Lecture Notes in Mobility

Beate Müller
Gereon Meyer *Editors*

Towards User-Centric Transport in Europe 2

Enablers of Inclusive, Seamless and Sustainable Mobility

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Lecture Notes in Mobility

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Foreword

The path towards a truly user-centric and intermodal transport system in Europe faces many challenges such as the implementation of novel transport solutions, ensuring the accessibility of these solutions for all EU citizens as well as guaranteeing the consistency of the solutions with the environmental objectives for climate protection.

Therefore, the Mobility4EU project[1], a Coordination and Support Action of the European Commission, employed a user-centric perspective and a participatory framework to develop a vision for the future transport system in Europe 2030 that would be user-centric, seamless and sustainable. All relevant actors from inside and outside the transport sector covering all transport modes including international, European and national stakeholders representing transport users, technology suppliers, policy makers, transport service providers and research organisations had been invited to participate in discussions at workshops and in surveys. The key learnings for the development of a user-centric transport system has been that the three pathways, *inclusive, seamless* and *sustainable* ideally interlink in synergetic ways and that

- universal design has to be employed in the development and implementation phase of novel transport systems;
- communities and planners have to be supported in exploring potentials of co-creation for urban mobility planning;
- Mobility as a Service (MaaS)-like systems should be implemented to build truly integrated and seamless travel across Europe; and
- the future mobility system needs to be developed in compliance with and mutually supporting the sustainability requirements towards the transport system.

[1] https://www.mobility4eu.eu/

The work and discussions on user-centric methods and developments in the project were driven by the lack of accessible transport, which prevents several groups of society from enjoying basic rights, e.g. right to education, employment, healthcare, etc. According to a study by the World Health Organisation, transport was frequently cited as the main obstacle for people with disabilities to participate in essential life activities[2]. Considering demographic ageing, it is expected that by 2020 approximately 120 million people in the European Union will have multiple and/or minor disabilities[3]. Furthermore, it is not only people with disabilities or the elderly who would benefit from user-centric design. Everybody benefits whenever a transport vehicle or service is made accessible. For instance, low-floor buses make transport usable not only for wheelchair users but also for people with different disabilities, for parents with strollers, small children, elderly people, and for people with heavy luggage.

To achieve user-centric transport, the Mobility4EU Action Plan recommends mainstreaming the method of universal design in the course of service and vehicle development or research from the initial to the final phase of the design, so that the final product would be accessible for every user[4]. If we translate the method of universal design to the realm of transport, it refers to the design and development of any transport vehicle, infrastructure and service so that they can be accessed, understood and used to the greatest extent possible by all people regardless of their age, gender, size, ability or disability etc. without the need for adaptation. Universal design would not exclude assistive devices for particular groups of persons with disabilities. A pre-condition towards a successful implementation of universal design in the future transport system is the involvement of users from the onset of the design to the final product, as well as the collaboration of stakeholders from all transport modes.

The papers, especially in chapter 2 of this book, address some practical applications and best practices of universal design in different contexts. These practices prove that solutions that respond to the needs of all passengers do exist; therefore, there is no excuse to create vehicles or transport services that are not inclusive of everybody. The most effective way to find solutions that are accessible for all is when developers and users work closely together, and the experience of passengers is respected and utilized in the course of the design and development.

User involvement is also essential in transport planning, especially in urban areas where the different interests of stakeholders lead to multiple conflicts in the public realm. The lack of citizen participation in top-down planning approaches often leads to sub-optimal solutions that are inconvenient or unaffordable for the

[2]WHO, World Report on Disability, 2011. Available at https://www.who.int/disabilities/world_report/2011/en/

[3]Federico Álvarez García, Polytechnic University of Madrid, EasyTV: Easing the access of Europeans with disabilities to converging media and content, Euroscientist, 25 July 2019

[4]Story, M. F., Mueller, J. L., Mace, R. L. (1998): The Universal Design File: Designing for People of All Ages and Abilities. Revised Edition. Center for Universal Design, NC State University, New York. Available online: https://files.eric.ed.gov/fulltext/ED460554.pdf

ultimate target groups i.e. citizens. Increasing participation in planning may have many positive effects. Firstly, citizens may show more support for schemes which were designed with their active participation. Secondly, policy makers can also promote services and infrastructure that better serve the needs of communities, therefore leading to increased satisfaction of citizens. While participation has been on the agenda for several decades, there is still a long way to go to achieve full participatory planning. Co-creation, for example, represents an advanced way of citizen participation. Despite this, there have been only a few examples of co-creation in transport planning, and the concept itself remains ambiguous. The articles of chapter 1 in this book review recent and ongoing projects applying co-creation in the transport domain. These concrete examples provide insights into the benefits and obstacles of the development and implementation of locally developed co-created mobility solutions. They highlight the potential for scaling up low-cost but high-benefit mobility solutions that have been initiated, designed and implemented by and with the local residents.

User-centric design is also important in order to put the several fragmented pieces of transport services together to allow every citizen to travel seamlessly and easily from any place in Europe to another in a reasonable timespan using multiple transport modes, including active modes of transport. Citizens should be able to book a single ticket valid for all trip segments even if the services are operated by different companies. When we compare this scenario with todays' transport system in Europe, the picture differs a lot. A multitude of transport service providers in each metropolitan area as well as transnational, long-distance operators of air, rail, or road transport offer isolated services. Digital solutions for trip planning and booking purposes are available but mostly limited to partial coverage of the entire transport services available.

The establishment of a MaaS system could be one potential solution to achieve a truly inclusive and seamless transport system in Europe. MaaS consists of the combination of services from public and private transport providers through a unified gateway that creates and manages the trip, which users can pay for with a single account.

However, several challenges and barriers arise on the way towards the successful implementation of a MaaS system. These include data sharing issues and reliability, incentives for users as well as for investors, and attracting a critical mass to use the service. Therefore the planning and implementation of MaaS requires collaboration between all relevant stakeholders. Discussions about the required elements such as a new legal framework, the implementation of technologies, and novel business approaches based on best practices will enable a common view on the MaaS system. The establishment of MaaS will be promoted through supporting the dialogue, especially in public transport and can be enabled by creating a common agenda and vision among the stakeholders on European, national, and local levels, and creating a data analytics and exchange framework.

Contributions in this book address potentials of viable business approaches for seamless transport, as e.g. traffic-management-as-a-service, innovative sharing and air mobility solutions in urban and peri-urban areas. Moreover, concepts to allow

seamless cross-border travel or interoperable electro-mobility services indicate the space of opportunities to solve current deficiencies.

The dialogue on solutions for inclusive, seamless and sustainable transport will be carried on beyond the Mobility4EU project within the European Transport and Mobility Forum (ETM Forum)[5]. The ETM Forum provides a platform to bring together representatives of all relevant stakeholder groups across all modes for passenger as well as freight transport. The ETM Forum is organised in working groups addressing the focus areas of the implementation of universal design, co-creation, and MaaS. The working groups are platforms where users and developers can discuss the challenges to design a future seamless mobility system accessible to everyone.

Mainstreaming the user-centric concept in the activities of working groups of the ETM Forum is essential. Just think of the recent developments of the autonomous vehicles that are deemed to be of benefit for all citizens, regardless their age or disability; or MaaS promising seamless travel for everybody. The members of the working groups share good practices, which can be of immediate guidance for developers and operators as well as policy makers. The outcome of these expert discussions will provide a valuable source of guidance to create policy and legal frameworks regarding universal design in the field of transport.

Everybody who is passionate about shaping the future transport system in Europe is invited to participate in the Forum, engage in discussions on challenges as well as potential solutions within the focus areas, and to connect with the other members representing a wide range of transport stakeholders.

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[5] http://www.etmforum.eu/

Preface

The public transport system of a city may appear disturbing or even scaring when entering for the first time. The complex overlay of different train, metro and monorail lines, each with their specific tariff and timetable structures, interconnects, and information systems are often overwhelming. The metropolitan region of Tokyo, for example, may appear particularly difficult to navigate, while actually it is the opposite: besides being fast and reliable, this city's transport web is surprisingly welcoming for foreign travellers: their staff are kindly anticipating the visitor's demands, and they are ready to give direction. The term Omotenashi is describing the underlying attitude of hospitality and service that is deeply implanted in the Japanese culture.

While the example of Tokyo is showing that a truly human and user-centric perspective can make a difference in transport systems convenience and accessibility, the reality is often the exact opposite all around the world. Transport is usually designed for the many, but not for all, thus turning travel for people with disabilities, but also for old people, for people with little children and others into a nightmare or even making it impossible. Often, transport systems let people question whether it actually answers the mobility needs of the users.

Consequently, inclusiveness is one of the three development paths in the 2030 vision for transport that the EU-funded Coordination and Support Action "Action Plan for the Future of Mobility in Europe" (Mobility4EU) recently explored—the other two are sustainability and seamless functionality. While the project is finished, its work is carried on by the European Transport and Mobility Forum (ETM Forum), a platform of experts discussing accessible, clean and multimodal future transport solutions for people and goods. Within the ETM Forum, three working groups have been established focusing on co-creation for mobility planning, involving users in R&D&I and discussing MaaS applications, challenges and opportunities. The chairpersons of these working groups are providing their take on the issues in the foreword of this book.

Like the first volume "Towards User-Centric Transport in Europe: Challenges, Solutions and Collaboration", the book at hand has been published in the "Lecture Notes in Mobility" series by Springer. It comprises a collection of chapters written

by ETM Forum members, invited experts and speakers at the 2nd Conference "Towards User-Centric Transport in Europe" that was held on 27–28 November 2018 in Brussels. The contents are focusing on technical, social, economic and legal aspect enablers of a user-centric, inclusive, seamless and sustainable transport system.

All authors' time and effort for writing their chapters are very much appreciated, as is the help of further experts with the peer review process of the book contents. Also, the European Commission's funding of and interest in the Mobility4EU project (EC Contract No. 690732) are particularly acknowledged.

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Contents

Co-creation of Future Transport System

Co-creation or Public Participation 2.0? An Assessment of Co-creation in Transport and Mobility Research

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Abstract. This paper investigates the use of co-creation in transport and mobility research. Based on the review of 5 on-going research projects and 5 papers in this field of research, we find that the term co-creation is used interchangeably with terms such as co-design and co-production. Moreover, co-creation is used as an innovation approach as well as a design method, and can focus on the process as well as the outcome. Rather than being a new method or approach, we propose a definition of co-creation that defines it as a form of public participation. This public participation 2.0 uses creative methods, emphasises innovation, and is situated on the highest rungs of Arnstein's ladder of participation. Future research should focus on the output of co-creation in order to investigate the added value of applying co-creation in transport planning.

Keywords: Co-creation · Public participation · Transport planning · Transport research · Mobility

1 Introduction

Public participation in policy-making allows the public to provide feedback on planned policy and enables policy-makers to design policies that better meet the public's needs. These (expected) positive effects of public participation have made it a legal requirement in many countries. However, there are many different forms of public participation, ranging from simply informing the public about policies to allowing them to design and implement their own policies. Despite the well-established tradition of public participation in policy-making, policy-makers are turning towards new governance approaches such as co-creation, as traditional policy-centric approaches no longer seem to be fit to address complex urban problems [1].

Drawn by the positive impacts of co-creation in the private sector such as increased efficiency and innovation, co-creation has become increasingly common in government discourses as well as research. While there is no clear and shared definition of co-creation, the different explanations of the term share an emphasis on the active involvement of the

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public in solving problems [2, 3]. Co-creation can therefore be seen as a form of public participation, in which those involved often have a high level of power.

Although public participation challenges the traditional top-down method used in transport planning, it has become a relatively widespread and well-established phenomenon. It has become especially relevant in changing the public's behaviour towards and perceptions of sustainable mobility [4]. Despite the potential for co-creation in transport, the application of it has not yet become common practice as it has in other sectors like education and health [5]. Furthermore, it is unclear what exactly co-creation is and how it can be applied to policy-making in the context of mobility planning since there is no good way to get a structured overview of how co-creation is currently applied in policy-making. The aim of this paper is therefore to assess how co-creation is approached in transport and mobility research based on a review of on-going and finished research (projects).

Using public participation as a starting point, this paper first discusses the use and development of public participation and its application in transport planning. The second section traces the origins of co-creation as well as related terms and analyses their application in transport research by comparing the different ways co-creation has been approached and applied in academic and grey literature. This is followed by a discussion on the implications of the conceptual unclarity of co-creation. The main findings of this paper are summarised in the conclusion.

2 Public Participation

Public participation can be seen as one of the foundations of co-creation, as the two terms share a focus on the involvement of the public. Just like co-creation, public participation lacks a clear, agreed definition. Half a century ago, Arnstein [6] already pointed out that there cannot be one definition because there are so many gradations. This lack of a common definition has also led to the use of terms that are similar or related to public participation, such as 'citizen participation', 'stakeholder involvement', or 'community engagement' to name but a few [7–9]. Having reviewed over 30 participatory processes, Schroeter et al. [8] define public participation as "a set of processes that include representatives of different social groups organised by a third party with the purpose of initiating a discourse and cooperative counselling process aimed at informing collectively-binding decisions."

Arguments in favour of public participation often stress that citizens possess values and knowledge relevant to decision-making, public participation can increase support for outcomes and facilitate implementation, and it is democratic since policy decisions affect the public [10]. Indeed, in her seminal article on the ladder of participation, Arnstein [6] writes that public participation is "a little like eating spinach: no one is against it in principle because it is good for you". Nevertheless, there are downsides to public participation such as higher costs, slower and more difficult decision-making processes, leadership problems, management difficulties, participation fatigue, decreasing credibility of authorities in case of failure, and increased inequity when only certain groups of people participate [11].

Several theoretical models have been developed to categorise the different forms of public participation. One of the earliest and best known attempts is Arnstein's [6]

ladder of participation. The eight rungs of this ladder represent eight different levels of influence for citizens. The bottom rungs are described as non-participation and are used when powerholders wish to educate or manipulate citizens in the guise of public participation. The middle rungs are defined as tokenism: although their opinions are heard by powerholders, citizens remain powerless when it comes to implementation. The topmost rungs give citizens influence and decision-making power.

Arnstein's ladder of participation has been critiqued and adapted by many scholars and practitioners. The ladder of participation has been critiqued for focusing on power relations between authorities and citizens and for implying that a higher rung is better than a lower one. Another critique is that Arnstein's notion of participation is devoid of context in which the ladder is used [12]. As an alternative to Arstein's ladder, Wilcox [13], for example, suggests five levels of participation: information, consultation, deciding together, acting together, and supporting. Here, the lowest level of participation means telling citizens what is planned and the highest level means helping citizens reaching their goals.

Transport planning is a complex policy domain in which involving the public is not straightforward. Although some stakeholders are involved in the classic model of transport planning, they are often only involved in the planning phase, are not involved frequently, and have little influence. Public participation is therefore challenging this classic technical, expert-led and top-down model [7, 14]. Transport planners have traditionally focussed on the physical dimensions of mobility such as urban form and traffic when looking for solutions to mobility problems, and less on the social dimensions such as people and proximity [4]. Their approach to transport planning is divided into steps from problem definition to implementation of a solution, and engaging in public participation was, until recently, not a concern to them [9].

Transport planners and policy-makers can benefit from involving the public, as it allows them to publicise their plans; provide information on proposed schemes; seek citizen's views on policies and proposals; gather information from the public on travel patterns; and engage in discussion on future policy [14]. The US Transportation Research Board [15] adds that public participation will result in policies that are 'owned' by citizens, are more sustainable, have more community support, and are more quickly implemented. Slotterback [16] writes that the involvement of citizens in transport planning can lead to improved community capacity and long-term changes in how public participation is handled by governments. The success of participation depends on the local context, however, which makes it impossible to prescribe any one way of public participation.

Public participation is a vital ingredient of sustainable mobility, which has a people focus, is local in scale, and includes environmental and social concerns [4]. Furthermore, the level of sustainability can also affect public participation. Portner and Berry [17], for example, found that more public participation takes place in American cities that are more committed to sustainability. Public participation can also bring ideas on the surface that contradict sustainability, however, as some citizens or stakeholders (e.g. car drivers) may suggest and/or favour unsustainable policies. Evaluation tools such as multi-criteria analysis (MCA) and multi-actor multi-criteria analysis (MAMCA) have been used in mobility projects to overcome this caveat by providing insights into the sustainability of

the different alternatives proposed as well as showing the potentially diverse preferences of stakeholders for these alternatives [18].

Although public participation has become a legal requirement in many countries, traditional top-down planning often includes a low level of public participation in which citizens have little power. Airport consultative committees in the UK are an example of this, as they are mandatory by law but have no statutory power [19]. Stakeholder involvement in the field of mobility and logistics has thus been very much on the level of consultation, dissemination of information and public meetings. Examples are the use of megafocus groups in Santander, Spain [20]; workshops in the Azores [21]; public consultation on regional transport plans in the UK [22]; and public acceptability assessment for congestion charging in London [4]. As decision-makers often see their task to rule *for* the people, not *with* the people, they often apply the lower levels of participation such as information and consultation as they wish to keep the decision-making power to themselves [3].

As urban problems are becoming more complex and citizens more vocal, traditional top-down planning is coming under pressure and policy-makers are turning towards new governance approaches like co-creation to involve citizens in finding solutions to problems [1]. Co-creation can therefore be seen as a form of public participation in which those involved often have a high level of power. The following section discusses co-creation and related concepts and how it has been applied in transport research.

3 Co-creation

Co-creation lacks conceptual clarity as it overlaps with other concepts and there is no consensus on whether co-creation is a method with which problems can be solved, an approach towards problem-solving, or both [1, 23, 24]. The literal meaning of co-creation is to together (co-) make something new (creation), but the concept has a different meaning depending on the field it is applied in [23]. In the context of urban research, co-creation is seen as an approach and has been defined as "a collaborative new outcome between two or more groups of actors" [25].

The origins of co-creation lay in the business sector, where consumer participation has been integrated into the supply chain and was dubbed 'co-creation' [23]. Co-creation allows businesses to produce their goods more efficiently as customers take over parts of the supply chain – such as having consumers transport and assemble new furniture at home instead of delivering assembled furniture – and serve as a source of innovation [26]. This also allows businesses to nurture customer relationships, and lowers costs for marketing, research and development [27]. Using co-creation, the customer is involved in a creative process in which they actively interact and share with the company, thereby allowing the contact between companies and customers to become an experience instead of a transaction [23]. The co-creation process thus generates value for customers as well as for the company [24].

Co-creation is often intertwined with co-design, a concept that also lacks conceptual clarity but whose definitions emphasise using the input of multiple stakeholders to solve a problem [5]. Co-design has been defined as "a design-led process, involving creative and participatory principles and tools to engage different kinds of people and knowledge

in public problem solving" [3] as well as "the effort to combine the views, input and skills of people with many different perspectives to address a specific problem" [5]. The relationship between co-creation and co-design depends on the discipline. In some disciplines, co-creation is a subordinate of co-design, in others this relationship is reversed [23, 26]. In this paper, the two terms are used interchangeably.

Co-creation can be seen as an approach towards innovation in which design is one step, or as a design method that uses tools and techniques to work towards a predefined goal (see Fig. 1) [23]. Whereas co-creation as an approach focuses on the different steps to be taken to go from problem identification to evaluation of a solution, co-creation as a design method focuses on how solutions can be generated and designed.

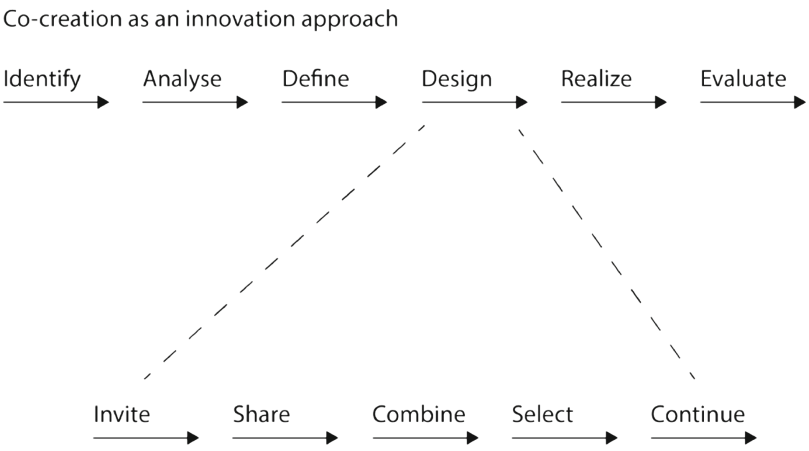

Fig. 1. The steps in a co-creation process [23]

Co-creation overlaps with other terms, movements or approaches such as open innovation and participatory design [28]. Other similar but distinct approaches to co-design are community engagement, co-production, participatory democracy, deliberative democracy, and human-centred design. The loose definitions of co-creation and related terms allow anyone to label any type of collaborative action as co-creation, whether or not it was intended as such [3].

The terms 'co-creation' and 'living lab' are also closely associated. According to De Koning et al. [23], living labs are vehicles for co-creation. This intertwinement of the two concepts can also be found in the definitions of living labs used by JPI Urban Europe [29] and the European Network of Living Labs [30]. What many definitions of living labs have in common are end-user involvement, open and social innovation, a form of governance (often by a public body), and a real-life setting [31]. Living labs also often have an approach similar to co-creation that guides participants from problem identification to design and implementation of solutions [32].

Co-creation can take place offline as well as online. One of the advantages of online co-creation is that it can result in more and more diverse participation as it allows anyone with internet access to participate whenever it suits them [33]. However, trust

and context are easier to communicate during real-life meetings and workshops than via internet platforms and applications [34]. Rather than choosing either offline or online co-creation, a combination of the two may be a more effective way to involve citizens [35].

In the context of public policy and planning, co-design has its foundations in established traditions of participation, collaboration and empowerment. Co-design methods include practical tools such as diaries, collages, model building, mapping, and roleplaying. These tools would allow policy-makers and researchers to reveal knowledge that would not have been uncovered using traditional participation methods [3].

Co-creation is situated high on the ladder of participation, as it involves many stakeholders, involves them during planning, decision, and implementation, involves them often, gives them influence in the process, and is motivated by instrumental as well as intrinsic goals (i.e. incorporating public values) [7]. Co-creation and co-design in policy-making is deemed to be more democratic, increase effectiveness, and result in more innovative solutions than other forms of public participation [3]. Similarly to public participation, which is seen as a virtue in itself, co-creation is also often a goal in itself [26]. Whether co-creation addresses the needs of citizens and is therefore correctly deemed a game changer in governance is unclear, however [2, 3]. Research has mostly focussed on the co-creation process rather than the outcomes, making it impossible to say whether co-creation is beneficial [26].

4 Co-creation in Transport Research

The previous section identified several features that can be found in co-creation. It can be used as an approach towards solving problems or as a method to design solutions; it can focus on innovation; it can focus on the process or on the outcomes; it can be used interchangeably with other concepts; it can be applied in living labs; and it can take place online and offline. In this section we review on-going and finished research (projects) that apply co-creation in transport and we analyse how co-creation is approached (see Table 1).

The articles mentioned in this section were found using Google Scholar by using combinations of the following search terms: mobility, transport, co-creation, co-design. The following two criteria were then applied to select articles: (1) co-creation or co-design was a focus of the research; and (2) the research was situated in the domain of mobility and/or transport. The few relevant articles found using these two criteria underline the lack of research. As co-creation in transport is a new field of research, the focus of the search was therefore widened to include grey literature such as project deliverables and project websites, which were found using the Google search engine. In total, 5 articles and 5 research projects were found and are analysed in the following section.

Table 1 shows how co-creation has been applied in transport research. Co-creation is often used to find solutions to mobility problems in an urban setting and at a neighbourhood or city level. Metamorphosis [44], for example, uses co-creation to create child-friendly neighbourhoods, and the co-created ideas in the Cities4People [45] project focus on improving the mobility options of local neighbourhoods. The other research projects

Table 1. Features of co-creation in transport research

Feature Authors and projects	Year	Co-creation applied to:	Term(s) used	Approach or method	Online or offline	Living Lab	Focus on process or outcome	Explicit focus on innovation
Enquist, Johnson and Gebauer [36]	2010	*Customer-relationship management of public transport operators*	*Co-creation* *Co-design*	*Method*	*Offline*	*No*	*Both*	*No*
Mitchell et al. [28]	2016	*Generate proposals for sustainable travel solutions*	*Co-creation* *Co-design*	*Method*	*Offline*	*No*	*Outcome*	*Yes*
Hofmeister and Stibe [37]	2017	*Change citizens' mobility practices*	*Co-creation*	*Both*	*Both*	*No*	*Both*	*No*
Stewart and Zegras [38]	2016	*Transport planning using digital tools*	*Co-creation*	*Method*	*Offline*	*No*	*Process*	*No*
Blomkamp [3]	2018	*Counter social exclusion*	*Co-design*	*Method*	*Offline*	*Yes*	*Both*	*No*
LOOPER [39]	2017–2020	*Solve mobility problems*	*Co-creation* *Co-design*	*Both*	*Both*	*Yes*	*Both*	*No*
Metamorphosis [40]	2017–2020	*Increase quality of life for all by co-creating child-friendly neighbourhoods*	*Co-creation*	*Method*	*Offline*	*No*	*Both*	*Yes*
SUNRISE [41]	2017–2021	*Solve mobility problems*	*Co-creation* *Co-production*	*Both*	*Both*	*Yes*	*Both*	*Yes*
Cities 4 People [42]	2017–2020	*Solve mobility problems*	*Co-creation*	*Method*	*Both*	*Yes*	*Process*	*Yes*
Mobility Urban Values [43]	2017–2020	*Solve mobility problems*	*Co-creation* *Co-design*	*Both*	*Both*	*No*	*Both*	*No*

listed in the table have a similar focus. Mitchell et al. [28] also apply co-creation to improve the sustainability of travel solutions at a local level in Loughborough. Enquist, Johnson and Gebauer [36], however, apply co-creation at a national level.

Different terms such as co-creation, co-design, and co-production are used in the articles and projects. In their case study on the customer-relationship management of the Swiss national rail operator (SBB), Enquist et al. [36] use a definition of co-creation in which co-design is understood as one *aspect* of co-creation alongside customer engagement, self-service, customer involvement, and problem-solving. In the Mobility Urban Values project, a clear distinction is made between co-creation and co-design: whereas the former is process-oriented and focuses on citizens, co-design is solutions-oriented and focuses on stakeholders [46]. In the LOOPER project, co-creation is seen as the process in which the co-design of solutions takes place [47]. In the SUNRISE project, however, co-creation is used interchangeably with co-production [48].

Co-creation in transport research is applied as an innovation approach as well as a design method. The LOOPER and SUNRISE projects, for example, view co-creation as an approach that leads from problem identification to implementation and evaluation of solutions. CoAXs (Collaborative Accessibility-based Stakeholder Engagement System), on the other hand, sees co-creation as a tool that aims to generate discussion between stakeholders on the accessibility impacts of transport projects. This interactive mapping tool was used to generate discussion on new bus rapid transit corridors in Boston, Massachusetts. Moving markers around on an interactive touchscreen, the tool calculates and visualises which areas of the city are reachable within different travel time thresholds, mode of transports, and destinations [38]. The Biking Tourney campaign used co-creation as an approach as well as a method to alter mobility practices of citizens towards cycling in Boston, Massachusetts and Austria. The co-creation approach was divided into three stages – idea generation; prototyping; and release – and was interspersed with co-creation methods such as experience mapping, prototype design, and gamification. All the inputs and experiences from participants were used to set up a large-scale cycling campaign [37].

Research on co-creation in transport often applies a combination of online and offline methods. Metamorphosis focuses on children to transform neighbourhoods and uses offline co-creation methods to generate solutions [44]. LOOPER, SUNRISE, Cities 4 People, and Mobility Urban Values, all combine offline and online co-creation. The LOOPER project, for example, uses offline and online co-creation during each step of the co-creation process. Offline co-creation usually take form in workshops in which co-creation methods are used, such as the 'Rings of Connections' activity to identify which connections participants have and can be valorised during the project to find solutions. Online co-creation tools allow citizens to participate in parts of the co-creation process such as problem identification and design of solutions [47].

Co-creation in transport research frequently takes place in living labs, especially in research projects. The description of the living labs is different per project: the LOOPER project calls the labs 'urban living labs', Metamorphosis uses 'neighbourhood mobility labs', Cities4People uses 'citizen mobility labs', and in Auckland it is called a 'co-design lab'. In research projects, each city in which co-creation takes place is often called a 'lab'. Metamorphosis, however, simply calls the different locations 'case studies'.

Co-creation in transport planning can have a focus on the process as well as the outcomes. In the Metamorphosis project, co-creation is seen as a method, as the project is "rather about experimenting than about final solutions" [49]. Cities4People also sees co-creation as "a collaborative process of design and creation" that focuses on the process rather than output [50]. The LOOPER project and the Auckland Co-design Lab in New Zealand both focus on the process as well as the outcomes. The latter has applied co-design to improve the driver licensing system in order to reduce social exclusion of the local indigenous population. The process included interviews between public sector workers and local families to understand their struggles with the licensing systems. This allowed public sector workers to come up with ideas to improve the system. These ideas or outcomes were then tested with more end users, and the results of which were communicated to policy-makers [3].

Innovation is a frequently emphasised aspect of co-creation in transport research, especially in on-going research projects. However, what exactly is meant by innovation is unclear. SUNRISE [51] mentions "innovative and sustainable mobility solutions", Cities4People [50] "innovative and smart mobility solutions" and Metamorphosis [52] aims to "achieve creative breakthrough innovations". Mitchell et al. [28] used co-creation techniques with participants such as story sharing and idea generation using 'how might we' statements to find ideas to improve sustainable mobility. After evaluating the innovativeness of co-created ideas by looking at whether the ideas had been implemented or proposed locally as well as elsewhere in the world, they conclude that co-creation led to a higher number of ideas, but that those idea are equally likely to be innovative as those generated without co-creation.

5 Discussion

Whereas public participation is not a new concept and has become institutionalised in many countries, co-creation is a more recent addition to (transport) planning and research. On a conceptual level, the novelty of co-creation can be put into question, as its attributed impacts are similar to those of public participation and can be seen as public participation 2.0. Both concepts are seen as more democratic than other policy-making methods and are expected to increase support for solutions from the public. What co-creation adds to public participation is a focus on creativity and innovation, but whether it actually leads to more innovative ideas is unclear [28]. Nevertheless, although co-creation is often situated on the higher rungs of the ladder of participation [26], just like 'regular' public participation, its outcomes can only be transformative in combination with decision-making power [53]. We therefore propose that co-creation should be seen as an approach or method used within public participation rather than a completely separate entity. In this view, co-creation is situated on the highest rungs of Arnstein's [6] ladder of participation: delegated power and citizen control.

The place of co-creation within transport planning and research is still unclear, as co-creation has been applied in different ways in different contexts. The examples cited in the previous section show that research on co-creation in transport is done on a case study basis. Applying the same co-creation approach and/or methods in similar contexts would allow for making comparisons and generalisations regarding the usefulness and

relevance of co-creation in transport planning. Furthermore, the lack of conceptual clarity allows one to identify co-creation where it was not intended or called co-creation. For example, Lucas [54] applied 'action research' to resolve transport policy challenges in London. This approach *could* be defined as co-creation: different actors such as citizens, policy-makers, and researchers were brought together, there was an emphasis on social learning, creative methods such as citizens' filmed experiences to generate a discussion on social exclusion were used, and solutions were designed together and later implemented and their effects were monitored.

As research has mostly focussed on co-creation as a process and not on the output of the process (one notable exception being Mitchell et al. [28]), it remains impossible to say whether using co-creation has a positive impact on transport planning or on citizens, and whether the outputs are sustainable. As with public participation, one could posit that co-creation can be a goal in itself. The pitfall here, however, is that public trust in decision-makers decreases when citizens are asked to give their input, but which is then not taken into consideration. This barrier to applying co-creation in transport planning is the same as the barrier to public participation. Decision-makers should therefore first identify how co-creation can be useful in a policy process instead of aiming to do as much co-creation as possible [5].

Co-creation in transport planning is a rather new phenomenon, as the low volume of academic articles shows. Future research should investigate how co-creation is approached in practice, to what extent co-creation is beneficial and to whom, and whether the co-creation outcomes are beneficial and to whom. This would allow co-creation to move beyond being a goal in itself to being a proven approach or method that helps policy-makers, citizens and researchers to find solutions to complex urban problems such as mobility problems.

6 Conclusion

Co-creation has become a buzzword in policy making as well as research. Based on the sources reviewed in this paper, it has become clear that co-creation – together with related terms like 'co-design' – have trickled into transport research. Public participation in transport is not new, but public participation processes in which citizens are given a high level of power are rarer. Power holders often see it as their task to rule *for* the people, not *with* the people. The novelty of co-creation has allowed it to become a 'magical concept' [55] that has a broad range of meanings and carries a positive normative charge. Its application in transport research shows that there exists a multiplicity of definitions and approaches of co-creation that make generalisations as well as assessing its effectiveness difficult. Rather than being a new method or approach, we suggest that co-creation can be defined as a form of public participation in which creative methods are used, innovation is emphasised, and which is situated on the highest rungs of Arnstein's [6] ladder of participation.

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