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Systems integration capabilities in public organizations: a study in the transport sector

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Systems Integration Capabilities in Public Organisations: a study in the Transport Sector.

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Abstract. This paper assesses how strategic innovation management studies applied in transport and mobility infrastructure projects can impact sustainable and economic growth in under-analysed local areas. To this objective, the system integration theory has been used as theoretical lens. This framework has been applied to analyse a case study in the Public sector, highlighting how systems integration capabilities represent a new opportunities for smart transformation locally. The enquiry has found system integration capabilities in the public sector and performance measurement in a long-term view as two main assumptions implying a real change. By putting together these conditions, the paper's main contributions point to refining the different actor's roles. The well-coordinated Strategic, Technical-Tactic, and Operational levels are proposed as crucial toward any realistic smart locality evolution.

Keywords: public transport, smart transport, systems integration, digitalisation, sustainability transition, Public-Private Partnership

1 Introduction

Humans interacting with and within the geographical space generate webs of relations triggering a constant adaptive mechanism that physically makes the territory a social construction, defined as a socio-territorial system [1]. Simultaneously, time determines continuous shifts, generating evolutions known as transitions led by technological differentiation over time [2]. Resulting complex socio-technical systems follow development trajectories and dynamic non-linear patterns in a time frame and space-related view functioning as backgrounds in everyday life. The transportation infrastructure is not an exception [3].

In this sector, theory highlights the need to re-adequate aged practices because of their crucial role in the sustainable liveability of places [4]. By nature, wherever-based processes in public transport, urban and suburban networking, and mobility services follow a lifecycle process that allows changes to happen. After structural stagnation and

inertia, a system re-adaptation phase is possible through new aspects and actors emerging, and this mainly happens at a small-scale level. Hence, as Bolton et al. [5] show, reconfigurations and new development patterns potentially start locally, expanding and finding stability later at the regional and national levels.

Since any development inevitably has a systemic nature, trans-disciplinarity, interrelations, and inter-dependencies between things, people, and processes must be optimised at the considered scale to allow any change [6]. When seeking efficient solutions in integrating planning, the literature finds the public authority as the right to act as a system integrator through dynamic capabilities [7] and is the key actor in engaging private stakeholders and citizens toward smarter municipality systems like the transportation one [8]. However, in many cases, integrated systems attempting to optimise the interchange between privately and publicly operated services have demonstrated low efficiency in coordinating multiple transport modes with information leakages and disruption risks, thus demonstrating the need to revise roles [9].

Moving from the limitations that emerged in applying the System Integration (SI) theory to this interplay, the Public-Private Partnership (PPP) is reconsidered as a valuable tool considering the present policy trends and the increasing deregulation and privatisation in the transportation sector [10–14]. As legally defined, PPP is the agreement between public and private entities to provide a public asset or service in the long run. While the private part assumes management responsibility and invests resources and expertise, the public can focus on regulation and planning by delegating daily operations [15–18].

Departing from the innovation strategy concept, we investigate the strategic challenges of the transportation sector in reframing these roles with an attentive eye on local areas and related actors involved. We will pay specific attention to networks and connections in this transformative system toward innovation, keeping the public administrator's figure as formally central but further clarifying its interface with the many private actors. Notwithstanding the public integrator’s confirmed value, we will demonstrate and account for the importance of the many small and medium companies in contexts like the Abruzzo region's transportation system, where they demonstrate to be crucial in territorial-based transportation history. These role analyses will give a more realistic vision of a smart local evolution.

Hence, the overall research question is the following: "how do transport and mobility infrastructure settings impact urban and suburban localities in terms of sustainable and economic growth by establishing PPPs as the main tool?". One objective and two sub-objectives will help organise the inquiry and achieve related results. The main one intends to assess the Strategic Innovation studies application in the local public transportation articulated through the PPP tool in the under-analysed selected limited areas. The two sub-objectives will first revise the delay in time and inhomogeneity in space when applying the PPP for local transports and, right after, the performance measurement for PPPs used in the brownfield environment.

The main findings introduce and reframe the technical tactic level as essential for a renewed PPP governance model where the meaning of 'Smart Localities' concretely makes minor areas liveable on environmental protection, social inclusiveness, and economic resilience.

2 Theoretical Background

2.1 Strategic innovation in public transport

Strategy and innovation studies have variously intersected with local mobility and sustainable growth. Strategic innovation is defined as an organisation's process where the internal strategy is redesigned at various levels, aiming at business survival and growth through sustainable value and competitive advantage creation [19]. Different authors have deepened into certain aspects of the subject building the literature over the years. In defining the innovation concept, most seemed to underline the constant human tendency to look for different and better ways of doing things naturally [20]. According to Schumpeter's vision in the early 1900, the individual entrepreneur manages the existing resources at this scope, thus being a central figure fighting the inherent resistance to what is different from usual or the system's social inertia [21].

Following Pavitt's taxonomy, innovations in the transportation field involve small and medium enterprises, modify the organisational model, leverage both qualitative and quantitative performance, and count on financers and users to cooperate for change [22]. On this line, innovating can become strategic depending on the individual company's position and performance. Quoting Porter [23], this conduct is defined either on offer variety, demand needs, practical access, or on a mix of these, and it can get different results when deepening into a specific sector and its possible trajectories.

Readapting this author's discussion, firms in the local public transportation field can position themselves differently [23]. On the variety-based positioning, one vector's offer differs from the others on the differentiated set of activities practised to provide the mobility service, thus defining how much value is created for the passenger and the local area. On the needs-based positioning, the service provider aims at the best set of activities to better target wider customer segments and what they are looking for, thus triggering uniqueness in responding to the demand. Finally, the transportation companies can differentiate on the access-based positioning depending on the concrete approachability of customer segments per area. Porter [23] discerns among rural versus urban-based passengers, small rather than large market share, or sparsely rather than densely situated users. The service supplier's strategic positioning will change accordingly, thus the meaning of being strategically innovative.

Past research also confirms that transportation infrastructures are among those socio-technical systems generally following a lifecycle process of change over time. Their readaptation phase is usually facilitated at the small-scale level before being expanded and stabilised at the regional and national levels [24, 25]. The space factor confirms to be important besides the timing to define strategic and innovative configurations in such a complex sector. Hence, since strategic positioning is more spatial-dependent in this primary service sector than in others, innovating as a learning process is inevitably linked to specific contexts and local actors [20, 26]. As a result, specialised private companies uniquely create value through complementary assets and tacit knowledge profiting from technology innovation [27], but also through renewed goals and ways of acting required to survive and grow on contextualization and adaptability [28].

Economic geographers' findings confirm that no innovation process can happen with a firm of whatever size isolated because it inevitably depends on extensive interactions with the related environment [20]. Thus, innovative practices can assume a strategic

meaning only when there are network links to trigger, foster, and sustain this development, inevitably also built on cross-sectoral interactions and generating value creation. As a case in point, the PPP is an expression of a collaborative model made effective only through a real mission-oriented and transformative roleplay among the parts [28]. While it has been rediscovered as a good blend approach for reaching strategy and innovation altogether, it still has to be scaled to achieve global progress in post-pandemic recovery through more inclusive economic growth. The main idea is that these partnerships, widely linked at different levels, can make the public sector's foundational capital and revival funds concrete build-forward supports for the private sector innovation initiatives[29]. Policy alone is likely to fail as much as a brilliant new idea with no capital access or no context prone to realisation [30].

At the communitarian level, the Next Generation EU plan reframes the importance of PPPs as important tools to implement investments and services quicker, overcoming bureaucratic limitations and conflictual interests toward the common objectives defined after Covid-19 [31]. On the same logic, the National Recovery and Resilience Plan PNRR find the resolutive approach in such a collaborative model to stimulate market incentives, join private and public value, and concretise long-term changes in Italy [32]. However, the latest studies show that more successful partnerships can only happen if the public side comes to have a renewed and reframed role [29].

Therefore, following experts' theories, policymakers must rethink the strategic link with business leaders. The current changed world suggests good opportunities to act in this way since there are common interests to balance for a more sustainable, resilient, and inclusive context to live in [29]. On this logic, we will focus on the public sector role and consequent public value generated with a more attentive eye on redesigning the co-evolutive background and mutual public-private contribution.

2.2 The PPP model in local areas' mobility

Different examples in the literature illustrate PPP as a facilitator for strategically innovative outcomes in public mobility before and after the pandemic. Historically, this kind of project delivery method has evident applications in the transport sector as critical for a nation's growth [17]. For example, toll bridges, highways and railways projects dating back to the late 1700 in the UK and US joined private parties' assets with public actor's ownership through agreements from the building phase to the concession to operate, thus fostering technological accumulation and industrial growth [33]. Over the years, individual states' different approaches to insourcing and outsourcing dynamics have focused the use of this tool on operating, maintaining, or managing existing transport infrastructure facilities effectively. In many cases, its role has revealed issues related to conflictual interests, regulation of competition, allocation of revenues, and social tariff applications [15, 16].

However, the latest trends register a substantial change in this approach's related motivation, legislation, and application that triggers from rethinking the state's role until now under-considered in collaboration with businesses [29]. PPP has been then rediscovered as valuable in solving the short-termism in the government's behaviour. With the state tending to serve priorities with immediately visible results to gain electors' support, industries could instead assume the burden of long-term infrastructure quality service, renewal and maintenance in exchange for later profits. While this

generates a good compromise to secure the final objective, it still results in complex private-public parties' contracts, sometimes needing renegotiations and adjustments [34]. Many examples relate to the infrastructure and transportation field, where the innovation risk and the 'high costs but low benefits' trade-offs are naturally inherent [18].

Since PPP aims to serve the public with the best possible outcome, its mechanism has necessarily changed in the present times, coherently with a fast-changing world. Today, it is anachronistic to define the private partner as the one upfronting the costs of a public project to fund in exchange for a later stage revenue over time [34]. The World Economic Forum suggest that it is probably the other way around. In most cases, the public sector provides the foundational capital supporting private companies' initiatives [30], thus promoting a different type of growth and stimulating research and innovation. Attracting investment, driving development, and reshaping new sustainable objectives in every relevant field are part of the various institutional levels' agendas forecasting the after Covid-19 recovery and the UK's [35], the Communitarian's [31], and the National's plans [36] are some examples. References to the transportation sector are equally present to confirm this matter's relevance to reaching new objectives. The main idea of building resilience on partnerships is also shared to the point that entire sections mention the renewed value of this tool.

Past research demonstrated that the system integrator corresponds to the capable owner, i.e. a public organisation with the right dynamic capabilities to lead in the PPPs [7]. Public and private actors concretely participate in this view's operational side when integrative knowledge transferring and co-evolutive dynamics are built. This approach potentially makes the most from private organisations' complementary assets, tacit knowledge, learning trajectories, and innovation initiatives [7]. Hence, both a re-imagined state's role and a re-theorised way of involving the private sector are equally fundamental to building concrete know-how [29].

At this scope, there is the impellent need to go beyond the integrator's management that embraces diversity and strengthens relationships among the single actors' contributions to operating the service in the project ecology [11, 37]. Inevitably, a re-evaluated version of the PPP governance setting requires a more comprehensive 360° technical engagement of the parts and a new balance to build on knowledge [28].

Not by chance, the geographically-based relationships are among the spatial-dependent factors that cannot be ignored [38]. These studies about local areas' mechanisms confirmed that informal personal ties are more cohesive and influential in small contexts' processes, like in the considered towns and suburbs. On the good side, personally shared information can here compensate for professional shortcomings in organisations or firms and overcome major boundaries like bureaucracy. The so-called 'communities of practice' can reduce transaction costs, facilitate access to social capital, build trustworthy relations, feed tacit knowledge, and ease fluid, interactive learning locally. On the flip side of the coin, concrete practices weigh the influence of personal interests against the common good. Traces of misbehaviour, unfair competition, and biases in informal interpersonal networks can negatively influence projects locally, thus diminishing the PPP's effectiveness towards the objective [38]. Enablers to enhance transparency and process fluidity are desirable in mitigating these aspects.

On this line, past research has cited digital transformation as a valid enabler maximising performance and value creation, plus creating a positive evolutionary path. If well managed on equally distributed public sector investment initiatives and tailored to

the context's needs, technological tools facilitate more coherent, adaptable, and reliable complex infrastructure projects in transport and mobility with the ambition to innovate [29]. Economic growth would result in its more modern version: smart, inclusive, and sustainable, improving today's minor areas' liveability [7].

3 Methodology

The present research is led by qualitative analysis in the willingness to achieve the objective and provide relevant outputs. In designing this qualitative study, logically related steps have been followed, always believing there is no fixed cause-effect relationship because multiple perspectives need equal attention for rigour [39]. The research design hereunder illustrated will have specific purposes: exploratory and evaluative [40]. It is safe to say that certain flexibility is required to explore the topics of interest since concepts considered foundational and taken from past research, like system integration, are ongoing studies in constant evolution.

This analysis focuses on the In-House Providing system case, realised in the Italian Abruzzo region's transportation field. The data has been collected in multiple ways, allowing for data-triangulation. The research has been physically led in situ in a 90 days-frame. Therefore, direct observation is methodologically followed. Moreover, thanks to online events, regional campaigns, and e-conferences about sustainable transport in this region and the central part of Italy, information and interest in the topic were fertile ground to hear relevant voices. The authors have constructed a large dataset of documental data. Finally, the authors conducted semi-structured interviews with people involved in the field.

About the interviews, it is worth underlining their concrete supportive role in the case study methodology, according to Yin [40]. The verbal reports have been purposively chosen to be semi-structured, using open-ended questions to build consistent and valuable discussions. Three sets of questions have been prepared and adapted to each contributor's specialisation field to better investigate the matter. Additional details are available upon request. In half an hour each window, the researcher briefly presented the research project to the interviewee and asked for theoretical and practical insights as contributions, hence opening up constructive information exchange. Each online meeting was scheduled after a first contact via institutional email, where consent forms and participant information were attached, assuring ethical conduct.

The interviews were conducted via video and phone calls with hands-on figures in strategic innovation, regional systems, alternative mobility studies, and Abruzzo regional department for infrastructure and transport. Among a not-so-numerous local population and dozens of requests sent via email, 7 were the responsive key informants on this occasion. A summary is reported in table 1. Some were directly involved in the case study analysed as private or public companies' managers or important stakeholders, while other interviewees were selected for their expertise on the topic (e.g., university professors). The Q&A discussions have been purposively scheduled to be done in the middle inquiry phase when the literature review and research background were already clearly analysed, and the case study was a work in progress. Hence, this approach and its timing have revealed crucial steps to gather data and gain findings. Given these procedures, the case study as a form of empirical inquiry is followed.

Great efforts have also been put in to avoid bias while still being sympathetic, even though the interviewer is an insider and a resident in the selected area. An iterative process, adjusting the case study investigation and reviewing additional literature, has been constructed around the interviews' insights.

Table 1. Summary of Interviews

	Interviewees	Role	Institution	Date	Length
Qualitative Interviews - Theory Focused					
1	Della Porta Armando	University professor	University G.d'Annunzio	07/10/2021	45'
2	D'Ovidio Gino	University professor	University of L'Aquila	27/07/2021	30'
3	Ponti Marco	University professor	Politecnico di Milano	18/10/2021	30'
4	Primavera Emidio	Infrastr & Transport Director	Abruzzo Region	06/08/2021	30'
Qualitative Interviews - Practice Focused					
5	Civitarese Nicola	Owner & Entrepreneur	Civitarese Viaggi S.r.l.	08/02/2022	45'
6	Emanuela Di Luca	Manager	Polo INOLTRA	26/05/2022	30'
7	Triozzi Lucio	Manager	Abruzzo Region	9/05/2022	30'

3.1 The empirical context

This research analysed the case of the In-House Providing system, realised in the Italian Abruzzo region's transportation field. The geological complex setting of the Abruzzo region has, over time, determined specific socio-demographical characteristics. Besides the coastal more developed areas, there are wide mountainous zones with hard accessibility for morphological reasons and spread conurbations with resource dispersion. 82% of the total urban agglomerations are small municipalities with less than 5'000 inhabitants per each, characterized by depopulation, underserving conditions, slow growth tendency, and productivity polarisation [41]. Multiple areas suffering low efficiency in services impact the regional results and have brought a vicious cycle in the past, neither repopulating nor attracting enough investments for improvement [42, 43]. Nevertheless, Abruzzo is now the top among the southern Italian regions for introducing product and process improvement technologies since 2019, enhancing productivity performance through building new connections among local enterprises, universities, and study centres for R&D. Increasing start-up and entrepreneurs networking are good practices in place to build on [41].

New chances to remedy past deadlocks are desirable through the post-pandemic PNRR, which allocates significant resources to the 'Mezzogiorno' (i.e. South Italy)

area, opening the opportunity to realise projects. Alongside, there are the Piano Sud 2030 and the Fondo Sviluppo e Coesione 2021-2027 for further economic support and the Accordo di Partenariato 2021-2027 for a renewed governance vision. The latter, namely as a partnership agreement, represents a big managerial toolkit behind sustainable development through funding integration in the Abruzzo Prossimo report [41], and we will here refer to it as a guideline. According to what was stated, the regional administration will have a strategic role in guaranteeing programmatic coherency and realising any projects. At the same time, the individual entrepreneur's initiative is crucial in grasping opportunities for innovation and investing in the post-pandemic reality. The whole new vision cannot disregard deregulation, privatisation, downsizing, and differentiation trends either, increasing the market complexity and requiring a more specific redefinition of roles in leading any change.

Assuming a modern collaborative mentality based on evolutionary dynamics, bottom-up and top-down approaches in the transportation sector need rebalancing. Also, the system integration concept must be refined on the development and cohesion politics seen through the new Partnership Agreement. The significant opportunities opened up by these latest guidelines are such in evident contrast with the brownfield reality that the need to find a relevant synthesis is now exacerbated.

4 Findings and discussion

4.1 Case Study: The In-House Providing solution

The European Community defines the In-House Providing activity as managing a public service through the controlling public authority [44]. Exploring the balance between public and private ownership in the Abruzzo region transportation sector, the agreement between the TUA S.p.A. company and the private satellite ones serves as a great example. Through the contract with the regional authority in 2017 and being under its control, this company had assigned 65% mileage of the total on the public funds' contribution aiming to keep a reasonable offer in serving the many local weak demand areas. The intent was to act a better supply efficiency and coverage than the private companies operating in the remaining 35% of the open market, thus having the public administration as first responsible for the overall outputs in mobility. The new model on this logic was developed under a revisited idea of public services management specially applied to the public transport system because of its peculiar nature, according to the communitarian regulation CE n.1370/2007. Indeed, unlike other public infrastructure systems, the transportation sector is less characterised by homogeneity in the application area and more in need of tailored by case modular and intermodal solutions per area to respond to passengers' requests and territorial cohesion. However, as Pellingra Contino [44] summarised by studying the Italian setting, the public enterprise has demonstrated the need to be in a competitive market to be efficient as expected in providing a public service like transportation. Even though the public power regulates the purposes of general interest in this sector, still, its management can be handed over in some cases to professionals if the expected goals to reach, the service supply continuity and economic efficiency are ensured. As applied in the Abruzzo region, this deliberation was founded on the European Community's directives about 'transport

enterprises assuming the service duties' on the public owner's behalf, the first of which was published in 1969.

On this logic, 5% of the services entrusted to TUA S.p.A. were posed in 2017 under a tendering procedure on the same CE n.1370/2007 by paying the local private companies one euro per kilometre serviced as a cheaper solution than operating by itself, with its buses and resources. Hence, saving a public money contribution surplus from the European Community on these daily routes, the intention was to reinvest in quantity and quality: more routes for capillary and better services were expected results [45]. However, over time, the limitations appeared evident on two sides: the public not properly reinvesting the money saved for better transport, and the private one still receiving the compensation per kilometre regardless of the service operated and related quality in practice. Moreover, the National Governmental Fund stopped assigning extra kilometres to implement regional services, thus causing a system development interdiction.

The formal act of concession later extended the validity of this procedure to 10 years, and the last agreement among TUA S.p.A. and the involved small-medium private companies is still valid for the years 2018 - 2027 as regulated by the regional council in the latest published DPE and DGR in March and April 2022 [46]. The actual functioning and results of this PPP attempt in the transportation field have been illustrated by directly involved figures.

4.2 Innovation Strategy through System Integration

The System Integration approach applied to the local transportation sphere has, until now, failed to solve the delay in time characterising the realisation of new initiatives from the moment of theorising them. As a case in point, many theories in the Abruzzo mobility system are still good unrealised ideas in the action plans of temporary political administrations, like the Programmatic tool 2021-2027. The clue timing to put them in practice would be the here-and-now availability of National and Communitarian funds and the renewed Global attention toward SDGs goals, with the transport and mobility revolution as a transversal social priority [47].

Shifting from timing to space relevancy, balance is also needed between two sides of the same coin: the depopulated and low-demand areas, where big services improvements seem not to be worth it, and the concrete locals' needs in these underserved areas, with consequent impact on exacerbating inequalities and impacting on the environment in the commuting routine [41]. For example, considering the town of Ortona and its surrounding villages, private cars are routinely used when different users' priorities do not coincide with scheduled buses and trains [48]. Even in such a small centre, the impact on congestion and carbon emissions during peak hours is noteworthy [43], and spatial-dependent initiatives to solve the issue are desirable.

Matching good timing with good context-based solutions and compromising between multi-level directions lowered from the institutional side and needs emerging from the common practices, we can now strategically and innovatively revise System Integration for the local mobility system improvement. On one side, geographical studies related to territorial development and governance practices have demonstrated the bottom-up approach as the more passenger-centred attentive dimension through which any development project is more resilient over time and socially acceptable [49]. On

the other hand, this public-centred vision appears to have a structural limit when applied to the transportation system through the lens of a strategic managerial perspective (Interviews n.1 and 2), and worldwide examples in mobility demonstrate a top-down competent decision-making pool as the innovative solution. In these cases, wider and smaller areas' interventions in the UK, Austria, Germany, and Switzerland are good practices with behind-the-scenes technical competency, transport planning discipline for concrete plans, and programmatic planning to base any decision (Interview n.1). Any political wing and related interests tend to be excluded from decision mechanisms related to departmental subject matters, like transport, and any form of sovereignty is handed over to a concrete network of people 'speaking the same technical language' for a common aim. The 'incompetency limit' is recognised, and skilled figures, technicians, and specialists are recognised and educated at the academic and professional level to undertake roles and responsibilities. The expert pool takes the move from the Strategic level, as the public sector's directives, funds and guidelines, and then networks with the Operational side, including private specialised companies, thus designing a project with logic, timing, and space-related view to implement over time (Interview n.1). This vision readapts the Anthony's Management Control System scheme for organisations' decisions in dynamic transformative settings to urban and suburban mobility systems [50] and the second level, named managerial, is here more Technical-Tactic. In fact, since the transportation field is transformative in all its routinely aspects considering fares, routes, time scheduled, capacity, and other contingencies to plan and manage, concrete responsiveness is required even on a planned system (Interview n.1).

What happened in Abruzzo in the last years emerges instead as a progressive stratification of changes and rules in the attempt to integrate different actors and new required-by-the-time procedures, like multimodality, or political interests' given decisions on short-termism, like privatisation, thus determining anti-social outcomes (Interview n.1). According to Pittaway et al. [51], the responsible local institutions lack the requisite know-how to improve public service delivery processes locally, and at the same time, they are also ideally positioned to integrate different scales' requests, data, and directives to well-match. Local municipalities have a comprehensive middle-level vision of national and regional government, private entities, and citizens to lead the implementation and enactment of what is planned by the emerged Technical-Tactic level, bringing concrete system integration from the strategic to the operational step. Moreover, if this vision is applied to local urban areas' digital and smart transformation, it can stimulate a stagnant situation through concrete decision-making on a planned logic [52].

4.3 Innovation Strategy through Performance Measurement

As a second matter, when considering an existing context with given structural characteristics, by-time matured factors, already built environment, and set standards, any change will need to consider the complexity of these factors altogether and compel with previously created mechanisms [53].

The last Abruzzo region's mobility setting report highlights that 55% of 30 companies supplying public transport in the region are small enterprises also operating as bus rental and touristic companies. Private companies form 80% of the same total, while the rest is formed by a joint venture and three medium-big public-owned companies,

Trenitalia S.p.A., A.M.A. S.p.A. and TUA S.p.A. [54]. Given this reality, there is a constant interface between public and private actors in this sector, which reveals to be a source of discontinuity and instability when trying to provide good service standards.

On the one hand, small and medium transportation companies in Abruzzo have contextual relevance since they historically founded the local system connecting towns and suburbs with dispersed surrounding villages in the post-World War II rebirth era. Today, the same companies are key actors in the regional public services system and touristic field but, as an evident limit, they act sparsely, autonomously and without stable economic and strategic support from the public administration (Interview n.2). For instance, e-ticketing systems have not been introduced by most of these companies, underlining a limit in the digital transformation process and its aim to improve everyday operations overall. As a case in point, data management and digitalised tools would here improve both the demand and supply sides, helping solve the trade-off between underserved catchment areas and costs to cover low-flux services [52].

On the other side, the bigger public companies in the sector mainly have the greater mileage under concession covering urban, extra-urban, and suburban areas. TUA S.p.A. manages the regional railways and the local public bus services, besides the 80% of private companies, also being the source of many good initiatives in line with European guidelines like LIFE3H. Practices like hydrogen buses for greener mobility and flux management through digitalised systems have been realised with the technical support of local universities and research centres (Interview n.4), thus confirming the mentioned tactic's specialised level's importance to balance strategic and operational sides. However, with an uneven digital transformation not accounting for the private enterprises' upgrade, there are no homogeneous perspectives of development and an increased risk of investing in big unneeded digital infrastructures just for the sake of modernising [52].

To overcome the stagnant state-of-the-art and bureaucratic loop on the territory, the private-public co-existence is made possible if acting purposively on a concrete analysis of each part's contribution to the local, both actual and aimed, performance in the transportation service. When realigning toward a synthesis for the Abruzzo region sustainability and growth, it is important to prioritise factors on the contextual different localities' aspects and needs (Interview n.3). From an analytic perspective, precise indexes must be reordered to define what matters economically, socially, and environmentally speaking in three steps: *Measuring* the context quantitatively and qualitatively, *Contextualising* local, national and global priorities, and *Planning* to act on a tactic-technical synthesis. The 'innovative strategy' comes from this improved process. When measuring quantitatively, the sector-related theory considers fares, subsidies, grants, unit labour cost, productivity factors, and other aspects besides the allocated administrative resources locally (Interview n.3). Related considerations are about the know-how capabilities to manage these funds and the interests and biases around the use of such [51]. Qualitative factors are instead evaluated on the actual demand analysis to assess service quality, capillarity, frequency, average delays, adaptability of the system, and everything making the passenger experience daily (Interview n.3). The related complexity can be seen in the trade-off between the need for sustainable and good performance and the service's economic accessibility and capillarity for users [47].

In a general analysis related to this region's context, mixing and crossing these aspects, the result seems to be a deficient quantity and quality of services compared to the

resources at disposal, even more after the allocated national, ministerial, and communitarian recovery funds [55]. The practical case study highlights what to learn from the past on data-based outcomes to better define the meaning of ‘smart’ for localities.

5 Conclusions

The analysed case of the in-house providing system in the Abruzzo region's Chieti-Pescara area represents a specific point in space and time where development opportunities like innovation and sustainability intersect with local problems to solve concrete needs, like efficient transport and naturalistic areas' protection. Once described the strategic innovation frame's ambition to reconfigure the localities' role in regional, national, and supranational innovative configurations, it is worth specifying how to better manage this process in practice through the renewed PPP governance structure proposed.

The resulting new model, resulting from past studies in the geography of innovation and sustainability transition and enriched through concrete on-field research, is reported in Figure 1. The Public sector's elements, including foundational capital, revival funds, more comprehensive vision, interests, and directives, result and evolve from the Regional, National, and Global systems of innovation, each depending on the other, hence vertically displayed. This multi-level perspective [3] makes the different levels of interactions manageable in dealing with complex processes, practices, and projects. The spiral on the right side synthesises the dynamicity of socio-technical system, like the transportation sector considered here. The Landscape constitutes the environment with all the supranational directives and visions jointly defining laws, trends, and big issues to face. The Regime puts together overlapping regulations, knowledge bases, physical systems, operations, and practices to handle altogether, like in a macroregional development. The Niche potentially affects the above levels in the spiral as a sheltered space open to spontaneous development, experimentation, and growth, thus stimulating change by doing, using, and interacting in a specific local area, sector, or technological practice. Again, localities' and small contexts' processes confirm to have the potential to foster innovation.

On the same logic, the Private sector, as the x-axis, acting more sparsely on the horizontal orientation, brings initiatives, research interest, system integration approach, dynamic capabilities, know-how and other complementary assets moving things and pushing toward different perspectives. As from past research [48], a mutual public-private contribution can be organised as Project Ecology only if public actor embraces the System Integration Capabilities. According to the findings, the whole works well for a strategically innovative PPP if there are two main conditions in place: (i) System Integration capabilities are present in public organisations to match clue timing and spatial dependent solutions in improving local mobility; and (ii) Performance Measurement on specific and concrete quantity and quality indexes for a context-based and timely adapted vision projected in the long-term, with Public and Private sectors rebalanced roles.

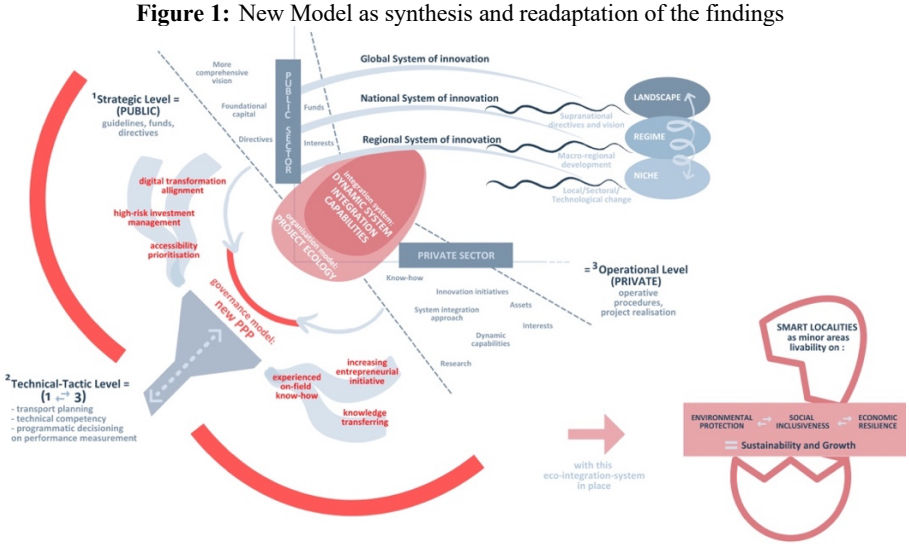
If both the assumptions are in place, local municipalities can be the clue to a real change as a comprehensive integration of the mentioned three key levels. The Strategic Level embodied by the Public sector highlights the right direction to follow, resulting from a multi-level synthesis of institutional priorities. The Technical-Tactic level acts

as the key filter by involving skilled figures in transport planning, technical competency, and programmatic decisions for urban and suburban areas on structured performance measurement and balances the trade-off between bottom-up and top-down decision-making. The Operational Level acts on-field through the Private sector in a flexible, efficient, and constant interface with the public organisations to solve discontinuity and instability.

The present research defines Smart Localities as those minor areas made liveable through an efficient interplay between environmental protection, social inclusiveness, and economic resilience. Here the role of the local transportation and mobility system is crucial to achieving sustainability and growth. Therefore, our study proves the central role given to the Public sector in strategically guiding a smart transformation through systems integration capabilities. At the same time, concrete results from the enquiry prove that the same role is not exhaustive in practice if the technical-tactic and operational levels do not promptly and coordinatively regulate processes in a brownfield environment.

Building on the implications discussed, the paper provides food for thought in theoretically and practically reshaping the urban and suburban contexts' dynamics in the digital and sustainable era through the geography, environmental management, and planning fields of study.

Figure 1: New Model as synthesis and readaptation of the findings



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