Shaping urban freight systems via a participatory approach to inform policy-making

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Shaping Urban Freight Systems via a Participatory Approach to Inform Policy-Making

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Abstract: In the upcoming era of new technologies, a transport system is expected to be 'more sustainable,' 'safer,' and 'more efficient.' However, to what extent is this true? Based on the results of a series of stakeholder engagement workshops, the paper explores the vision of different stakeholders about urban freight of the future. A Participatory Approach was used to allow stakeholders to identify the problem and co-design a set of solutions. Potential impacts of innovative urban deliveries on economy, environment, and society were analysed. Methodology and results were then compared with those of a city stakeholder engagement workshop delivered in Newcastle upon-Tyne in 2014. Stakeholders considered that an "engaging" and "easy to use" process was needed to facilitate the process and it encouraged participants to find solutions for a 'common good.' The participatory approach proposed in this process would support transport planners and policy-makers to design and implement a consistent policy framework for future sustainable urban freight systems.

Keywords: stakeholder engagement; participatory approach; sustainability; urban freight of the future

1. Introduction

Transport is fundamental to the economy. However, it imposes significant costs on society in the form of traffic congestion, road collisions, and health and environmental impacts [1,2]. These impacts are more concentrated in urban areas, due to the high density of activity and people, resulting in high exposure. According to recent observations (see, for example: [3,4]), despite the global economic crisis, online sales have been subjected to a very significant growth over the last years, making more significant the negative impacts of last-mile deliveries, which are today considered as the most expensive, least efficient, and most polluting leg of the whole supply chain [5]. Different solutions have been developed to reduce negative externalities due to these increasing freight flows in urban areas. Innovative vehicles (e.g., electric vehicles), depot station location, collaborative and cooperative distribution systems, transport management optimisation, and innovative public policies and infrastructures (e.g., urban pricing) were identified and sought as opportunities to reduce externalities from the last-mile logistics [6]. In terms of emerging solutions, autonomous vehicles, drones, and 3D printing have been identified as potential future solutions to reduce urban congestion and air pollution, whilst at the same time improving safety [7]. However, such innovative solutions remain relatively unexplored both in terms of technology testing and policy implications, and for this reason are likely to become one of the most promising areas of study. Also, new schemes and solutions might imply resistance from stakeholders, and users' acceptance often represents an important barrier to their implementation. Behaviour change and stakeholder collaboration have been acknowledged as necessary to support local authorities to design a successful urban freight transport system [8,9]. For this reason, this paper focuses on stakeholder engagement as a key factor and explores how to design new city logistics schemes that can be accepted and viable. A set of alternatives to solve current and future urban

freight issues have been co-designed by a group of key stakeholders (e.g., logistics operators, supply chain managers, retailers, customers, citizens) through a series of Stakeholder Engagement Workshops (SEWs) based on a Participatory Approach (PA). The SEWs took place in Bristol (UK) in January 2019. Results were then analysed and compared with the stakeholders' vision of city logistics solutions that has been investigated in Newcastle upon-Tyne within the SMARTFUSION project as reported in [10]. The project was a Green Car Public Private Partnership Initiative under the European Commission research framework programme launched in 2010. The project objectives were to trial the potential use of technologies (via, for instance, electric truck and smart vehicle routing navigator) and planning policies (such as the use of an urban consolidation centre and delivery servicing plan [11]), to address contemporary sustainable city logistics. The SEWs in Newcastle were held in 2012 and 2013, but recent interviews in January 2019 with key stakeholders were held to contextualise the study presented in this paper.

The rest of the paper is organised as follows. Section 2 describes the state of the art of existing methods used for stakeholder engagement within transport planning and policy-making for urban freight systems. Section 3 introduces the methodology and the new method we propose for a participatory process. Section 4 presents the results of the application of the model across a series of stakeholder engagement workshops organised in Bristol. Section 5 provides a comparison with the results of the project delivered in Newcastle. Finally, the conclusions are in Section 6.

2. Background

2.1. The Policy Design Context

Policy design is a complex process that requires [12]: (1) the identification of a problem and its causes; (2) the design of a range of specific policy measures that address the problem; (3) the evaluation of costs and benefits of each measure; (4) and the choice of a specific measure. There would ideally be an additional final step, with the evaluation (ex-post) of the real effectiveness of the measure, in order to allow policy-makers to modify or terminate the chosen measure [12]. It is worth noting that designing a policy requires a deep knowledge of the wider policy framework [13], in order to understand where to position a specific policy measure with respect to it, and how this is in line with policy goals [14]. Usually transport policies are selected purely on rational analysis of their efficacy [12], and for lower priority policy areas (such as urban freight) choices are driven by financial and human resources [15]. Politicians play a key role in the definition of policy goals and the implementation of policy measures. However, they often make decisions not considering the general policy goals, but rather considering how to gain legitimacy [12] and public acceptance [16]. In fact, according to Christiansen [17], when citizens are not satisfied with the quality of transport services, they are also dissatisfied with the performance of local democracy. Considerations about the policy-making process might be different when talking about (urban) freight policies, as no single policy would work equally well in two different places [18].

In general, when local authorities decide to design and implement new urban freight transport policies, they are influenced by National and European goals, which are usually reduction of polluting emissions, congestion, and increased road safety [19]. Based on these main objectives, they design a range of targeted policy measures, which might be opposed by citizens. The most common measures are traffic restrictions [20], time windows [21], and low emission zones [22]. Others include consolidation and coordination of city logistics measures (known as best practices) as the essential machinery of a city to achieve efficient urban freight operations [23]. Lack of communication between local authorities and stakeholders (e.g., retailers, manufacturers, logistics operators) is still a common problem in many UK cities, as strategic city freight planning was often bypassed by city authorities [24], and responsible for the unsuccessful implementation of city logistics measures [12]. This factor, together with the inability to identify and select the most effective policy measures, and to properly integrate the overall transport planning with urban freight transport, represent the main causes of an inefficient urban freight system.

2.2. Collaboration in Urban Logistics

Several authors recognised that communication and collaboration among stakeholders are key factors to foster the success of a sustainable urban freight scheme since the design stage of a project [25,26]. Collaborative urban logistics has long been the bread and butter of Operations Research (OR) researchers. It is a collaboration or cooperation between businesses, logistics, service providers, citizens, and public sectors that can be characterised by vertical and horizontal, along a supply chain management [27,28]. Solutions given by OR are either optimised transport cost or decision parameters including sustainability cost [29]. Those operational logistics solutions are mostly applicable to certain supply chains and often benefit a single company, such as a transport operator. Port operators, for instance have benefitted from the time and cost saving gained from mathematical models developed for various purposes including optimum capacity of transport operations, see for example [30–36]. The link between OR and urban logistics as perceived by a city (transport) planner is however limited [37], to the extent that decisions made to inform transport policy were often not informed by OR solutions, but rather on wider strategic political, socioeconomic and geographical considerations [38]. Large investment decisions made for freight were informed by macro-level data analysis such as in transport infrastructure development and fuel duty [39,40]. How can such diverse knowledge such as these be bridged in a single dialogue with different objectives prioritized by different urban logistics stakeholders? Certainly, multiple dialogues with different stakeholders would make sense, as there would be no one size fits all. We would like to draw that our approach in this paper leans toward urban planning, with the understanding that urban land use is a limited resource, and therefore decisions that only benefit certain city stakeholders had to be balanced with common public interest.

The current challenges of urban freight systems have been replacing the bigger urban planning collaborative approaches problem as illustrated by Healey [41], where she pointed out the negative role of public authorities which was deemed as defending 'community' against the forces of 'capital' and seen as a burden on business and the workings of the market, and not as facilitator. While Healey's observation applied to city planning in general then, with no specific agenda made to freight systems, it is now timely to rethink the approach to address urban freight systems. Indeed, despite the expected benefits due to innovative and sustainable solutions, their successful implementation strongly depends on to what extent users are prepared to shift from a more traditional, well-known system, to a new one.

2.3. Stakeholder Engagement

Stakeholder engagement in the policy-making process has been widely recognised as a key factor in users' acceptance and a key driver in a successful implementation of new policies [42,43]. Urban-freight-related problems dealt with by city stakeholders are quite similar across European countries [44], and coordinated urban logistics planning would help to harmonise the imbalance of the degree of awareness among actors of their potential influence [45]. Several authors explored methods and tools to engage with stakeholders. Probably the most common tool used by policy-makers to involve stakeholders in city logistics decision-making is the creation of online forums, where stakeholders can express their interests and discuss about problems and solutions [46,47]. Looking into other research field domains, stakeholder participation methodology is generally quite well established in the field of environmental management, and recommendation was made to avoid a "tool-kit" approach and, instead, emphasized participation or engagement as empowerment, equity, trust, and learning process [48]. Another example is in medical engineering, where a participatory and co-design process held via series of stakeholders' workshops, to introduce, to visualize, to mock-up, to prototype, and to package and market a design product [49]. In computing science, stakeholder collaboration was used via design thinking method to find solutions from a nonlinear consideration of design issues which allow returns to previous phases, overhauling them and improving design solutions [50]. In the design science paradigm, solutions-focused driven research can contribute to management theory, while problems-focused to organization theory [51].

In the UK, the key entrance to any adoption of city logistics measures by city authorities is through a consultation process forum with city logistics stakeholders. This forum is known as Freight Partnership, where Newcastle is one of the early adopters—dated electronic recorded meetings are seen since January 2006, with regular three or four monthly meetings among city logistics stakeholders to discuss issues that touch city businesses' operations. However, not all cities in the UK dedicate authorities to hold open forum specifically for city logistics, as for many, logistics are the businesses of businesses, and there is no strong reason to spend extra penny to support regular consultation. The scope of Freight Partnership is generally local, as acknowledged by Browne et al. [52]. Zunder et al. [10] applied the Design and Monitoring Framework (DMF) (typically used in project management) to Newcastle, Berlin, and Como city logistics, engaging with city stakeholders to improve the environmental sustainability of urban freight. Those cities were chosen because each city has an urban freight partnership, with public and private stakeholders who were interested in piloting novel urban logistics solutions and was granted a research fund by the EU Commission. However, according to Lebau et al. [42], all these methods consider stakeholders as actors able to talk and discuss about urban problems, rather than an active component with a proper role in the decision-making process. For this reason, they propose the Multi-Actor Multi-Criteria Analysis (MAMCA), which was developed by Macharis [53]. MAMCA considers stakeholders' priorities first, and then builds solutions based on these priorities. Stakeholders are involved in a bottom-up approach and feel committed in the decision-making process. They are motivated by expected benefit and hindered by competitive intelligence risks [54]. However, the set of alternatives is not designed by the stakeholders, who are rather asked to evaluate a set of scenarios designed and proposed by the research group.

In this paper, we aim to explore yet another approach of stakeholder consultation process to address the future of the urban freight system via logical framework and co-design process, with particular focus on the stakeholders' vision of sustainable city logistics.

3. Methodology

The key methodological concept of this research is 'co-production,' i.e., a deep and broad participatory process for identifying, scoping, and undertaking an initial assessment of future collaborative sustainable and innovative urban freight solutions, including new technologies, automation, and driverless delivery vehicles. Co-production prioritises consideration of the needs of the stakeholders involved to develop solutions that can be more attractive to potential providers and users, because they are tailored to their needs. Following that, the research project addresses the following research question:

"What are the needs and expectations of stakeholders in respect of future, more sustainable, urban freight transport"?

This was addressed through a series of Stakeholder Engagement Workshops (SEWs) organised in Bristol (UK) in January 2019. The choice of Bristol is due to the interest of local authorities in understanding what kind of solutions could be implemented to improve the sustainability of urban freight and reduce traffic congestion in the city centre. Bristol has been involved in several European projects that promoted sustainable schemes for urban goods distribution. These include the Bristol and Bath Freight Consolidation Centre (BBFCC), which was established in 2002 and is still operating [55]. Despite the positive impact of BBFCC in terms of polluting emissions reduction [56], it is currently dealing with the economic sustainability, which could depend on poor demand due to lack of communication among stakeholders [57]. The results of the SEWs were compared to the ones of other workshops organised in Newcastle (UK) in 2012–2013, with extra interviews with key stakeholders who were involved with the process then in January 2019. Ten key stakeholders were involved in Bristol, including policy-makers, logistics professionals, experts, retailers, and citizens for needs identification and the visioning of future innovative services.

In Newcastle, many key stakeholders were involved through a series of meetings and workshops, with city authority, logistics service providers, the national Freight Transport Association (FTA),

city retailers, warehousing company, transport consultant, universities, technology providers (i.e., carmakers), logistics experts and researchers, and many business subfunctions (university purchasing director, estate service director, student union manager). Unlike the Bristol SEWs, which aim to vision future innovative services, in Newcastle, SEWs then were limited with the funding regime that required certain stakeholders with compulsory engagement in making innovative services run as a real business model.

The output in Bristol is a co-designed framework that can support policy-makers to design and implement new policies during the transitory period (i.e., today-to-2040) to achieve the objectives identified by the stakeholders as the most important. In Newcastle, the output was a real business model of urban logistics operation.

Similar to MAMCA, this method considers a bottom-up approach, which makes stakeholders feel committed in the decision-making process. However, this approach offers more freedom to stakeholders, who are asked to design a set of alternatives and analyse the related drivers and barriers. This happens by mixing the target groups (differently to MAMCA), which strengthens the democratic and participatory co-design approach. The process is following the step of DMF, where a logical framework approach is employed to facilitate the participatory approach, except that there is no DMF produced as the final product.

3.1. Participatory Approach (PA)

The Participatory Approach (PA) is used to design a critical model to support policy-makers to make decisions on the future of urban freight. The PA considers two parts that are connected to each other into the same framework:

- a problem tree, which includes the problem with the related causes and effects;
- a group of solution trees, which includes a set of solutions with the related drivers and barriers to their implementation.

The trees are connected to each other into the same comprehensive framework (Figure 1). Both are designed by the stakeholders through a consultative and democratic process that considers stakeholders as decision-makers who co-work to shape the future of the urban freight system.

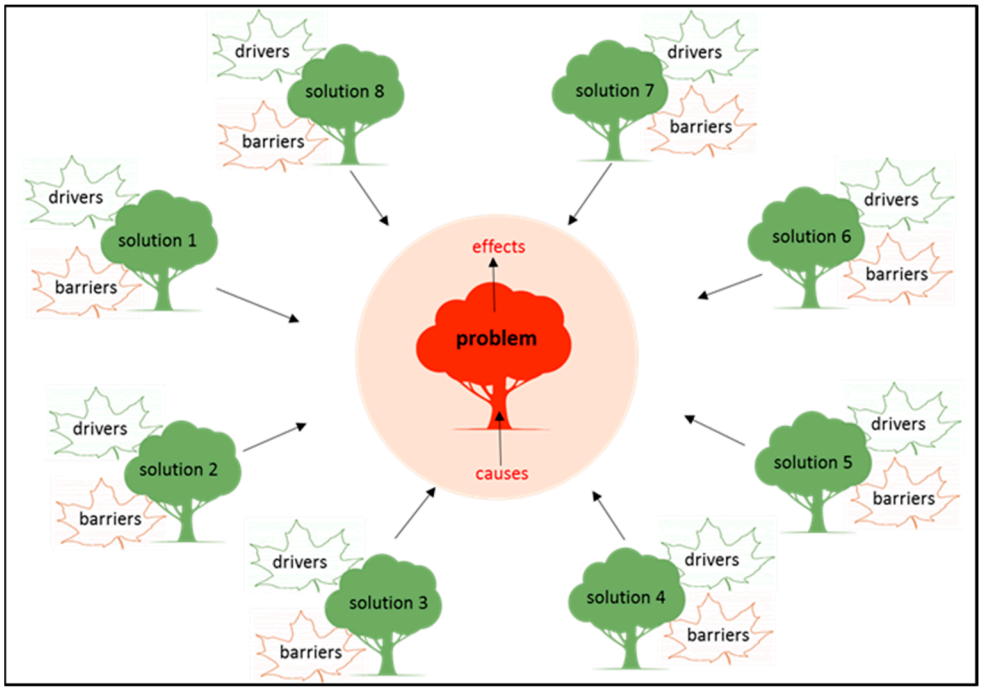

Figure 1. The "Problem tree and Solutions' forest" model (PTSF model).

The added value of this model is that problems are analysed by different perspectives, which consider all the key actors of the urban freight system who become decision-makers. In the same way, solutions are suggested considering all the possible combinations of current and future alternatives. This provides a holistic view of the problem, giving all the stakeholders the same 'weight/importance' in taking part in the process through a democratic and inclusive approach.

3.2. Stakeholder Engagement Workshops (SEWs)

The variety of the stakeholders (e.g., experts/managers from logistics and retail sector, policy-makers, customers) participating in the workshops provides a multi-perspective approach to both problems and solutions. SEWs allow to explore different needs and expectations about the future of urban freight and to understand what the priorities are for each target group, and for the community as a whole. The SEW is articulated into 4 steps:

Step 1. Stakeholder analysis. The research team: (1) identifies and selects key stakeholders based on their role in the urban freight decision-making process and their interest in the topic; (2) identifies their needs; (3) explores their expectations and perception of the current urban freight system.

Step 2. Problem Analysis. Stakeholders identify the main problem in the urban freight system and the related causes and effects. This step is very relevant to understand when there is any difference in the perception of the problem, based on the different role they assume within the urban freight system. At the end of step 2, stakeholders identify and select the most critical problem they want to solve.

Step 3. Solution Analysis. Stakeholders identify a set of solutions, which include current and future tools/schemes that can be used within the urban freight environment. They are required to imagine how the future will look like in 2040 and to highlight any kind of future solutions. For every solution, they are asked to identify drivers and barriers to implementation.

Step 4. Conclusions. The SEW ends with a summary of the results of the previous steps, which form a co-design framework to support policy- and decision-makers of the future.

All stakeholders who took part in the research activities gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Faculty Research Ethics Committee (Faculty of Environment and Technology) at University of the West of England, Bristol (UWE REC REF No: FET.18.10.015).

4. Results: The Co-Designed Framework

The research group invited and selected key stakeholders to take part in the workshops. At the beginning of each workshop, participants were informed about the reasons of the research, the urban freight background (e.g., presentation of some applications). Participants were asked about their role in the urban freight system, their needs and expectations with respect to urban freight problems, and future solutions. They were then provided with a problem card (e.g., a sheet with a red tree) where they had to indicate a major problem related to the urban context, identifying causes (roots) and effects (leaves). They were then invited to discuss with the other stakeholders and choose a common problem they wanted to solve together. Considering the selected problem, stakeholders were then asked to identify possible solutions on a solution card (e.g., a sheet with a green tree) with the related drivers and barriers for implementation. The facilitator of the workshop was attending in the quality of observer, and intervened only to ensure equity in terms of a balanced participation of all the participants, or in case something was not clear. Stakeholders' interactions and thoughts were audio-recorded. The facilitator's notes, together with the audio recordings and the raw materials produced by participants, were collected and analysed in order to identify stakeholders' perspective on the urban freight system of the future. Results are presented below.

The Problem

Not surprisingly, within the two workshops, both groups identified and agreed in indicating 'traffic congestion' as the main problem in the city of Bristol.

Causes. They identified 'population growth,' 'increased e-commerce,' and 'not optimised load factor' as main general causes. They also acknowledged 'segmentation of demand' (e.g., high number of stores with frequent and small-size deliveries), together with the presence of 'independent retailers' (e.g., especially restaurants, bars who use their own vehicles to deliver fresh food to their stores every day). 'Demanding receivers' (e.g., both retailers and individuals who want to set the delivery time or have 'same day delivery') were also included in the causes of traffic congestion. It is worth noting that the 'change of the landscape,' with the recent growth of offices and residences in the city centre, was included in the main causes. This produces a higher number of passengers and freight flows that encourages people to work from home to avoid spending time in a congested environment. Globalisation, "buying cheaper," and the "want-it-now" culture were been identified as important causes, due to people's unawareness and lack of knowledge.

Effects. Stakeholders identified 'air pollution' and the related impact on 'public health' as the most important ones. They also indicated 'road safety' and 'inefficiencies in the transport system' (e.g., 'slow journey time,' 'delay on transport network') as major effects. They also recognised that congestion and air pollution strongly impact the 'quality of life' in the city centre, 'discouraging walking and cycling,' and negatively reflecting on the 'shopping and visiting experience,' which can be translated into a 'loss of sales and profit' for retailers.

After identifying the main problem with the related causes and effects, stakeholders provided a set of alternatives to solve the problem. For each solution they also indicated drivers and barriers to implementation. These solutions were grouped into the measures shown in Table 1.

Table 1. Set of solutions.

Measure	Description
Traffic regulation and planning	Clear Air Zone (i.e., traffic restrictions to polluting vehicles in the city centre), congestion charging, workplace parking levy, pedestrianisation of the central shopping area, Park & Ride, bus lanes shared with delivery vehicles, and in the future night-time deliveries with Autonomous Vehicles (AVs).
Shared schemes	Virtual platforms/apps with uber/cabs for freight and passengers, collaborative schemes for carriers (e.g., sharing vehicles and customers to increase vehicle's load factor), passengers and freight tube, with specific wagons for freight.
Behaviour change	Not allow people to take deliveries to work, incentivise 'working from home,' communication campaigns to sensitise people to more sustainable choices.
Urban Planning and Land Use	Redesign the city (e.g., housing, workplaces) to reduce the number of flows in the city centre.
Freight measures	A network of micro-consolidation centres, cargo bikes, electric scooters, and 'walking' deliveries, Pack stations, virtual loading bays, IT, and efficient tracking information systems to allow flexible and sustainable on-demand services.
Behaviour change	Not allow people to take deliveries to work, incentivise 'working from home,' communication campaigns to sensitise people to more sustainable choices.

Stakeholders suggested that these solutions might be integrated into each other to maximise the effect. They imagined, co-designed and proposed the following futuristic 2040 scenario (Figure 2):

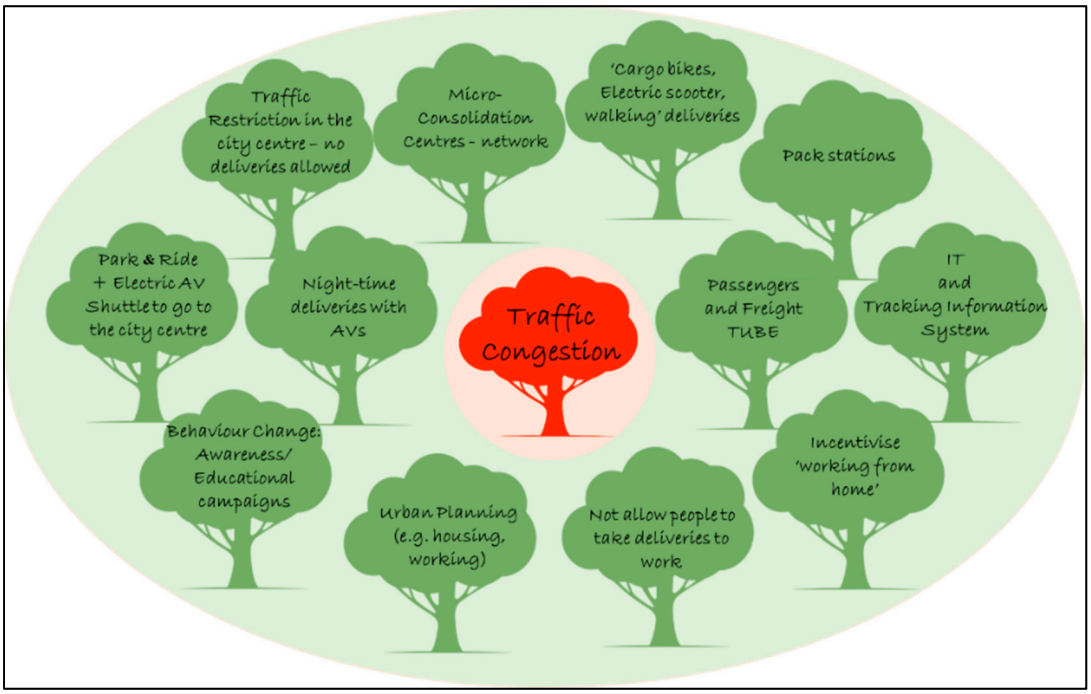

Figure 2. Co-designed 2040 "Problem tree and Solutions' forest" model (PTSF model). for the city of Bristol.

Road vehicles are not allowed to circulate in the city centre of Bristol, only Autonomous Vehicles (AVs) can circulate on public roads and deliver by night. A tube travels underground across the city, moving people and freight in an accessible network. Porters pick up goods at specific stations closed to micro-consolidation centres, which are organised in a network around the city centre. Here, goods are consolidated and delivered to destination points (e.g., stores, pack stations, collection points) via electric scooters, cargo bikes, and walking deliveries. The overall system operations are optimised due to IT and a Tracking Information System, which allows all the actors involved to monitor and check the ongoing operating status.

This significantly has cut traffic congestion off, which has progressively disappeared from Bristol. Citizens, visitors, and shoppers can now enjoy the high quality of life in the city centre. People who live in the suburbs can decide to access the city centre by bus, bike, or can get by car to specific car parks located outside the central urban area. Here, they can take an electric autonomous shuttle/pod that drives them to the city centre. The citizens of 2040 will feel more responsible and aware of their personal contribution in improving the quality of cities. This comes from a long educational programme started in 2020, which aimed to let people understand the impact of their choices on traffic congestion and air pollution. E-commerce is still an important factor, but receivers are now less demanding in terms of delivery times and dates in favour of a more sustainable and less impactful delivery solution. Pack stations are in every neighbourhood, and people are happy to collect their own goods when they go back home.

A range of drivers and barriers to the implementation of the above solutions have been identified. Probably the most important barrier is public acceptance and behaviour change. Stakeholders suggested a strong awareness campaign to educate people to sustainability and drive behaviour change to more responsible and sustainable choices. However, they acknowledged that" stick" measures (e.g., traffic restrictions, congestion charging, pedestrian areas) are needed to drastically reduce traffic congestion in the city centre.

Stakeholders also liked the idea of designing and implementing a passengers' and freight tube, which might have very high infrastructural and operational costs that could be well covered by passengers. They also recognised that communication is the key to ensure a successful implementation

of the solutions: "people need to understand why the measures are implemented," and "what kind of advantage they have with their implementation" (e.g., reduced congestion, improved air quality, public health and quality of life). They think this will be a 'step-by-step' process that will naturally evolve into more sustainable cities when all the stakeholders will understand that they all benefit from more sustainable choices.

5. Comparison with Newcastle

The fact that a freight partnership is already well established in Tyne and Wear region (where Newcastle is one of the cities in the conurbation) has created opportunities for new innovations and/or interventions regarding urban freight solutions to be introduced to the partnership's members. From the first workshop, a single, synthesised problem tree was formulated to identify three main causes for unsustainable freight: use of mainly conventional fuels for freight transportation; illegal parking on and around the city of Newcastle; and highly unconsolidated freight flows. The stakeholders also identified causes of those issues with lack of awareness of the problems, lack of collaboration, lack of regulation, and lack of co-operation.

After the first workshop, only a small number of key stakeholders were interested in following up with any real business model to address the city logistics challenges within their business operations. The city retailers and transport operators did not identify any freight issue and consequently dropped the invitation for the second workshop. Meanwhile, the University, the NHS (National Health Service) hospitals and the City council—the three big employers in the region—followed on to work on developing solutions. Three solutions were drawn to include:

- the use of clean vehicles via the use of electric vehicles;
- correctly parked freight vehicles via the routing and access maps for deliveries;
- coordinated freight deliveries via delivery and servicing plans, suppliers self-consolidation, the use of an urban consolidation centre, out-of-hours deliveries and vehicle time windows.

Following the successful engagement with the key stakeholders, the University, through the purchasing and estate service function, has adopted local city logistics policy, which include investment made toward electric vehicles to run consolidated deliveries to the University campus. Delivery servicing plans have also been employed to regulate the pattern of goods delivery to the campus. It was envisaged that the successful business operation should have been widened to include other big employers in the city to increase the impact, but a recent interview with key stakeholders found that the logistics innovative operation has now been aborted due to costly operation to the University.

On a wider note, to map the future urban freight system, Table 2 below summarises the stakeholder engagement outcomes from Bristol versus SMARTFUSION (as reported in [10,58]).

Table 2. Summary of results—Bristol vs SMARTFUSION.

	Bristol	Newcastle	Berlin	Como
Collaborators	Policy-makers, logistics professionals, experts, retailers, and citizens	City authority, logistics service providers, Freight Transport Association, city retailers, warehousing company, consultant, technology providers, experts, and many business subfunctions	City senators, city port warehousing company, consultant,	Collaborators, please see [53] for detailed description

Table 2. *Cont.*

	Bristol	Newcastle	Berlin	Como
Problems	Traffic congestion	Traffic volumes; high transportation cost; and high use of conventional fuels	Market uptake of electric vehicles in specific urban area that causes low air quality	Congestion and air pollution that causes congestion and air pollution
Objectives	Addressing traffic congestion and the related negative effects (e.g., air pollution)	Addressing traffic safety issue and low air quality	Addressing barriers for market uptake of alternative vehicles	Addressing congestion and air pollution
Alternatives	Integration of a range of urban freight solutions, e.g., micro-urban consolidation centre, passengers' and freight tube, electric AVs and cargo bikes, night-time deliveries, when delivering to retailers; and pack stations, traffic restriction, when delivering to privates (e.g., e-commerce). Both are supported by new policies on urban and transport planning, and awareness/educational campaigns driving behaviour change.	Adoption of electric vehicle to serve freight transport in Newcastle; and consolidation and coordination of high unconsolidated freight flows	Addressing imperfect market conditions with alternative propulsion systems; coordinating overpoweringly strong supply of cheap and flexible proven diesel technology; and to provide clear and stable political framework conditions	Adoption of environmentally friendly vehicle fleet; providing conditions for loading and unloading within the limited traffic zone; increasing load factor in vehicles; and to provide transport services to meet customers' expectations

As can be seen in Table 2 above, the visions of the sustainable urban freight system from the case studies are concentrated on general urban transport problems, namely: traffic congestion and environmental pollution. Efforts have been made via adoption of technologies and policies in which key stakeholders play a critical role in the success of the operation.

6. Conclusions and Policy-Design Implications

Despite the expected high impacts new technologies and future solutions might have on urban freight, the perception of the main stakeholders and their willingness to use these new forms of mobility are the key factor to a successful implementation of future sustainable urban distribution systems. The Participatory Approach proposed in this research project represents a key tool to design new policies with high impact on industry, economy, environment, and society. The novelty is that all the parties are involved in the process as direct actors, rather than spectators, and this adds value to the results. Differently to well-known participatory approaches (e.g., MAMCA, public consultation), this approach let participants be completely free (no choices are provided) to identify the problem and democratically find solutions. This freedom makes them more aware of the range of problems and encourages them to find and agree on solutions, critically analysing drivers and barriers. The involvement of key stakeholders from different target groups (e.g., logistics operators,

policy-makers, retailers, citizens) in the same workshop is also a key point, as they all can consider different perspectives and needs, and can design a system that works for all the parties involved. Other methodologies and tools used for stakeholder engagement do not offer the same freedom, and can be considered mainly consultative processes. In fact, they investigate the perspectives of stakeholders on a range of problems/solutions that were preselected by policy-makers or researchers, rather than asking them to independently and critically identify problems and solutions. Based on the above considerations, the Participatory Approach presented in this paper can be considered: (1) inclusive (e.g., involve representatives from all target groups); (2) equal (e.g., all stakeholders have the same weight, and all voices are considered within the decision-making process); (3) collaborative (e.g., stakeholders integrate each other's ideas to find a set of measures/solutions to solve a common major problem). Another added value was the size of the sample involved in each workshop. A small size of preselected key stakeholders fosters a more balanced contribution from all participants, and makes it easier for the facilitator to manage 'stronger' participants.

It is worth noting that this method is not intended to be a 'free-flow' process, it rather is a participatory process that guides key stakeholders into the identification and design of solutions in a collaborative way. Every participant individually identifies and suggests specific solutions that are then validated by the other participants during the discussion step. They are asked to discuss and critically analyse the feasibility (drivers/barriers) and integration of all the proposed solutions. The final set of agreed solutions is a result of multi-stakeholder perspective, critical analysis, and evaluation. The diversity of the key stakeholders involved, and their active role provides an output that reflects a more comprehensive analysis of the problem and the related solutions. This would not have been possible if only some parties were involved. The final set of solutions is then compared with the solutions described by the researcher/mediator during the 'induction' step (before the workshop starts). This is an additional validation step that allows the researcher to understand if the stakeholders' view is in line with the literature/state of the art. Each solution is then validated twice: (1) the participant who proposes the solution needs to discuss it with the other stakeholders, providing a critical analysis of the feasibility and impact (e.g., drivers/barriers), and needs the other stakeholders' approval/agreement to be able to include the solution into the final set. (2) The final set of solutions is then compared to the solutions presented by the researcher during the induction step (before the workshops starts). This represents a further validation step that allows the researcher to understand if the stakeholders' view is in line with the literature/state of the art.

Participants defined this approach as "engaging" and "easy-to-use." They recognised that, contrary to a more traditional public engagement, often used by local authorities in the UK, this approach is "quicker" and "very positive," as it encourages participants to find solutions for a 'common good.' Unexpectedly, none tried to propose solutions that could provide a personal advantage. Also, the participation of different stakeholders brings added value to the process, as different perspectives and expertise met together, trying to find a set of (integrated) solutions to a common problem. A guided engagement process such as participatory approach would help to promote cities to adopt a coherent policy toward achieving a future sustainable urban freight system.

The Newcastle freight stakeholder engagement forum has a much longer experience in comparison to Bristol. From the successful engagement process, which turns into a real operational city logistics' business model, this proves that dialogue among key stakeholders can bring change that involves investment commitment. Despite the failure to maintain operational efficiency of the new business model, the consultation process remains a key strategy to engage with key city stakeholders. A recent freight partnership meeting in Newcastle (December 2018) demonstrated a familiar agenda for the regional freight strategy, in which air quality standard is a priority with potential impact toward freight industry in the region.

From a practical point of view, Freight Partnership in the UK is generally not institutionalized, and only certain cities like Newcastle and London benefit from that. The new evidence from Bristol showed the need for such a forum, to catalyze new technological deployment, and allowed a wider

audience to access new knowledge while maintaining a public–private–academic relationship. The new evidence in Newcastle demonstrated that decisions emerging from the participatory processes can be turned into actual investment decision-making, although it stopped due to unforeseen operational barriers (urban consolidation centre location, certain products' delivery requirements (hazardous material and express delivery, please see [59] for detailed analysis), and electric vehicle maintenance).

From the theoretical point of view, participatory approach in urban freight planning is relatively new to many cities (authorities) in the UK and EU, as they are not familiar with what should be done as opposed to a formal consultation process for a new (transport) investment scheme, for instance. It is therefore not too surprising to draw some positive remarks from participants with the process, and this is especially the case for businesses with an interest in expanding their businesses with technological advancements. The problem of urban freight is not dissimilar to urban transport, and therefore the proposed solutions are rather generic, and freight solutions are at best ad hoc and benefit only certain stakeholders in certain business set-ups or interests. This fact is echoing concern of the barriers of institutionalizing such an approach and complicates understanding of the quality of policy decisions made as discussed in [48]—moreover, the fact that such multi-actor with multi-background interactions in urban transport decision-making can mesh distinction of description-driven and prescription-driven research objectives as once described in [51].

Revisiting Healey's (1998) [41] collaborative planning approach, urban freight transport vision-making lies in its contribution to building institutional capacity with focus on enhancing the ability of local stakeholders to improve their power to 'make a difference' in the qualities of the future of urban freight systems. On another note, 'collaboration' perhaps is the essential key catalyst alongside 'consolidation' and 'coordination' as city logistics best practices, to forming a '3Cs'—dubbing the popular '3Ds: density, diversity and design' concept in urban planning advocated by Robert Cervero [60] in addressing travel demand—that are badly needed for addressing city logistics demand to be sustainable. This research represents a step forward in supporting the ongoing and upcoming decision- and policy-making process, and is highly relevant to industry, society, and the environment, since it considers a challenging emerging topic with high impact on the three sectors.

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