, there was a need for a new discipline, between technique and norm, to plan, and at the same time, to control the dynamics of the territory. The quality of life and well-being are linked to the integrated actions, between the transport system and urban planning. The two disciplines, in order to perform at their best, must work together. Now, more than ever, there is a clear need to plan territories with integrated process planning [24].

The railway network is an indicative system for the socio-economic developments and transformations that characterize the sites. At the moment, HSR is an important opportunity for the development of territorial dynamics; for issues related to transport; for urban development and socio-economic growth of cities [25].

The location of the stations is the further input that the railway system inspires on territorial dynamics. The territory will take on a new meaning, both in form and function, completely dependent on the choice to locate the station. The determining factors for the success of station location are: high accessibility; implementation of an intermodal node; ability to generate new functions; offer of services and activities, in the adjacent urban systems if, of course, they are interconnected [26, 27].

New York's Grand Central Terminal is mentioned as a first example of part of railway network, with a function dedicated to daily commuting [28]. The project demonstrates the merit of the integrated technical choice, between urban planning and transport. In Europe,

HSR stations are mainly located as network hubs [29]. It is a multi-scale dimension, which allows the integration of multiple transport scale [30]. The station, intended as a hub, becomes a node of interest, especially for regional and national firms [31]. In many cases, the station assumes the additional role of place of new urban functions. The spaces of the station are used by citizens. Travelers' experience the spaces of the station, using services and functions, similar to those of the city. This new concept of station, as urban function, supports the concept that the station must be designed with the function of 'node and site' [32].

In Italy, the two new HSR stations, Mediopadana in Reggio Emilia, in the North, and Naples Afragola, in the Center of Italy, were built outside the city. They have been designed by international archistar. They are the implementation of valuable projects, for which the government and decision-makers have allocated relevant funds.

The stations are strong signs on the territory; visible far away and immediately recognizable. This type of choice testifies to the importance that decision-makers wanted to attribute to these places. These new 'nodes and sites' [32] are the physical and unequivocal demonstration of the superior and decisive role for the future development of the territory.

In recent years, two exemplary railway stations have been built in Italy. These works, designed by international architects, are the sign of a further historical moment that the nation is going through. The HSR station is an opportunity to bring together aesthetic-formal renewal with functional and technological innovation. Urban regeneration is revealed through the spectacularity of a strong architectural project, which combines technical function and formal symbol.

2.2 Attractiveness and Lacks

New HSR stations are catalysts for urban, economic and social development; both regionally and locally. If the station is accessible and is interconnected with other modal networks, it will increase the attractiveness for new projects and urban development [2]. The attractiveness of the territory is not a technical parameter, easy to calculate [33]. Precisely because territories are complex, evolving systems, involved in the transformative dynamics caused by historical-cultural, socio-economic and environmental phenomena, the effects of the inclusion of an extensive project are not certain. "Territorial attractiveness is a complex and multifaceted concept, which lend itself to several interpretations. It can be first intended as 'revealed attractiveness', which is associated with actual incoming flows (investments, workers, talented people, students, etc.) in a geographical area [34]. The existence of these flows reveals its attractiveness" [35].

In China, in order to revive the local economy, it was decided to build the new stations away from the urban center, to encourage the foundation of a new city around the station. The location of the HSR station is part of an industrial political choice, to attract new industries and population. The urban model of the new city, built near a mega infrastructure, determines a new model of development; activates a new supply for the territorial system [21, 24, 36].

In Italy, the economic trend and the urban development in recent years show that the inclusion of a new mega infrastructure can give rise, a new territorial identity, not always compatible, by the territorial systems that gravitate around it.

Territorial dynamics are sets of interconnected processes, which generate new identities, historically drawn from the constitutive characteristics of sites, landscape, historical and cultural resources and housing habits [37, 38]. Dropping an imposing infrastructure by a top-down approach, without using qualitative evaluation techniques, can cause the phenomenon of the 'cathedral in the desert'. The authentic development of the territory is achieved by following the objectives of sustainable development, based on the quality of life and well-being of citizens [39]. Indicators and targets need to be calculated, applying social criteria, in order to combine economic, social and environmental dimensions in a coactive way. The Operational Guidelines for the evaluation of public works of 9 September 2022, assess Social Sustainability. For the first time, it is mandatory to consider the social dimension of infrastructure [40].

The attractiveness of a railway station consists in its ability to attract users, services and investments [41]. In the literature, there is no single definition to describe attractiveness. For example, for the economic sector, it is supply and demand; for urban and regional studies, it is the ability of places to attract. It determines, on the same places, positive or negative impacts. The attractiveness, therefore, can be positive or negative, with respect to the effect that the node generates on sites; it is not a static datum [42].

The attractiveness is positive, if the station becomes a reference node for further investments; if it becomes a place of infrastructural, but also social and receptive connection; if it is a meaningful, vital and welcoming place. If it proposes urban functions for leisure, culture, commercial activities; if it is autonomous in its management, and increases the socio-economic development of the territorial context in which it is inserted. If it is a catalyst for new functions and is able to attract flows of tourists, visitors and inhabitants [43].

The presence of a mega-infrastructure can generate the urban process of territorial regeneration. It is the new supply. The HSR station, if it triggers the factors of positive attractiveness, generates the new model of global development; the influence of the advantages extends to the entire area of gravitation [21].

When the infrastructure generates this kind of integral development, then, the true theoretical concept of urban regeneration is fulfilled. Urban regeneration, in fact, intersects multiple factors. It is not only made up of static or architectural recovery; it is above all economic revival of the territory; it is the enhancement of the social framework; it is the assignment of a new identity, which becomes a driving force for the integral development of the global territorial system [44, 45].

The paper analyzes the cases of the two new stations: the Mediopadana in Emilia Romagna; and the Napoli-Afragola in Campania. The focus on the design and function of the stations pushes towards the goal of an integrated urban plan.

3 The HSR Station Mediopadana

3.1 Characteristics of the Architectural Design and Urban Transformations

The Mediopadana HSR station in Reggio Emilia is the only stop on the Milan-Bologna HSR line, built in 2008. The new railway line, which runs parallel to the A1 motorway, is one of the most popular contemporary architectural projects in Europe.

The station construction starts in 2010 for a total cost of 79 million euros, financed by Italian Ministry of Infrastructure and Transport and by the railway company Ferrovie di Stato. The station was opened in 2013 [46]. Reggio Emilia is a medium-sized city, with about 170,000 inhabitants. It is located along the historic infrastructural axis of the Via Emilia, between Milan and Bologna.

The Mediopadana area is made up of an urban network, densely urbanized and economically very important. The geographical area of the Mediopadana station has an enormous potential for development, with about 2,100,000 inhabitants [47].

The main cities of Parma, Modena, Mantova, Cremona, are among the richest in Italy. The province of Parma has a very strong industrial vocation. It is characterized by a modern agri-food industry (about 35% of the employed people). It produces world-famous excellences, such as Parmigiano and Zibello ham. Modena is considered the world capital of motoring. In the province of Modena, there are: Ferrari, Maserati, Pagani, Bugatti, and a few kilometers away, Lamborghini. Mantova is called the widespread urban museum, also for Sabbioneta: a perfect example of an ideal city; A model of urban planning of the Italian Renaissance. In 2008, UNESCO named the city a World Heritage Site.

The Mediopadana station was designed by the Spanish archistar Santiago Calatrava. It is an impressive architectural sign that testifies to its special function. The station is a steel structure 480 m (m) long, about 20 m high. The structure has a futuristic design. The roof is made up of repeated modules. The image is similar to a moving wave. In fact, depending on the perspective, the optical illusion changes the visual effect of the waves, alternating the static front with the dynamic front. This structure covers the tracks of the HSR line. The building is organized on two levels: the street level, which can be accessed from the outside, has services and commercial activities; the upper level, where are present the tracks. The two levels are connected by two escalators and two panoramic elevators. The Mediopadana HSR station is equipped with ancillary services both for passengers in transit and for those going to the city. It has a direct connection with the local railway lines and with urban and suburban bus lines; taxi; parking; car and bicycle rental areas [46].

3.2 Attractiveness and Lacks Territorial of Mediopadana Station

The Mediopadana area, in particular the one that develops along the Via Emilia, directly connected to the HS station, has experienced high and continuous development in recent years. This demonstrates the positive attractiveness of the HSR station in the adjacent area. The Mediopadana station has determined a strong, specific, attractiveness: it has transformed the territory; has assigned a new regional identity.

The geographical area on which the station is located is a high productive reality, with strong socio-economic relevance. It has accepted the mega infrastructure. The intervention was conceived according a top-down approach, with a successive bottom-up confirmation, and it has been integrated into the territory. Indeed it has become an opportunity for the development of the area. The location of a mega infrastructure in an economically advanced area has activated the process of integral development, enhancing the territorial resources, as well as the typical potential of the territory [48].

Integrated transport connection is considered to be the priority. The strategic location gives the station considerable importance. Its central position, both in relation to the A1 motorway and in relation to the railway network, emphasizes its role as a core for regional, national and international mobility.

The station is not directly connected to the regional railway lines (and this is a limit), but allows to reach Bologna in 20 min (min), Milan in 40 min, Florence in 50 min, Rome in 2 h (h)10 min and Naples in 3h 30min; as shown in Table 1.

The Mediopadana station is an important intermodal hub. The choice of location was decided to allow access to the station from all over the region [49].

The Mediopadana station has increased the accessibility of Reggio Emilia and its territory. The station has transformed the Mediopadana area into a functional region. The functional region is the perspective of the new urban plan. The political will of decision-makers transforms the territory into a smart territory. The strategic plan connects local resources and implements services and functions [50].

In recent years, the urban dynamics of the Emilia Romagna region have been more relevant than in other parts of Italy. Industrial growth has been continuous and has attracted national and international workforces, increasing urbanization. This had positive effects on economic growth, but at the same time has favored the phenomenon of territorial sprawl [51, 52].

The case study above analyzed, demonstrates the essential need to make integrated choices. The choices made with the integrated process planning do not contradict it. They contemplate the sustainable development of territories, they operate by integrating sectors, which of course cannot be ignored [53].

Table 1. The fastest lines connecting Mediopadana station and Napoli-Afragola with the principal Italian HSR stations

HSR Station	Milano	Bologna	Firenze	Roma	Napoli
Mediopadana- Napoli-Afragola	40 m 4 h 03 m	20 m 3 h 10 m	50 m 2 h 27 m	2 h 10 m 54 m	3 h 30 m

4 The HSR Station Napoli Afragola

4.1 Characteristics of the Architectural Design and Urban Transformations

The station of Napoli Afragola, is located along the HSR Roma-Napoli line. The station lies about 1 km from the historical center of Afragola and about 10 km from Naples Central Station (NA). Its location covers the territory located eastern from NA, in which medium and extensive urban settlements are widespread.

The station does not create an alternative pole with NA. It avoids having trains entering and exiting the NA, speeding up the trips along the North-South direction.

The fastest lines allow to reach Rome in 54 min, Florence in 2 h 27 min, Bologna in 3 h 10 min, Mediopadana area in 3 h 46 min, Milan in 4 h 3 min (to run a distance

of 654km), and Reggio Calabria in 4 h 6 min (to run a distance of 334 km); as shown in Table 1.

It is not directly connected with the regional railway lines, but it ensures the rail connection to the Naples Central.

It is considered one of the most important realizations of the European, Scandinavian Mediterranean TEN-T corridor. A first step for speeding up the connection between Rome and the Southern Italy. It has been named the 'gateway to the South': an important interchange node, for access to the Southern Italian regions [20, 54].

The station has a catchment area that includes the metropolitan city of Naples (about 2 million inhabitants), Caserta, Avellino, Benevento, Sannio and Irpinia. The potential inhabitants are estimated in about 3 million.

The territory is densely populated, but the economic context frame is not rich. Italian National Statistics consider the area as a low-income one. There are socio-environmental problems mainly linked to unemployment.

Napoli Afragola station is a strong territorial landmark, like the Mediopadana station. The station was designed by the archistar, Zaha Hadid Mohammad, from Iran. It was built by the Italian railway company Ferrovie di Stato for a total cost of about 60 million euros. The Naples Afragola station was inaugurated in 2017 [55].

The central part of the station is characterized by a large sinuous bridge, about 400 m long. This bridge crosses the railway tracks with an average height of about 9 m. It is organized on 4 levels and it spreads over an area of 30,000 M^2.

It is an exceptional work; it is made with large windows. The roof was made of Corion, an innovative material never used before for the coverage of such a large infrastructure. The curved surfaces are composed by 5,000 M^2 of glass, 5,000 tons of steel, 20,000 M^2 of Corion.

The infrastructure takes care of environmental sustainability: two solar roofs produce 200 megawatts per hour and a range of rainwater harvesting systems.

Services and commercial activities are present in the four levels of the station. The users are mainly long-distance travelers.

4.2 Attractiveness and Lacks Territorial of Station Napoli Afragola

The Naples-Afragola HSR station is an architectural jewel, with a huge potential catchment area, a gateway between Europe and the Southern Italian regions. The infrastructure, however, due to the state of urban decay of the surrounding area, appears to be in conflict with the area [56]. The work has been inserted in an area sadly called 'the land of fires', due to the past events, on the illegal disposal of waste. The station is surrounded by an area with low economic income, with urban and social problems.

The geographical area in which it lies grew in a spontaneous way out of any planned territorial development. The area lacks of urban services and infrastructures. Built settlements have expanded, over time, without adequate strategic smart planning [57].

The location was chosen to create a strategic intermodal node. The project has given the station considerable importance. Unfortunately, at present, the connections are insufficient; therefore, the node does not fully assume the role planned.

At the moment, the station is served only by local public transport with seven bus lines, waiting to complete the Cancello variant and the interconnection with the NA - Baiano of the Circumvesuviana line, the metropolitan railway network.

The station is not integrated with the surrounding area; it has not become a functional site. It remained a top-down, isolated decision, devoid of productive relations and interconnections with the gravitational territory [58].

The allocation of the mega infrastructure, in an economically depressed territory, has not been able to activate, on its own, the process of integrated development of the territory. It has failed to drive the economy; nor to activate processes of urban regeneration. This often happens in economically depressed areas, such as those in Southern Italy. Some similar effects have been evaluated for the case of the intercontinental port of Gioia Tauro and the SEZ [2, 21]. The lack of infrastructure and services does not allow the project to exert a positive attractiveness on the gravitation area [35, 42].

The scarcity of economic activities and the social difficulties in the adjacent area; the missing connections, with incomplete motorway junctions and insufficient public transport are the main causes why the station is unable to give the expected boost to the territory. A highly urbanized territory, with considerable potential for development due to the satisfy the mobility needs of a high number of travelers, appears scarcely used because, in reality, it is not adequately connected [59].

It was estimated to be a node of international trade; connection between the south, Italy and Europe. Unfortunately, it lacks of important parts. The station alone cannot activate the positive propulsion necessary for the increase of development.

5 Conclusions

From the comparison between the Mediopana high-speed rail stations of Reggio Emilia and Naples Afragola, it is possible to understand what are the elements that can determine the positive attractiveness of a mega infrastructure.

Both stations are designed by two famous archistar, who have created a modern and international image; they have combined aesthetic form, with function and technological innovation. The two infrastructures, although having the same objectives, did not produce the same effects. An important railway node, located in two territorial contexts with different characteristics, has generated different effects.

The first station is located in the North of Italy; in one of the richest regions, with an elitarian industrial and business system, appreciated in the world. The second station is located in the South of Italy; in an economically depressed territorial context; densely populated, lacking in services and infrastructure, unplanned.

A further consideration derives from the analysis of the typology of travelers [60]. In fact, travelers from the Mediopadana are mainly workers who have to reach the richest cities of the country. This data is interesting, because it gives to Mediopadana an important role on the regional scale; it offers a service to users on business trips. The Naples Afragola station is mainly used by travelers who need to reach cities outside the regional area.

Further factors implementing the positive attractiveness are the presence of land available to increase the already active process of urban regeneration. The presence of

parallel motorway junctions is also an attractive factor. In fact, the growth stimuli are stronger, when the motorway connection is integrated with a high-speed rail station [14]. The location of the HSR is a factor of activation of the true urban regeneration and integrated development of the territory, if the characterizing systems are interconnected; if there are functional connections to business centers, strategic centers, universities or other gravitation nodes [61].

In summary, the elements that generate the positive attractiveness of the infrastructure are: accessibility on a regional scale and interconnection with the territory; intermodal interchange hub; connections with infrastructures; facility of services; the pre-sence of urban regeneration projects; the presence of a productive and proactive socio-economic background.

All the elements combined together generate the ideal characteristics to make HSR an opportunity for innovation and sustainable development, an activating and implementing node of the urban regeneration process [62, 63].

The HSR station, if included in a strategic and integrated urban plan, stimulates local economic growth. The new conceptual approach integrates urban planning choices with the transport infrastructure system; therefore, it pushes towards technological innovation and transforms territories into smart. Urban regeneration interventions, with an integrated vision of the future, apply the categories of the smart city and achieve the objectives of sustainable development [11, 64]. Urban regeneration is essential to increase the quality of life of citizens [13, 39]. Moreover, if implemented with the principles of integrated urban planning, it will transform territories into smart and sustainable systems.

Territorial deficits can be solved with urban rebalancing actions. The integrated balance between quantitative and qualitative data makes it possible to create new models of urban development, for new territorial systems, such as those generated by the presence of a mega infrastructure.

The new supply of the high-speed station requires a new territorial model. Integrated urban model, for the new territory that increases around an important infrastructural node. The academic debate and project action are still divergent and fragmented, in providing the right knowledge to apply an integrated urban model [24] although the integration of spatial planning with transport planning is considered essential [19]. The planners must decide in an integrated way and take action in a current time, to resolve the needs that arise, against the predictions defined by the inactive sector plans.

The research supports this new conceptual approach, which is also coherent with the EU guidelines on qualitative indicators of well-being and smartness. The research focused on the integrating urban process planning with transport planning, but it cannot propose a model to be replicated, in the same way everywhere. The two case studies analyzed, and chosen for their contrasting location, support the conclusions.

Acknowledgements. "This study was carried out within the MOST – Sustainable Mobility National Research Center and received funding from the European Union Next-Generation EU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4 – D.D. 1033 17/06/2022, CN00000023). This manuscript reflects only the authors' views and opinions, neither the European Union nor the European Commission can be considered responsible for them."

References

1. Albanese, G.: Il territorio dell'urbanistica. Gangemi Editore, Roma, Italia (1999)
2. Russo, F., Rindone, C., Panuccio, P.: Structural factors for a third-generation port: between hinterland regeneration and smart town in Gioia Tauro. Urban and Maritime Transport XXVII, 204, 43, ISSN 1743–3509 (2021)
3. Italian Government: Law of 3 August 2017. http://www.parlamento.it/leggi/htm
4. European Commission Recommendation 2023/550 of 8 March 2023 on National Support Programmes for Sustainable Urban Mobility Planning. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023H0550. Accessed 12 Jan 2024
5. Salzano, E.: Fondamenti di Urbanistica, Laterza, Bari, Italia (1998)
6. Allmendinger, P.: Planning theory, 2nd edn. Palgrave and Macmillan, Basingstoke, UK (2009)
7. Benevolo, L.: Il Tracollo Dell'urbanistica Italiana, Editori Laterza, Bari, Italia (2012)
8. Faludi, A.: A decision-centred view of environmental planning. Pergamon Press, Oxford, UK (1987)
9. Hollands, R.G.: Will the real smart city please stand up? City **12**, 303–320 (2008)
10. European Commission 2012. Communication from the Commission Smart Cities and Communities. European Innovation Partnership. https://digital-strategy.ec.europa.eu/en/library/smart-cities-and-communities-european-innovation-partnership-communication-commission-c2012-4701. Accessed 12 Jan 2024
11. Sustainable Development Goals 2030. https://sustainabledevelopment.un.org. Accessed 12 Jan 2024
12. Sachs, J.D.: Il bene comune: economia per un pianeta affollato, Mondadori, Italia (2010)
13. European Commission 2023. Sustainable Urban Development. Cities forum. https://ec.europa.eu/regional_policy/policy/themes/urban-development_en. Accessed 12 Jan 2024
14. Russo, F.: Which high-speed rail? LARG approach between plan and design. Future Transp. **2021**(1), 202–226 (2021). https://doi.org/10.3390/futuretransp1020013
15. Russo, F., Sgro, D., Musolino, G.: Sustainable development of railway corridors: methods and models for high speed rail (HSR) Demand Analysis. In: Gervasi, O., et al. (eds.) Computational Science and Its Applications – ICCSA 2023 Workshops: Athens, Greece, July 3–6, 2023, Proceedings, Part VII, pp. 527–538. Springer Nature Switzerland, Cham (2023). https://doi.org/10.1007/978-3-031-37123-3_36
16. Di Gangi, M., Russo, F.: Design of hybrid rail services on conventional and high-speed lines. Int. J. Transp. Develop. Integrat. (2023)
17. Givoni, M., Banister, D.: Moving towards low carbon mobility elgaronline, social and political science, p. 304 (2013). https://doi.org/10.4337/9781781007235
18. Hull, A.: Policy integration: What will it take to achieve more sustainable transport solutions in cities? Transp. Policy **15**(2), 94–103 (2008). https://doi.org/10.1016/j.tranpol.2007.10.004
19. Russo, F., Musolino, G.: Methodologies for sustainable development of TEN-T/RFC corridors and core ports: economic impacts generated in port-related areas. In: International Conference on Computational Science and Its Applications, pp. 515–526 (2023)
20. Hall, P.: Magic carpets and seamless webs: opportunities and constraints for high-speed trains in Europe. Built Environ. **35**, 59–69 (2009)
21. Russo, F., Panuccio, P., Rindone, C.: External interactions for a third-generation port: from urban sustainable planning to research developments. WIT Int. J. Transp. Dev. Integr. **6**(3), 253–270 (2022). https://doi.org/10.2495/EI-V6-N3-253-270
22. Panuccio, P.: Smart planning: from city to territorial system. MDPI Sustain. **11**(24), 7184 (2019). https://doi.org/10.3390/su11247184
23. Benevolo, L.: Le origini dell'urbanistica moderna. Universale Laterza, Bari, Italia (1989)

24. Russo, F., Rindone, C., Panuccio, P.: European plans for the smart city: From theories and rules to logistics test case. Eur. Plan. Stud. **24**(9), 1709–1726 (2016)
25. Musolino, G., Cartisano, A., Fortugno, G.: Methodologies for sustainable development of TEN-T/RFC corridors and core ports: estimation of time-series economic impact. In: International Conference on Computational Science and Its Applications, pp. 551–562 (2023)
26. Russo, F, Pellicanò, D.S.: Methodologies for sustainable development of TEN-T/RFC corridors and core ports: the role of governance in the export time optimization. In: International Conference on Computational Science and Its Applications, pp. 622–634 (2023)
27. Russo, F., Chilà, G., Zito, C.: Methodologies for sustainable development of TEN-T/rfc corridors and core ports: settlement capacity of industrial firms in port related areas. In: International Conference on Computational Science and Its Applications, pp. 539–550 (2023)
28. Moccia, F.D.: Stazioni e città nella prospettiva ecologica. Inconsapevoli precursori. Urbanistica **LXIII**, 145, 64–76 ISSN 0042-1022 (2011)
29. Mulders-Kusumo C.: Is a Railway station a Central Urban place? Spatial configuration study of retail distribution pattern around Railway Stations. In: 5th International Space Syntax Symposium, pp. 201–10 (2005)
30. Dragan, W.: Development of the urban space surrounding selected railway stations in Poland. Environ. Socio-Econ. Stud. **5**(4), 57–65 (2017)
31. Castaldo, A.G., Di Martino, F., Cardone, B., Moccia, F.D.: Italian high-speed railway stations and the attractivity index: the downscaling potential to implement coworking as service in station. Appl. Spatial Analysis **15**, 1369–1386 (2022). https://doi.org/10.1007/s12061-022-09457-z
32. Bertolini, L., Pasquier, F.: Des gares en transformation. Nœuds de réseaux et lieux dans la ville. Les annales de la recherche urbaine **71**(1), 86–89 (1996)
33. Lee, K.: The conceptualization of country attractiveness: a review of research. Int. Rev. Adm. Sci. **82**(4), 807–826 (2016)
34. Dubini, P.: L'attrattività del sistema Paese. Territori, settori, paese. Il Sole 24 Ore (2006)
35. Musolino, D.A., Panuccio, P.: Special economic zones planning for sustainable ports: the test case of territorial attractiveness and urban planning in calabria region. In: Gervasi, O., Murgante, B., Misra, S., Rocha, A.M.A.C., Garau, C. (eds.) Computational Science and Its Applications – ICCSA 2022 Workshops. LNCS, vol. 13381, pp. 72–84 (2022). https://doi.org/10.1007/978-3-031-10548-7_6. ISBN 978–3–031–10547–0
36. Lu, H., Jong, M.D., Heuvelhof, E.F.: Explaining the variety in smart eco city development in China – what policy network theory can teach us about overcoming barriers in implementation? J. Clean. Product. **196**, 135 e 149 (2018)
37. Panuccio, P.: Urbanistica e Paesaggio, p. 160. Gangemi Editore, Roma, Italia (2007)
38. EU Consiglio d'Europa, Guidelines for the implementation on the European Landscape Convention, 6.02.2008 (2008). http://www.coe.int/t/dg4/cultureheritage/heritage/Landscape
39. European Commission 2019. Green Deal European (2019). https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0006.02/DOC_1&format=PDF
40. Ministero delle Infrastrutture e della Mobilità Sostenibili. Linee Guida Operative per la valutazione delle opere pubbliche infrastrutture. Struttura Tecnica Missione per l'indirizzo strategico, lo sviluppo delle infrastrutture (STM) (2022)
41. Musolino, D., Meester, W.J., Pellenbarg, P.H.: Stated locational preferences of Italian entrepreneurs: The underlying location factors. Reg. Sci. Policy Pract. 18 November (2021)
42. Servillo, L., Atkinson, R., Russo, A.P.: Territorial attractiveness in EU urban and spatial policy: a critical review and future research agenda. Europ. Urban Region. Stud. **19**(4), 349–365 (2012)
43. Ingallina P.: Le Projet Urbain, Une Notion Floue. Que Sais-Je? **3**(3585), 7–13 (2008)

44. Friedmann, J.: Planning theory revisited. Eur. Plan. Stud. **6**(3), 245–253 (1998). https://doi.org/10.1080/09654319808720459
45. Schilling, J., Mallach, A.: Cities in transition, vol. 56(4). American Planning Association (2012)
46. Stazione AV Mediopadana Reggio Emilia. https://www.fsitaliane.it/content/fsitaliane/it/innovazione/tecnologie-per-i-trasporti/le-principali-stazioni-av/reggio-emilia-av-mediopadana.html
47. Brouwer, A.E., Mariotti, I., van Ommeren, J.N.: The firm relocation decision: an empirical investigation. Ann. Reg. Sci. **38**(2), 335–347 (2004)
48. Camagni, R.: Principi di economia urbana e territoriale, pp. 17–155. Roma, Carocci editore (1993)
49. Pol, P.M.J.: The economic impact of the high-speed train on urban regions. European regional science association econpapers (2003). http://www.ersa.org
50. Piano Urbano Mobilità Sostenibile Bologna Metropolitana ad altra velocità. PUMsBO. pumsbologna.it/consulta_il_piano/documenti (2019)
51. Hall, P.G.: Urban and regional planning, 4th edn. Routledge, London (2002)
52. EEA. Urban sprawl in Europe – The ignored challenge. EEA Report No.10/2006, European Environment Agency, Copenhagen (2006)
53. Bisello, A., Vettorato, D., Laconte, P., Costa, S.: Smart and Sustainable Planning for Cities and Regions. SSPCR. Springer, Bolzano, Italy (2017)
54. EU 2010. Decision No 661/ 2010/EU of the European Parliament and of the Council of 7 July 2010 on union guidelines for the development of the trans-European transport network. Off. J. Eur. Union L.204, 5.8.2010 (2010)
55. Domus Stazione Napoli Afragola 12giugno 2017. https://www.domusweb.it/it/architettura/2017/06/12/stazione_napoli_afragola.html
56. Gottmann, J.: Megalopoli, funzioni e relazioni di una pluricittà. Einaudi, Torino, Italia (1970)
57. Mitchell. W.J.: Smart cities: vision. Retrieved October 2014. https://www.smartcities.media.mit.edu/frameset.html
58. Kuhn, D.: A developmental model of critical thinking. Educ. Res. **28**, 16–25 (1999)
59. Vitetta, A.: Sustainable mobility as a service: framework and transport system models. Information **13**(7), 346 (2022)
60. Rindone, C., Panuccio, P., Sgro, D.: Methodologies for sustainable development of TEN-T/RFC corridors and core ports: workers mobility between urban and port-related areas. In: International Conference on Computational Science and Its Applications, pp. 608–621 (2023)
61. Rindone, C., Russo, A.: A network analysis for High Speed Rail services in the South of Italy. (submitted to) International Conference on Computational Science and Its Applications-ICCSA 2024
62. Russo, F., Sgro, D., Musolino, G.: Dynamic structure of fares for High Speed Rail services. (submitted to) International Conference on Computational Science and Its Applications-ICCSA 2024
63. Russo, F., Moschella, M., Musolino, G.: Railway demand evaluation: HSR induced component. (submitted to) International Conference on Computational Science and Its Applications-ICCSA 2024
64. Giffinger, R., Fertner, C., Kramar, H., Meijers, E., Pichler-Milanovic, N.: Smart Cities Ranking of European Medium-Sized Cities; Centre of Regional Science. Vienna University of Technology, Vienna, Austria (2007). http://www.smart-cities.eu/download/smart_cities_final_report.pdf. Accessed 12 Jan 2024