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Urban logistics facilities and storytelling. Stakeholder engagement, participatory policy-planning and co-creation

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ABSTRACT

City Logistics demand increase has relevant implications for vehicle movements and the environment. This depends not only on fleet composition and delivery strategies, but also on the positioning of logistics facilities currently characterised by two contrasting tendences: 'proximity logistics' and 'logistics sprawl'. When stakeholders evaluate logistics facilities, they typically use three evaluation categories: economic, resource endowment, and policies regulations. This paper illustrates the use of storytelling as a stakeholder management tool for logistics facilities participatory planning, where it has never been used before. Storytelling promotes behavioural change since stories generate a sense of identity and community, thanks to their intrinsic transformative capabilities. This paper reports the case-study of the Metropolitan City of Rome where L-3D, a purposed built software, was used to develop a storytelling strategy with the intent of promoting stakeholder participation, fostering a better understanding, knowledge-sharing, and effective cooperation.

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Storytelling; urban logistics facilities; stakeholder management; participatory policy planning

1. Introduction

COVID-19 has caused significant disruptions in City Logistics (CL). Restrictive anti-contagion measures have accelerated ongoing transformations. Consumers, in response to this, have increased their online platform use to satisfy daily needs producing notable consumer behaviour changes (Kim and Wang 2021). This e-commerce surge has posed unprecedented challenges to the logistics sector (Ciapetti and Le Pira 2022), that witnessed an increase in the percentage of users purchasing physical products online (Villa and Monzón 2021). These changes notably impact the transportation sector, responsible for 30% of CO_2 emissions in Europe, with road traffic contributing more than 70% (Marcucci, Gatta, and Le Pira 2023).

Amidst the global e-commerce surge, last-mile logistics services are undergoing disruptive changes (Gatta, Marcucci, and Le Pira 2023; Wang et al. 2021). CL poses

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notable challenges to urban mobility and generates considerably higher (in percentage terms) negative externalities compared to passenger transport. CL demand increase, ignited by the surge in e-commerce and on-demand logistics, produces relevant consequences for both vehicle movements and the environment. This relationship depends not only on fleet composition (e.g. internal combustion engine vs. electric) and the delivery strategies (e.g. home delivery vs. click & pick) companies might adopt but also on the spatial structure of the logistics facilities network (e.g. warehouses, hubs, micro-hubs, parcel lockers).

It is crucial to recognize that e-commerce ability to fullfill its value proposition heavily relies on a – well-thought-out vehicle fleet composition (e.g. internal combustion engine vs. electric) and a well-positioned set of warehouse facilities helping to jointly minimize vehicle kilometres travelled while maximising market coverage and service quality. Buldeo Rai (2023) emphasizes how these networks represent the backbone of e-commerce operations, facilitating the efficient storage, transportation, and delivery of goods to consumers. In this perspective, the positioning of the logistics facilities network plays an important role for determining the total amount of kilometres driven and their ensuing impact on the environment. This trend is characterized by two contrasting emerging tendences: 'proximity logistics' (Buldeo Rai et al. 2022), which pertains to the strategic location facilities *within urban areas*, and 'logistics sprawl' (Dablanc and Rakotonarivo 2010), which refers to the shift of logistics facilities towards *peripheral areas*.

Urban planners and local policy makers alike need to carefully assess both the merits and limitations of land use allocation when it comes to logistics facilities since they represent an essential component of the overall logistics network (Aljohani and Thompson 2016). Positioning these logistics sites benefits from discussions, negotiations and possibly collaborations between local authorities and a diverse array of local and global firms (Barbier, Cuny, and Raimbault 2019). While there is a wide consensus on the importance of stakeholder involvement, the jury is still out when it comes to how one should deploy a participatory planning in practice.

Storytelling constitutes a valuable stakeholder management tool within a participatory planning framework, facilitating dialogue in two crucial ways. First, storytelling empowers participants, within a policy co-creation process, by promoting a self-identity reciprocal awareness capable of fostering both empathy and understanding that, in turn, is essential to recognize and value each other's perspectives (Black 2008). Second, it facilitates dialogic interactions by assisting stakeholders in navigating the tension between *self* and *other*. In fact, storytelling encourages perspective-taking, enabling participants to acknowledge the validity of differing viewpoints, even amidst disagreement. Indeed, narrative techniques have long been recognized as a fundamental tool of human communication, rooted in oral traditions that help conveying knowledge, culture, and values. It has proven to be a versatile tool across various sectors, including energy, tourism, and public health, where it has played a crucial role in facilitating communication, promoting engagement, and driving behavioural change. Storytelling has also emerged as a powerful method for simplifying complex information, fostering engagement, and facilitating consensus building among diverse stakeholders. In the context of urban planning, narrative methods proved a powerful tool to bridge the gap between complex technical data and diverse stakeholders' perspectives. This communication technique is particularly

valuable in participatory planning, where the successful implementation of shared policies often depends on the collaboration and understanding of multiple parties. In fact, storytelling not only makes information more accessible but also fosters a deeper emotional connection among participants, enhancing their engagement and willingness to collaborate (Sandercock 2003).

The use of storytelling in CL can represent a transformative tool in participatory planning. In this context, it can be used to present different scenarios and policy options to stakeholders, making the trade-offs and possible impacts of each choice more understandable. Contextualizing logistics challenges and solutions within a narrative framework, stakeholders are more likely to engage with the material and meaningfully contribute to the planning process.

This paper, by discussing the case study of the Sustainable Urban Logistics Plan (SULP) of the Metropolitan City of Rome, a strategic plan with a 10 years planning horizon, clarifies how storytelling can fruitfully be applied to logistics facilities positioning. In particular, it illustrates the role of L-3D, a purpose-built software, plays in this process. L-3D consists of two modules: (1) L-3D Choose, capable of supporting the different phases of the participatory planning process, from the identification of intervention measures to their selection; (2) L-3D Visualise, capable of providing a cinematic representation of the measures selected through L-3D Choose. The software has been specifically developed for a Living Lab (LL) environment.

Case study methodology (Thomas 2011) helps describing the application of the procedure developed and illustrating the specific L-3D functions. The SULP case of the Metropolitan City of Rome provides a revealing example to elucidate storytelling role in participatory planning with respect to logistics facilities positioning. The methodological choice of a case study approach is justified and appropriate since storytelling, to the best of our knowledge, has never been used in a participatory planning process in CL, in general, and in logistics facilities positioning, in particular.

The paper is structured as follows: Section 2 explores the various trends in logistics facility positioning, emphasizing the distinctions between *proximity logistics* and *logistics sprawl*. Section 3 clarifies participatory planning process in CL and LL as a collaborative environment to facilitate dialogue and cooperation among stakeholders. It also describes the role of storytelling as a stakeholder management tool, specifically in fostering the consensual decision concerning the locations of logistics facilities in a participatory strategic planning process taking place within a LL. Section 4 presents the case study of the SULP of the Metropolitan City of Rome, providing an overview of the plan and its objectives. It also reports stakeholders' preferences regarding implementation strategies for logistics facilities and clarifies the procedures for using storytelling to engage stakeholders within this realm. Additionally, it reports the results obtained and discusses the ensuing policy implications. Section 6 concludes.

2. Proximity logistics and logistics sprawl

Dablanc et al. (2022) highlight how COVID-19 has attracted attention towards CL. This focus extends to the spatial configuration of the logistics facilities network whose positioning plays a crucial role in determining the overall distance travelled and its ensuing environmental impact. While they often co-existent in the same city, *proximity*

logistics and *logistics sprawl* have different implications and contrasting effects on urban mobility, environmental sustainability, and the efficiency of logistics operations.

Proximity logistics, as defined by Buldeo Rai et al. (2022), involves strategically locating facilities within urban areas, jointly prioritizing closeness to demand centres, transportation networks, and end-consumers. The goal is minimizing distance between logistics facilities and consumers to reduce transport costs, delivery times, and environmental footprint while ensuring a predetermined service level. This strategy typically involves the location of warehouses, distribution centres, and micro-hubs in urban centres or close to densely populated areas. *Proximity logistics* aims to enhance operational efficiency, optimize last-mile delivery processes, and mitigate congestion and emissions associated with long-distance transportation.

Dablanc and Rakotonarivo (2010) define *logistics sprawl*, as the spatial deconcentration of logistics facilities and distribution centres in metropolitan areas. This phenomenon involves either locating or re-locating logistics activities away from densely populated urban areas to peripheral districts, where large-scale distribution centres and storage facilities are established mainly due to relatively lower land prices. While *logistics sprawl* may provide advantages in terms of reduced land expenses and abundant space, it typically results in larger transport distances, heightened traffic congestion, and increased dependence on long-haul transportation. It is important to note that, while benefits mostly pertain to the private sector, the costs are typically socially distributed. This illustrates the contrasting objectives that a participatory planning process tries to accommodate via a co-creation process with the intent of defining a jointly acceptable compromise solution, that explicitly needs balancing the trade-offs among operational efficiency, environmental sustainability, and land use.

Xiao et al. (2021) identify three distinct elements stakeholders consider when selecting the locations of logistics facilities; namely: economic factors, resource endowment, as well as policies and regulations.

The most important economic factor is the rise in land costs that is driving large warehouses to locate outside the city. This explains *logistics sprawl*. However, with the growth of e-commerce, which entails fast on-demand deliveries, private companies are trying to strike a balance between land cost and high-service quality. This has led to positioning additional interchange points within the city, such as micro-hubs, giving rise to *proximity logistics*.

Resource endowment analysis implies assessing the availability of resources such as land, infrastructure, and utilities in potential areas given the current level of service and expected delivery times. Private operators aim to identify locations with sufficient resources to support logistics operations effectively, thereby minimizing logistical constraints and enhancing operational resilience (Buldeo Rai et al. 2022).

Finally, policies and regulations significantly influence logistics facilities positioning, mostly when it comes to *proximity logistics*, and re-positioning, which mainly imply *logistics sprawl*. Local administrations frequently discourage logistics activities positioning in certain areas due to their minimal contribution to tax revenue and given their relevant adverse environmental impact (Yuan 2018).

The positioning or re-positioning of logistics sites involves negotiations and discussions among local authorities, local and global firms. While the positioning of logistics facilities is influenced by metropolitan discourses and strategies, it is also highly

influenced by local negotiations embedded in legitimization processes (Raimbault 2019). Lack of comprehensive CL data poses significant challenges for the optimization of urban logistics facilities positioning (Dablanc 2023; Lægran, Pitera, and Tørset 2023). Insufficient data, particularly concerning e-commerce and last-mile delivery, hinders urban planners' and policymakers' ability to take well-informed decisions regarding facility location. Addressing this data deficit emerges as a critical policy issue in urban logistics facilities planning (Buldeo Rai and Dablanc 2023). Participation in decision-making processes can enhance policymaking efficiency by ensuring wider and faster acceptance of new intervention policies (Marcucci, Gatta, and Stefania 2019). This approach not only builds trust and credibility but also favours adopting compromise solutions.

3. Participatory planning, Living Lab and storytelling

3.1. Participatory planning

Participatory planning is a collaborative methodology that actively involves various stakeholders, including citizens, planners, public institutions, and private companies, in the decision-making process. It is particularly effective in addressing complex issues such as environmental quality, urban design, and economic development, where stakeholder interests may conflict, and power dynamics can influence outcomes.

Forester (1999) highlights the importance of deliberative practices that foster dialogue and negotiation among stakeholders, emphasizing how participatory planning enables them to jointly explore, critique, and redefine their goals, leading to more inclusive and widely accepted outcomes.

Participation is particularly useful in contexts where the decisions to be taken will have significant and heterogeneous impacts on various groups or, alternatively, when the issues are structurally complex and contentious. Participatory planning aims at gathering diverse perspectives, improving the legitimacy and acceptance of decisions, while building consensus among stakeholders. This is crucial in urban development projects, where public buy-in is necessary for the successful implementation and long-term policy sustainability.

Transitioning towards a collaborative urban governance framework proves essential for effectively addressing the significant challenges CL poses to urban agglomerations (Ehrler, Schöder, and Seidel 2021; Gómez-Marín et al. 2024;Marcucci et al. 2017). Fostering cooperation between public administration and private stakeholders, specifically receivers, senders, and transport providers, is fundamental for coordinating freight activities, especially for planning purposes within urban areas (Le Pira et al. 2017a). In fact, stakeholder involvement is key not only for co-creating effective policy plans but also for testing and deploying innovative solutions in CL, highlighting the importance of collaboration between local authorities and various stakeholders (Barbier, Cuny, and Raimbault 2019; Gatta et al. 2019).

3.2. Living lab

LLs are innovative platforms where stakeholders collaborate to co-create, test, and refine solutions in real-world settings. They foster the creation of an environment that

encourages experimentation and iteration, both needed for addressing complex urban challenges. LLs are widely adopted in urban planning, sustainability projects, technological innovation, and other realms characterized by intrinsically complex environment where traditional planning methods may not suffice.

Cilliers and Timmermans (2014) emphasize the importance of involving community members in the planning process arguing that creative participatory planning is crucial for designing spaces that truly reflect community's needs and desires. The LLs approach is not only necessary but also vital because it ensures that the solutions developed are practical, sustainable, and embraced by the community at large. The sustainable mobility paradigm emphasizes reducing transportation environmental impact by adopting integrated strategies that consider not just technological advancements but also changes in behaviour, land use, and policy interventions (Banister 2008). LLs ensure that sustainable mobility solutions are not only environmentally sound but also in line with the actual needs and preferences of the population. In fact, by actively involving stakeholders in the decision-making process, LLs help tailor these strategies to specific and articulated needs, creating more effective and widely accepted solutions, ensuring that those implemented are practical and address specific challenges faced by the community. Furthermore, Lyons et al. (2024) introduce the notion of a 'triple access planning', integrating transport, telecommunications, and land use planning. This approach is innovative and well-suited for LLs, where stakeholders can collaboratively explore how these three elements intersect and interact to create resilient urban systems.

When it comes to CL, Lindholm and Browne (2013) emphasize the importance of exchanging information and knowledge between stakeholders, highlighting that effective collaboration often proves successful when duly promoted at a city level. A well-functioning Logistics Living Lab (LLL) environment helps stakeholders moving beyond the mere self-perception of being independent entities and, instead, it produces a sense of structured community pursuing common goals. By promoting a sense of community and collaboration, LLL initiatives can induce positive changes in CL leading to more efficient, sustainable, and resilient logistics operations in urban areas (Maltese et al. 2023). LLLs are indeed particularly well suited for addressing the complexities of a CL system (Quak et al. 2016). LLLs function as real-world testbeds bringing together stakeholders from diverse backgrounds to collaborate and experiment with innovative solutions with respect to complex and articulated challenges.

However, one should note that such collaborative environments mainly consider rational and technical policymaking aspects. This can overlook the emotional and narrative dimensions, fundamentals for promoting deeper engagement and a more comprehensive understanding among all participants. The integration of innovative communication techniques can add both a cognitive and relational dimension to the process, simplifying the understanding of complex logistics policies while also encouraging stakeholder involvement and empathy.

3.3. Storytelling

Storytelling has been a fundamental aspect of human communication, serving to pass down knowledge, culture, and values through generations. Over time, it has evolved from its origins as an oral tradition into a sophisticated tool used across various

media, including written texts, films, and digital platforms. In decision-making contexts, storytelling has progressed from a simple narrative method to a powerful strategy for enhancing communication, fostering understanding, and engaging diverse stakeholder groups. The ability to engage audiences on an emotional level constitutes storytelling most important strength. Storytelling has been already used in different contexts, such as, for instance, energy, tourism and public health. Mourik, Sonetti, and Robison (2021) explore the practical application of storytelling in local energy policy contexts. They highlight how storytelling can support collaborative decision-making, especially in dealing with complex energy challenges. Findings show that storytelling facilitated significant learning among stakeholders, having, as in CL, conflicting interests. It allowed participants to step into others' perspectives and ensured diversity in discussions, leading to more inclusive and actionable outcomes. Moscardo (2010) illustrates how stories play a critical role in sustainable tourism by creating connections between tourists and local cultures. The study emphasizes how narratives about local traditions, history, and environment helped tourists develop a deeper understanding and appreciation of the places they visited as well as the impact of their actions. This in line with what happens in CL, where stakeholders need to understand the effect of their behaviour within urban environments. McCall et al. (2021) review various public health interventions where storytelling was used for gathering insights and influencing public knowledge/attitudes. The use of narratives to communicate complex health messages, which can be challenging for laypeople to comprehend, has proven effective in reaching diverse audiences. This can be particularly useful in CL where specific stakeholders (e.g. citizens) might find it difficult to understand the technical details of logistics policy measures.

In all three sectors, storytelling addresses the challenge of translating complex and technical information into simple narratives, encouraging cooperation and mutual understanding. These findings suggest that storytelling in CL can similarly enhance comprehension, encourage partnership, and foster inclusive decision-making, ultimately leading to more sustainable logistics solutions.

Storytelling is widely recognized as an effective tool for promoting behavioural change (Passon 2019). However, it is important to also consider its potential drawbacks. These include the risk of oversimplifying complex issues, which can result in decisions that do not fully account for all relevant factors (Prusak et al. 2004). Additionally, storytelling's inherent subjectivity may introduce biases that could marginalize certain stakeholder voices, particularly if dominant groups shape the narrative (Gabriel 2000). Emotional responses evoked by storytelling can sometimes overshadow rational analysis, leading to decisions driven more by sentiment than by evidence (Denning 2006). Moreover, when narratives reinforce the *status quo*, they may create resistance to change, limiting the potential for innovation (Boje 2001).

While storytelling is well-established in other fields, its application in logistics is still limited. Narrative techniques must be carefully adapted to address the sector's specific challenges to fully harness the potential of storytelling in logistics. To effectively use storytelling in this context, it is essential to develop a data-driven narrative capable of ensuring that all stakeholder perspectives are adequately included, thereby guaranteeing a focused evidence-based decision-making process, leveraging the strengths of storytelling, mitigating its risks, thus leading to more informed and equitable urban planning outcomes.

4. Case Study: SULP of the Metropolitan City of Rome

The SULP of the Metropolitan City of Rome (Piano delle Merci e della Logistica Sostenibile) published in December 2022, with a 10-year horizon offering a long-term strategic plan, constitutes one of the four sectoral plans linked to the SUMP of the city of Rome. SULP at the metropolitan level (covering an area of 5363.22 km²), starting from an urban-level SUMP (covering 1287.4 km²), represents a first step toward a multi-level governance model necessary for the effective implementation of CL policies in large urban areas (Figure 1).

This approach could also be extended to the regional level, as the Metropolitan City of Rome encompasses almost one-third of the Lazio region's total area (17,235.97 km²) (Figure 2).

The three other urbans sectoral plans are: Public Transport Plan for the Metropolitan Area (Piano del Trasporto Pubblico del Bacino Metropolitano); Urban Plan of Cycling Mobility – Biciplan (Piano Metropolitano della Mobilità Ciclistica); Mobility Plan for People with Disabilities (Piano della Mobilità delle Persone con Disabilità).[1]

The SULP illustrates the measures selected to mitigate and/or solve the critical issues that emerged from the preliminary knowledge framework developed. The drafting of the SULP benefited from intensive consultation via dedicated meetings and workshops with key stakeholders in the metropolitan area, with the intent of exchanging data, perceptions, knowledge, and opinions. The measures the SULP identifies are also the result of the interaction with stakeholders' groups, both through plenary meetings, bilateral ones, and dedicated workshops. This approach helped to define, develop, and deploy a plan that not only pursues efficiency but also decarbonization by defining a set of

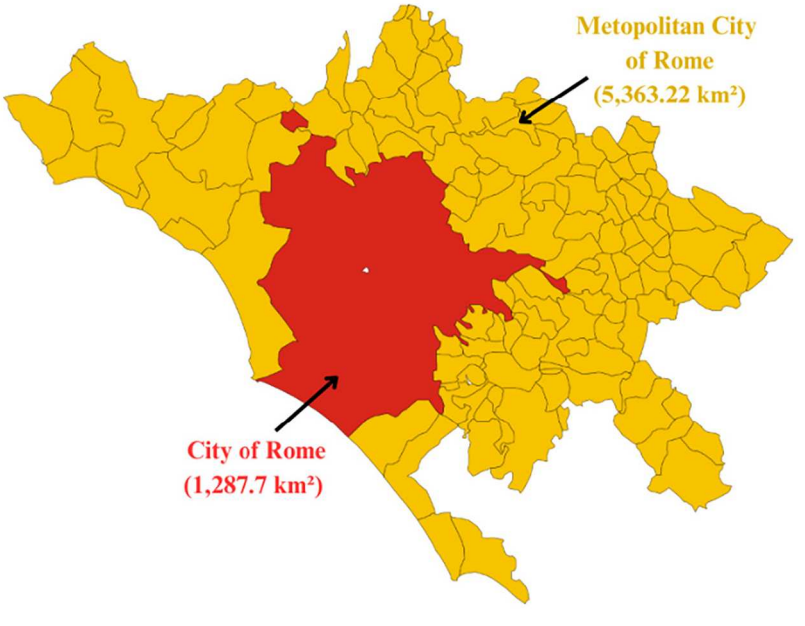

Figure 1. Map of the City of Rome and the Metropolitan City of Rome.

Figure 2. Map of the Metropolitan City of Rome and the Lazio Region.

sustainable and shared measures that are truly achievable since they are fully supported by all stakeholders.

This section incorporates five subsections, respectively: (1) describing the participatory process approach, (2) illustrating the methodology and clarifying the sequence of the storytelling steps implemented, (3) reporting the case-study set-up, (4) discussing the results obtained, and (5) elucidating the ensuing policy implications.

4.1. Participatory process

Key stakeholders, across the metropolitan area, actively collaborated in drafting the SULP for the Metropolitan City of Rome. This participatory process was developed in collaboration with the Mobility Agency and the Department of Sustainable Mobility and Transportation of the city of Rome. Stakeholder engagement and ex-ante policy evaluations play a fundamental role in ensuring an effective, transparent, and efficient decision-making process. One can argue that decisions guided by stakeholders are implemented with fewer conflicts and greater success. In line with the extant literature, the involved stakeholder-types were grouped in four clusters, namely: senders, transport providers, receivers, and public administration. The LLL of the City of Rome, originated from the CITYLAB[2] project, funded by the European Union and aimed at enhancing CL through stakeholder collaboration as well as the establishment of LLs across several European cities (i.e. London, Southampton, Paris, Oslo, Brussels and Rome), served as a participatory co-creation laboratory, systematically involving both public and private actors in collaborative pilot projects, among other activities. Storytelling has been implemented via a tailor-developed procedure and dedicated L-3D software, an output of 'L-3D – a new dimension of participation' project, that promotes, develops, and systematizes an innovative decision support system to facilitate stakeholder involvement and assess ex-

ante policy acceptability. The procedure preliminarily identifies shared measures and finally prioritize them. The software uses new technologies and innovative communication tools to enhance stakeholder engagement in the decision-making process for CL. L-3D Choose module allows the acquisition, segmentation and aggregation of stakeholders' preferences during the consultation process. The software can store and process responses in real-time, allowing for instant results representation, that are subsequently presented to the public through graphic optimization. This process represents a form of visual storytelling.

4.2. Methodology

The storytelling steps are: (1) illustrate the status quo and the problem characteristics; (2) present the singularly most preferred policy mix estimated using participants' replies to discrete choice experiments; (3) illustrate the overall best compromise solution by clarifying which policy mix generate the total maximum utility considering all stakeholders; (4) compare point 1 and 2 by visualizing stakeholders' satisfaction for the best policy mix for all participants and for the specific stakeholders' group in particular; (5) build collective compromise awareness by allowing all stakeholders to compare their group preferred solution to the one which is best on average for all.

Each of these steps also represents the components that generate the plot of the story, each logically following from the previous one to ensure a coherent and effective narrative (Vogler 2007).

Step 1 shows the current CL framework in the context under investigation. The *status quo* scenario is constructed thanks to the information gathered from CL players, taking part to the participatory process, concerning their values, issues, and aims.

Step 2 introduces the actors, which are the stakeholder-types involved in the decision-making process, characterised by their singularly most preferred policy mix. These elements set the stage for everything that follows, establishing the foundational factors that will shape the entire narrative (McKee 1997).

In *step 3*, according to Truby (2008), the narrative evolves as the plot unfolds, focusing on illustrating the best possible compromise solution based on the preferences actors expressed by all.

Step 4 introduces the story's conflict and emotional engagement, where stakeholders compare their individually preferred policy mixes with the overall compromise solution. The procedure developed allows to visually clarify the satisfaction or dissatisfaction of each stakeholder group, highlighting the differences between their ideal single outcomes and the collective compromise. This step is essential for creating a deep connection with the audience, as it brings the tensions and stakes of the decision-making process to the forefront (McKee 1997).

Finally, *step 5* culminates in the denouement, the resolution phase where the narrative reaches its conclusion by building collective compromise awareness. In this final step, the story moves toward increased policy acceptance and collective understanding, bringing the narrative to its closure (Vogler 2007).

The approach this study adopts is explicitly outlined in the narrative arc diagram, also known as the Freytag's Pyramid (Figure 3). The methodology, inspired by Gustav Freytag's dramatic model structure, serves as an effective framework for illustrating the

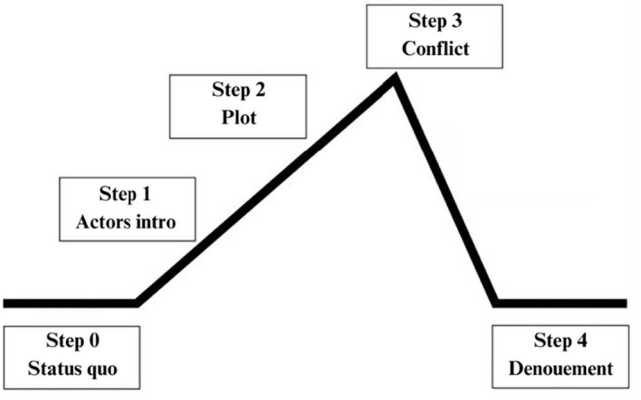

Figure 3. Freytag's pyramid (Narrative arc diagram).

development and resolution of conflict in a narrative. Yang et al. (2021) propose a design space for narrative patterns, data flows, and visual communications, providing practical guidance to achieve narrative intents, organize data facts, and select visual design techniques. This approach applies Freytag's Pyramid to data, showcasing its versatility and effectiveness in conveying complex and technical information. This research adopts a similar approach for participatory planning, emphasizing its potential to enhance stakeholder engagement within collaborative decision-making.

The order of these steps is crucial. The logical flow from introducing actors to unfolding the plot, addressing conflict, and reaching resolution mirrors the natural progression of understanding and decision-making. Each step builds on the previous, creating a structured and cohesive narrative that guides stakeholders from initial preferences, through compromise, to collective agreement. Changing this order would disrupt the narrative flow, potentially leading to confusion, incomplete understanding, or a lack of engagement, thereby undermining the entire decision-making storytelling process.

4.3. Case study set-up

The decision-making process for CL in the SULP for the Metropolitan City of Rome case study involves 31 stakeholders from diverse sectors, highlighting the complexities of the logistics environment. A convenience sampling approach was used, involving participants who expressed interest in taking part in the process. The sampling technique is extremely important and may have significant implications for the robustness of results. However, in the context of CL participatory planning, theoretical requirements often confront the reality where only a limited number of stakeholders typically participate. This occurs despite the research group's efforts in disseminating information about this opportunity.

During a preliminary phase, stakeholders define attributes (areas of intervention) and levels (policy measures for each area of intervention).

Subsequently, stakeholders are asked to fill in a Stated Preference (SP) questionnaire, automatically generated by the L-3D Choose module, within a participatory event. The questionnaire, generated by the software, prompts stakeholders to choose from

different policies or policy packages. The experimental design, created on the basis of the previously defined attributes and levels, consists of 9 choice tasks, including, for each of them, two different unlabelled policy mix alternatives: 'Option 1' and 'Option 2'. Every alternative is characterised by five policy measures, one for each strategic area of intervention selected by stakeholders in the preliminary phases of the participatory planning process.

It is important to note that stakeholders highlight the importance of positioning proximity logistics infrastructure within central urban areas. Implementation strategies for interconnected logistics facilities involve warehouses, distribution centres, and transportation hubs to optimize the flow of goods in the whole metropolitan area. Among them, stakeholders identify the following three main elements. (1) 'Integrated Pick-up and Drop-off (PUDO) network', which foresees the installation of new automated packing stations allowing citizens to pick-up their deliveries without any time constraint. Their positioning should prioritize areas that are easily accessible to operators and located along consumers' regular home-to-work routes. (2) 'Availability of loading/unloading bay', locating/relocating them in a way that maximizes goods accessibility for transport providers. (3) 'Integrated micro-hub network', referring to logistics facilities designated for transhipment activities that aim to optimize distribution and provide support to drivers in carrying out deliveries efficiently. The sequence of the storytelling steps, previously described as a generic procedure, is illustrated in detail in what follows.

Step 1 shows the *status quo* scenario, for which all stakeholder-types involved in CL exhibit a very high level of dissatisfaction, emphasizing the urgent need for modifications to the current situation so to address ongoing challenges. In fact, CL is, at present, fragmented and with inconsistent regulations across municipalities, also exacerbated by e-commerce market growth. The increasing demand for direct-to-consumer deliveries, combined with the lack of comprehensive access control systems, adequate loading/unloading zones, and an optimized strategy for logistics facilities positioning, hinders goods distribution efficiency and sustainability.

Step 2 presents the actors, namely senders, receivers, transport providers, with their own most preferred policy mix, estimated in real-time by the L-3D software automatically. Figure 4 reports the most preferred policy mix for each stakeholder-type. Stakeholders identified three different key priorities for logistics facilities. Receivers prioritize the establishment of an integrated and wide-spread PuDo network. Senders emphasize the importance of ensuring the availability of adequate loading and unloading areas within logistics spaces. Transport providers, on the other hand, underscore the importance of developing an integrated micro-hub network. It is evident that, in our case, when it comes to logistics facilities priorities, there are contrasting interests among stakeholder types.

Step 3 presents the overall (all stakeholder-types) best compromise solution (Figure 5) which includes: facilitations for green vehicles (LTZ access); logistics inclusion in urban planning (governance/infrastructure); priority lanes for green delivery vehicles (operational facilities); incentives for off-hours delivery (monetary incentives); and, finally, integrated micro-hub network (logistics facilities).

Step 4 shows both individual and aggregated best policy mix (Figure 6). The overall best compromise solution cannot accommodate all specific stakeholder-types most preferred options. This example clarifies the inherently conflictual characteristics pertaining

STRATEGIC AREAS	SENDERS	TRANSPORT PROVIDERS	RECEIVERS
LTZ ACCESS	FACILITATIONS FOR GREEN VEHICLES	FACILITATIONS FOR GREEN VEHICLES	RESTRICTIONS ON POLLUTING VEHICLES
GOVERNANCE/ INFRASTRUCTURE	ELECTRIC CHARGING INFRASTRUCTURE	LOGISTICS IN URBAN PLANNING	LOGISTICS IN URBAN PLANNING
OPERATIONAL FACILITIES	PRIORITY LANES FOR GREEN VEHICLES	PRIORITY LANES FOR GREEN VEHICLES	LOADING / UNLOADING AREAS FOR GREEN VEHICLES
LOGISTICS FACILITIES	AVAILABILITY OF LOADING/UNLOADING BAY	INTEGRATED MICRO-HUB NETWORK	INTEGRATED PUDO NETWORK
MONETARY INCENTIVES	€ CONSOLIDATION	€ GREEN VEHICLES	€ OFF-HOURS DELIVERY

Figure 4. Best policy mix for stakeholder-types.

to a compromise that, if too pronounced, can, in principle, forestall the process. At the same time, this also represents the hard-to-tackle issue that storytelling explicitly addresses. One should notice that the compromise solution includes only 'Integrated micro-hub network' which constitutes transport providers' best option. While there is an overall perception of the status quo which is evaluated as very bad by everybody, there is a heterogeneity on compromise solution evaluation.

Step 5 provides all the necessary ingredients to build a collective compromise awareness by drawing stakeholders' attention away from what they are losing and shifting it towards what they are gaining. To cool off the steaming negative emotions generated by the comparison between own preferences and group compromise ones, possibly emerging from a sense of not being heard, not being duly considered that explains the single stakeholder opposition towards the compromise solution presented, *step 5*, by visualizing stakeholders' satisfaction using emoji, clarifies that all stakeholders are, *de*

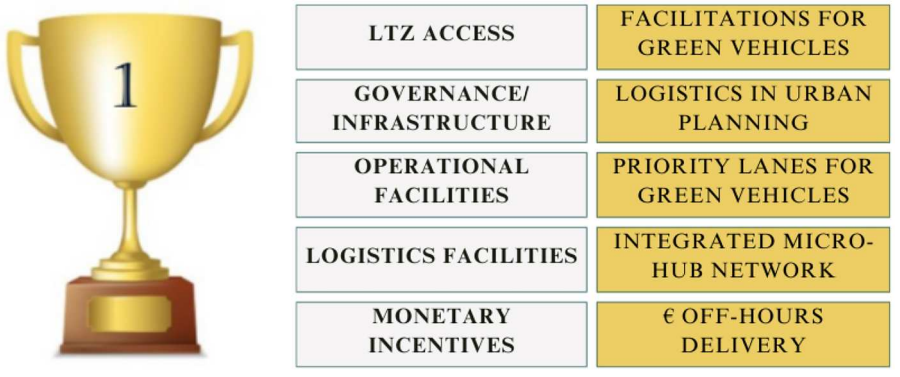

Figure 5. Best compromise policy mix.

A

STRATEGIC AREAS	SENDERS	TRANSPORT PROVIDERS	RECEIVERS
LTZ ACCESS	FACILITATIONS FOR GREEN VEHICLES	FACILITATIONS FOR GREEN VEHICLES	RESTRICTIONS ON POLLUTING VEHICLES
GOVERNANCE/ INFRASTRUCTURE	ELECTRIC CHARGING INFRASTRUCTURE	LOGISTICS IN URBAN PLANNING	LOGISTICS IN URBAN PLANNING
OPERATIONAL FACILITIES	PRIORITY LANES FOR GREEN VEHICLES	PRIORITY LANES FOR GREEN VEHICLES	LOADING / UNLOADING AREAS FOR GREEN VEHICLES
LOGISTICS FACILITIES	AVAILABILITY OF LOADING/UNLOADIN G BAY	INTEGRATED MICRO-HUB NETWORK	INTEGRATED PUDO NETWORK
MONETARY INCENTIVES	€ CONSOLIDATION	€ GREEN VEHICLES	€ OFF-HOURS DELIVERY

B

LTZ ACCESS	FACILITATIONS FOR GREEN VEHICLES
GOVERNANCE/ INFRASTRUCTURE	LOGISTICS IN URBAN PLANNING
OPERATIONAL FACILITIES	PRIORITY LANES FOR GREEN VEHICLES
LOGISTICS FACILITIES	INTEGRATED MICRO-HUB NETWORK
MONETARY INCENTIVES	€ OFF-HOURS DELIVERY

Figure 6. (A) Best policy mix for stakeholder-types; (B) Best compromise policy mix.

facto, on average happier when comparing the compromise solution to the *status quo* (Figure 7c). Emojis, associated with the satisfaction level of each stakeholder-type with respect to the best compromise solution, communicate results in an effective, user-friendly, and emotionally driven format. In fact, Churches et al. (2014) suggest that using emojis expressing enjoyment can enhance recipient's mood. Similarly, Haltmayer and Gierl (2021) advocate that the brain processes them similarly to human facial expressions. Moreover, emoji-based digital communication fosters a sense of warmth and reduces social distance, positively impacting the perceptions of the source of the message. Emojis frequently play a role in storytelling, enabling recipients to interpret narratives through their sequences.

Moreover, *step 5* highlights, for each stakeholder-type, the policy overlapping between their *singularly* most preferred policy components and the *overall* best compromise solution (yellow boxes in Figure 7A). It underlines that all stakeholder-types find some of their most preferred policy options included in the best overall compromise policy mix. As it is for logistics facilities, only transport providers *de facto* see their most preferred option included in the best compromise solution (i.e. 'Integrated micro-hub

A

STRATEGIC AREAS	SENDERS	TRANSPORT PROVIDERS	RECEIVERS
LTZ ACCESS	FACILITATIONS FOR GREEN VEHICLES	FACILITATIONS FOR GREEN VEHICLES	RESTRICTIONS ON POLLUTING VEHICLES
GOVERNANCE/ INFRASTRUCTURE	ELECTRIC CHARGING INFRASTRUCTURE	LOGISTICS IN URBAN PLANNING	LOGISTICS IN URBAN PLANNING
OPERATIONAL FACILITIES	PRIORITY LANES FOR GREEN VEHICLES	PRIORITY LANES FOR GREEN VEHICLES	LOADING / UNLOADING AREAS FOR GREEN VEHICLES
LOGISTICS FACILITIES	AVAILABILITY OF LOADING/UNLOADIN G BAY	INTEGRATED MICRO-HUB NETWORK	INTEGRATED PUDO NETWORK
MONETARY INCENTIVES	€ CONSOLIDATION	€ GREEN VEHICLES	€ OFF-HOURS DELIVERY

B

LTZ ACCESS	FACILITATIONS FOR GREEN VEHICLES
GOVERNANCE/ INFRASTRUCTURE	LOGISTICS IN URBAN PLANNING
OPERATIONAL FACILITIES	PRIORITY LANES FOR GREEN VEHICLES
LOGISTICS FACILITIES	INTEGRATED MICRO-HUB NETWORK
MONETARY INCENTIVES	€ OFF-HOURS DELIVERY

C

	EMOJI	STAKEHOLDER TYPE
STATUS QUO PERCEPTION	VERY BAD	S, R, TP
	BAD	
	OK	
	GOOD	
	GREAT	
	EXCELLENT	

	EMOJI	STAKEHOLDER TYPE
COMPROMISE PERCEPTION	VERY BAD	
	BAD	
	OK	
	GOOD	S
	GREAT	R
	EXCELLENT	TP

SENDERS: S
RECEIVERS: R
TRANSPORT PROVIDERS: TP

Figure 7. (A) Best policy mix for stakeholder-types intersected with best compromise policy mix; (B) Best compromise policy mix; (C) Emojis for representing satisfaction levels for stakeholder-types.

network'). However, while senders preferred 'Availability of loading/unloading bays', and receivers 'Integrated PuDo network', the former saw the inclusion of both 'Facilitations for green vehicles' and 'Priority lanes for green vehicles', in the best compromise solution and the latter had both 'Logistics in urban planning' and 'Incentives for off-hours delivery'.

4.4. Results and discussion

Storytelling proves as a valuable stakeholder management tool within participatory planning, facilitating engagement in decision-making. The case study demonstrates that storytelling fosters empathy and consensus-building by contextualizing logistics challenges within a narrative framework. This methodology allows stakeholders to visualise trade-offs and solutions more effectively. Storytelling has been used to simplify complex information, promoting engagement and fostering an emotional connection between participants and the planning process in other sectors, such as, energy, tourism and public health, as literature review reports. In CL context, this technique helps bridge the gap between technical data comprehension and diverse stakeholder perspectives, facilitating more inclusive discussions and policy development.

The procedure developed adopts a hybrid format combining both digital and oral storytelling, allowing policy measures and their anticipated impacts to be presented in an engaging narrative formal structure easy for stakeholders to comprehend. A facilitator guides the storytelling process, ensuring all stakeholders can easily follow the narrative. The facilitator plays a crucial role in interpreting the visualizations and integrating them into the broader narrative, thereby helping stakeholders understand the process of compromise and decision-making procedure adopted.

The participatory planning technique developed, hinging on storytelling, allows visualizing that compromise is both *needed* and *made* by all stakeholder-types. This visually illustrates that the best overall compromise solution *de facto* represents a trade-off among all stakeholder-types' singularly most preferred policy mix. In few words, one can assert that, when all stakeholder-types have a clear perception that also other stakeholder-types must give up something, this immediately generates an empathic atmosphere within the whole community. This valid evidence for this case study needs to be confirmed through an iterative and recursive research process.

In our case storytelling created a positive perception of the best compromise policy mix that was willingly considered acceptable after some back-and-forth discussion among participants. In fact, both some verbal and, mostly, non-verbal communications suggested to the research group members, managing the workshop, that the adopted storytelling illustrative procedure had a profound impact on participants' perceptions inducing all of them to feel in their respective 'interlocutors' shoes' thus evidently modifying the overall stakeholder meeting atmosphere.

Initially, some stakeholders were sceptical and firmly entrenched in their positions, displaying a defensive posture typical when individual interests are perceived to be at risk. However, as the storytelling process evolved, highlighting the compromises being made by all parties, these rigid attitudes began to soften a bit. The narrative effectively demonstrated that concessions were being made universally, which helped stakeholders recognize the collective nature of the decision-making process. This shift in perception

gradually led to increased acceptance and cooperation, as participants began to value the shared effort and mutual understanding that emerged from the discussions. By the end of the storytelling process, what started off as scepticism had been transformed into a broader acceptance of the compromise, resulting in a more collaborative and harmonious group dynamic. This perception generated by the description of the results, in our opinion, was the 'secret ingredient' that allowed reaching a jointly acceptable solution. The awareness of this group dynamic, while it cannot be documented using hard evidence, was clear to all researchers managing the meeting. In fact, this immediately emerged at the beginning of the debriefing among organizers that took place soon after the end of the meeting.

To evaluate the effectiveness of the participatory planning process through storytelling, key questions were presented to participants during a follow-up meeting. These questions aimed to gather detailed feedback on their overall experience and to assess the impact of the methodology employed. The results suggest a significant increase in participant satisfaction after being exposed to the storytelling steps. For example, the question 'How satisfied are you with the policy mix that you contributed to determining?' that was originally posed to participants, initially received an average score of 4.2. However, after the storytelling experience, the satisfaction level increased to 4.7, indicating that the use of storytelling positively influenced participant engagement and their perception of the decision-making process. While one cannot claim that the difference between the two measurements is statistically significant, we still believe this is relevant from a policymaking perspective.

This experiment provided a clear, objective, and measurable assessment of the positive impact storytelling has on the participatory planning process. The findings revealed that participants felt more included and were more satisfied with the outcomes when storytelling was incorporated into the process. Moreover, the case study demonstrates how several operators, including one of the largest global players (whose identity cannot be disclosed for confidentiality reasons), have expressed interest in the method. They found it particularly useful for interacting with public administration during the process of locating micro hubs. Additionally, they expressed a willingness to continue participating in meetings that encourage the use of innovative communication tools and technologies capable of fostering dialogue both among operators and with local institutions.

This interpretation of the sequences of events clearly illustrates the mechanics of what storytelling made possible, namely the facilitation of cross compensation between singular stakeholders' most preferred policy elements and those included in the overall accepted policy mix. This dynamic enables an emotionally resonant and balanced approach to conflict resolution and consensus-building.

Academic research proposes several methods to engage stakeholders in the prioritization of CL policies within the literature.

Among these, SP and Discrete Choice Models (DCM) are highly regarded for their ability to assess and elicit stakeholder preferences for different policy options (Marcucci et al. 2017). In addition, Le Pira et al. (2017b) integrate DCM with agent-based modelling (ABM), which simulates complex systems by representing communities of autonomous agents that interact with their environment and each other based on individual interests.

Multi-Criteria Decision Making (MCDM) employs various ranking techniques to determine the optimal solution among multiple alternatives, each evaluated against

several criteria (Janjevic, Knoppen, and Winkenbach 2019). Multi-Actor Multi-Criteria Analysis (MAMCA), an extension of the MCDM approach, adopts a bottom-up methodology that allows integrating different objectives specific to each stakeholder group (Macharis, Milan, and Verlinde 2014).

While scientifically robust, traditional participatory planning tools face limitations such as time constraints, stakeholder diversity, limited resources, and potential conflicts. Moreover, they tend to focus on the rational aspects of decision-making, often neglecting the emotional and relational dimensions that shape collaborative outcomes.

This paper proposes a novel methodology leveraging storytelling within LLLs to overcome these gaps. Storytelling enhances stakeholder involvement by simplifying complex issues, stimulating empathy, and fostering consensus, thus addressing limitations of conventional engagement tools in city logistics planning.

A participatory planning environment must encourage collaboration, transparency, and open communication. It should offer tools that facilitate inclusive discussion and ensure that each participant's input is heard and valued. This enables the continuous exchange of ideas, allowing for the iterative refinement of planning strategies. The outcome is not only more robust decision-making, but also a stronger sense of stakeholder ownership and commitment. LLLs empower stakeholders to collaboratively address shared challenges, pooling their expertise and resources to co-develop innovative solutions. Serving as multi-actor platforms for CL policy co-creation, LLLs support coordinated planning among private operators, public agencies, and citizens (Gatta et al. 2019). Thus, LLLs are ideal venues for negotiating logistics facility placement and urban distribution schemes. Moreover, storytelling functions as an effective planning tool for the siting of warehouses, micro-hubs, parcel lockers, and related facilities. It helps planners convey the benefits of location strategies and gather community feedback. Multimedia content, interactive workshops, and digital platforms facilitate transparency, accountability, and community engagement (Mayer 2014). These narratives empower stakeholders to shape the logistics landscape of their neighbourhoods. When applied within LLLs, storytelling and participatory planning create what may be termed 'super-additivity.' This synergy produces outcomes greater than the sum of their parts. The integration of narrative-based tools into LLLs thus suggests adopting a dynamic framework for stakeholder engagement and innovation in urban logistics policymaking.

This paper advances the state of knowledge by demonstrating how storytelling, proven in fields like public health, tourism, and energy, can be effectively transferred to CL. By embracing both cognitive and emotional engagement, this methodology complements existing decision-making tools and offers a holistic participatory planning framework. This contribution supports future policy experimentation and reinforces the relevance of LLLs as platforms not only for technical testing but also for co-creating socially accepted, sustainable solutions.

4.5. Practical policy implications

SULP official guidelines, approved by the Metropolitan City of Rome on February 17th, 2024, incorporate the measures achieved through the proposed participatory process integrated with storytelling. In particular, the development of an integrated micro-

hubs network should, according to the SULP duly consider (1) selecting compatible industries/ sectors with similar logistic interests and constraints so to ensure the functional integration of stakeholders' characteristics and those of the measure; (2) identifying suitable physical structures within urban areas to serve as functionally adequate micro-hubs; (3) initiating pilot projects and drafting detailed guidelines for practical implementation considering different supply chain characteristics; (4) activating new micro-hubs based on the guidelines developed during successful pilot projects (by 2025); (5) gradually transitioning to full-fledged operations following the guidelines elaborated and tested (by 2032). Furthermore, the plan aims to ensure the effective monitoring, implementation, and recalibration of measures over time so to keep the whole process under control.

The case study of the Metropolitan City of Rome suggests stakeholders predominantly favoured logistics facilities solutions related to proximity logistics, such as the development of an integrated micro-hub network, over options contrasting logistics sprawl. The SULP serves as a strategic document, establishing the framework and guiding principles for CL. However, the tactical implementation of these strategies, such as the precise positioning of the micro-hubs, must be further refined possibly using the same participatory methodology within the LLL environment through storytelling.

5. Conclusions

COVID-19 has raised the awareness with respect to CL. The strategic positioning of logistics facilities emerges as a pivotal factor in promoting sustainable and efficient CL operations in urban planning and policymaking. Factors such as lower land costs and widely available warehouse space have often induced *logistics sprawl*, the tendency to locate logistics facilities in peripheral districts. While, more recently, a growing body of literature advocates relocating them within urban centres, a phenomenon known as *proximity logistics*. These two contrasting yet coexisting trends can significantly impact operational efficiency, environmental sustainability, and city liveability. They highlight conflicting agendas not only between private firms and local authorities responsible for urban planning and governance, but also among different CL stakeholder-types.

Participation in decision-making processes enhances efficiency by ensuring greater/ faster acceptance of new intervention policies, building trust and credibility, and garnering support for proposed logistics facilities. Stakeholder engagement is fundamental for co-creating policy plans and testing innovative CL solutions by creating ex-ante support for policy measures. In fact, contrasting interests and heterogeneous preferences typically require compromise solutions. LL environments foster collaboration toward common goals, ensuring that stakeholders feel heard, involved, and engaged in the planning process. In particular, LLL provides an ideal environment for achieving a policy mix acceptable to most, if not all, through the effective management of opposing interests.

Storytelling emerges as an effective communication strategy, promoting community and empathy among stakeholders, enabling them to perceive individual benefits and recognize collective trade-offs and compromises. Storytelling promotes empathy, community building, and helps cultivating a sense of ownership and accountability for decisions made, ultimately improving policy co-creation, acceptance and implementation.

The paper delineates and exemplifies the application of a storytelling procedure, through the case study of the SULP of the Metropolitan City of Rome that integrates storytelling in LLL for a participatory planning process with a specific focus on CL facilities. L-3D software serves as a valuable tool for eliciting preferences and finding the best compromise solutions. Moreover, effective communication of compromise solutions is fundamental. For this reason, visual storytelling has been integrated in L-3DVisualise, enabling real-time representation of stakeholder preferences and compromise results through a graphic optimization approach. Indeed, storytelling proves functionally appropriate in promoting compromise solutions, fostering community building and empathic co-creation. It is not only *what* to show but also *how* and *when* to present the relevant information that matters.

The level of detail SULP provides is strategic and long-term. However, the same storytelling procedure steps can also be replicated at tactical and operational planning levels. Along this line we intend to use this tool during the SULP implementation phases for a more precise identification of the micro-hub positioning.

Future research endeavours will allow creating more sophisticated forms of visual storytelling. Once the scenarios deemed most acceptable by most stakeholders are defined and a story is created, one can transform the latter into video format, featuring animated and interactive audio-visual content. Moreover, one can also include in the story the likely impact the proposed policy measures might have within the urban landscape, thus increasing realism, accuracy, and stakeholders' engagement.

As illustrated in the case study, thanks to appropriate use of storytelling procedures/techniques, even in a situation where three stakeholder-types have three contrasting policy priorities, the successful adoption of the single priority to logistics facilities, namely the integrated micro-hub network, initially indicated as the favourite measure just by transport providers was, at the end of the meeting, fully supported also by senders and receivers. It was possible to clarify that all voices have been heard and duly considered through storytelling.

The case study described underscores the significance, relevance, and potential of adopting a storytelling-based communication strategy within LLL co-creation meetings. This, in fact, stimulates a shift from a self-centred to a community-centred perspective, essential for fostering community building, empathic co-creation, and finally finding a viable and effective solution.

Notes

1. https://pums.cittametropolitanaroma.it/i-piani-di-settore
2. https://civitas.eu/projects/citylab

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