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Hubs for People and Goods: nodes to achieve societal goals

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Abstract

For urban planning challenges, such as increasing scarcity of space, hubs can pose a solution. In this paper we define hubs as an interchange, transshipment and/or node consisting of different activities, services and facilities. Hubs have the potential to contribute to urban challenges concerning mobility, logistics, livability, sustainability, (conflicting) spatial claims, and welfare beyond GDP. In this paper four main bottlenecks in hub development are described based on literature, project experiences and expert judgement. Furthermore, we list elements that need to be addressed for integral, futureproof hub design, using lessons learned from the European MOVE21 project. The paper concludes with a discussion on knowledge gaps and next steps to overcome barriers, so that hubs can transform from ‘only a transport solution’ to integral, futureproof hubs to achieve societal goals.

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1. Introduction

The attention for urban mobility and logistics hubs is increasing. Policy ambitions and measures such as Zero Emission Zones (ZEZ), climate neutral cities and car-free or car-lite cities increase the need for solutions such as hubs where multiple solutions (ranging from mobility, to logistics and societal solutions) can be combined (KiM, 2021; RI.SE, ARUP, 2020). Especially in the context of urban planning, where scarcity of space is an increasing challenge, a hub can pose a solution with a lot of potential - however, also with a lot of complexity.

MOVE21, an innovation project funded by the European Commission, works on multimodal and interconnected hubs for freight and passenger transport with the main objective of transforming European cities to functional urban areas into climate neutral, connected multimodal urban nodes for smart and clean mobility and logistics. By combining mobility and logistics, MOVE21 aims to improve efficiency, capacity utilisation, accessibility and innovation capacity

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(MOVE21 (b), 2021). The project will test and upscale both technical and non-technical solutions in Living Labs (Oslo, Gothenburg and Hamburg) and replicator cities (Munich, Bologna, Rome).

To achieve the ambitions of the project, as well as to implement hubs as a solution that contributes to various societal challenges, there is need for a more integral and futureproof approach to designing and implementing hubs. In this paper we want to address four main bottlenecks in hub development based on literature, experiences from projects (including MOVE21) as well as expert judgement. These are:

1. A too limited scope in relation to the involvement of domains and disciplines (KiM, 2021; Stevin, 2020);
2. A lack of strategy and vision. This accounts both for finding ways to make hubs work (from perspective of the user, the operator and societal contributions) beyond the pilot stage and also to include a network perspective;
3. Insufficient attention to (the full width of) governance aspects such as stakeholder involvement, roles, responsibilities, ownership and steering mechanisms (Groenendijk, 2017; Wamsley, 1999 in Hill & Hupe, 2002:13);
4. Undisclosed knowledge and knowledge gaps that lead to miscommunication, unrealistic expectations and an inefficient design and implementation process.

We also want to highlight four elements that should be considered for integral and futureproof hub design to overcome these bottlenecks in hub development:

- Creating a vision based on integral goals (Berkers et al., 2017; TNO & Provincie Noord-Holland, 2020);
- Working from an multidisciplinary and futureproof system perspective;
- Adaptive governance (TNO, 2021); and,
- Working area-oriented and fact-based (TNO & Provincie Noord-Holland, 2020).

If these bottlenecks can be overcome and these four elements can be implemented, hubs could be *more* than a transport solution. This way hubs can also contribute to – as MOVE21 aspires – urban challenges concerning mobility, logistics, livability, sustainability, (conflicting) spatial claims, and welfare beyond GDP (APPM, Posad Maxwan, Vereniging Deltametropool, SUM-one, 2021). Finally, in this paper we want to share the lessons learned towards implementation of integral and futureproof hubs in MOVE21 as well as address the remaining knowledge gaps and barriers towards implementation.

2. Urban Hubs

Municipalities, regional governments, national governments and private parties are faced with major social challenges. It is expected that multifunctional mobility hubs can contribute to achieving social goals such as liveability, sustainability and accessibility at both regional and local levels. Both in existing neighborhoods and in area developments, hubs can improve the environmental quality and combine challenges (including energy transition, greening, climate adaptation and the mobility transition), save space, and facilitate housing, working and recreation (APPM, Posad Maxwan, Vereniging Deltametropool, SUM-one, 2021). Hubs can in this way contribute to policy goals like car-free city centers and Zero Emission Zones. This will require a major adjustment in the behaviour of travellers and the carriers of goods and thus also in the design of hubs. The demand for hubs is not only increasing due to these types of policy developments, but also due to the ever-growing pressure on space in urban areas. Hubs are put forward as a solution to relieve this pressure. However, developing and spatially implementing a hub is therefore also complex (Hub Holland Hub, 2021)

Depending on how you view them, hubs are not necessarily new. There are existing hubs in logistics, in construction and (urban) hubs for passenger mobility (Mobiliteitsalliantie, 2020). A port, train station or airport is thus also a hub for people and goods. A hub can also be seen as another word for node. The smart spatial integration of mobility (often with special attention to public transport) with living, working and leisure in a hub is therefore not necessarily different from the traditional node developments (CROW, 2019). The KiM (Netherlands Institute for Transport Policy Analysis) defines a mobility hub as “physical links between transport modalities that, in addition to their mobility function, can also serve as concentration points for spatial development” (KiM, 2021). At the same time, hubs are

currently presented as innovative and promising solutions. We note that while there are many different definitions of hubs, there is still a lot of confusion about the concept and innovative aspects of hubs. So, what's new?

TNO defines hubs as an interchange, transshipment and/or node consisting of different activities, services and facilities. Hubs can be classified on several characteristics including (geographical) scale (the area served by the hub and the area where the effects of the hub are visible), functions with subdivision into (sub)activities (e.g. interchange location, partial mobility, transshipment, etc.), users/target groups and the governance aspects (e.g. ownership, operation, cooperation constructions) (Janjevic & Winkenbach, 2020). We have identified two knowledge gaps in the field of hubs is futureproofing and an integral set of societal goals. By future-proof we mean that already in the development of the hub, trends and developments are taken into account that may have limited application today but may play a larger role in the future. Examples are MaaS (Mobility-as-a-Service), partial mobility, electric transport, zero emission logistics and self-driving transport. Only by having insight into these trends and developments and how this can transform mobility and the living environment in urban areas, it is possible to take them into account in the hub design. By an integral perspective we mean that attention is paid to the full breadth of societal goals with a focus on welfare beyond GDP. It is our hypothesis that a future-proof and integral perspective - with attention to welfare beyond GDP - can increase the attractiveness, added value and financial feasibility of a hub.

In addition, attention is needed for the interaction between transport of passengers and goods in urban areas in order to provide a place for functions for passenger mobility and logistics also within (high) urban living environments. Less "attractive" functions such as heavy logistics receive less attention within urban development, which means that they may only be incorporated at a later stage. This can lead to sub-optimal solutions and detract from the quality of the environment. This also applies to the energy (infrastructure) required for the hub and its functions, in particular for the charging of electric (part) vehicles. Electric vehicle charging, according to Netbeheer Nederland (2019), requires "much more peak power" which may result in the need for substantial expansions of the electricity grid - which, of course, also implies a spatial claim (Netbeheer Nederland, 2019). This demand for peak power is also shown in MOVE21 as an important resource constraint (risk of electricity shortages) that will only increase in the years to come with more electrification and thus more claims on grid capacity (Rostoft & Jensen, 2022). A hub can also offer services that do not have a direct link to mobility but can increase the social added value of a hub. For example, a day care center for the elderly, a library, café or a central meeting point in the neighbourhood.

A hub aims to solve multiple problems at once, however, we see a number of shortcomings in the current approach to urban mobility hubs to fully utilize the potential of hubs. Despite the often sky-high expectations, a hub is not yet specifically designed to address multiple societal challenges. It is regularly thought that a hub is an easy solution, a 'quick-fix'. Realizing a hub in existing public space, where there is often little or no space left and where the infrastructure for mobility and energy is heavily burdened, involves many complexities and requires making difficult choices and trade-offs and the timely involvement of the right parties (Hub Holland Hub, 2021). In fact, the wrong design of a hub can create more spatial claims, energy consumption, emissions or deteriorated quality of the living environment if it is inefficiently used and/or does not achieve the intended behavioural change. In this paper, we discuss some of these shortcomings - bottlenecks in hub development - followed by an outline of how hubs can be designed to be more future-proof and integrated. This paper concludes with four points of interest for governments in the development of urban mobility hubs.

3. Bottlenecks in hub development

In the current approach to hub development, we have identified four barriers that detract from both future-proofing and integrality of urban mobility hubs. These are: 1) too narrow scope, 2) lack of vision and strategy, 3) insufficient attention to governance, and 4) lack of knowledge.

3.1. Too narrow scope

First of all, hubs are now too often designed from one domain and from one location while they could actually be an intersection of social tasks and an important link in a network of hubs. To illustrate: the clustering of mobility and energy demand within hubs, for example through the local generation of energy, the buffering of energy in electric vehicles and the realization of charging infrastructure, seems a logical step to take in the energy transition of the

mobility system (KiM, 2021). If only the mobility domain is used as a starting point, there is a risk that the required energy infrastructure will have to conform to the mobility solution. For example, developing a large charging plaza in an existing downtown parking garage may require an enormous grid reinforcement, while this might not have been necessary at another location. The potential to link the energy transition and mobility transition is very high provided it is designed integrally to ensure efficiency (from a space, energy and mobility perspective) and affordability (Stevin, 2020).

Broadening the scope in hub development is an explicit part of the MOVE21 approach. The goal is integration on the levels of policy and governance, technology, infrastructure, as well as vehicle and energy sources (MOVE21 (c), 2022). Organizing this integration is one of the central challenges in the project. What is seen in the Living Labs of Oslo and Hamburg is that this is especially difficult considering that hub development is highly context dependent. Therefore determining the scope and needs is not a one-size-fits-all exertion (Baeza & Naue, 2022; Rostoft & Jensen, 2022). In Hamburg for example, it is mentioned that in one area the scope should be broadened to include social justice and equal access to basic services, whereas in another it is facilitating services complementary to workplaces (Baeza & Naue, 2022).

3.2. *Lack of vision and strategy*

Second, we see a lack of vision and strategy in the implementation and development of hubs. Hubs are mainly developed as an operational-tactical measure - an ad-hoc solution to a problem in the here and now or the near future. This development then takes place mostly bottom-up and it is often not well-explicated what the contributions of the hub are to the societal goals, how the hub relates to the systemic perspective, and lacks a strategy to get it up and running. There is a lot of momentum for hubs as a concept, which runs the risk of building air castles and failing to achieve real impact at the system level and change in the behavior of travelers and carriers of goods.

In MOVE21, some of the Test Sites in the Living Labs are located in areas that are foreseen to undergo developments in the coming years, transforming by adding housing, facilities, workplaces or placemaking. This means that the needs with regards these areas will also change during development, as well as the relevant stakeholders to consider. Reasoning only from the current situation therefore does not make sense. The challenge is to start learning and experimentation now, keeping long term development needs in mind. This is specifically the case in Oslo (Filipstad) and Gothenburg (Klippan and Lindholmen) (Rostoft & Jensen, 2022; Sobiech & Schnur, 2022). Oslo is also looking at developing a network of hubs in the city, that should seamlessly integrate transit, Public Transport, shared cars, micro mobility, cargo bikes and parcel pick-up points and includes charging facilities as well (Rostoft & Jensen, 2022). In Gothenburg, regarding the Klippan hub, placemaking is of big importance – to serve the future users of the area and make sure it is developed as a ‘place’, not just a ‘path’ (Sobiech & Schnur, 2022).

3.3. *Insufficient attention to governance*

As a third bottleneck, we note that governance - choosing, prioritizing, directing and steering (Wamsley, 1999 in Hill & Hupe, 2002:13) - is often lacking at present. Roles and responsibilities around the hub and its development are unclear. Also, the added value of the hub and its functions in relation to the goals and needs of stakeholders (in particular companies, governments and users) is not sufficiently explicit. The development of hubs is a growth process in which governance can be a crucial success factor. Many hubs currently remain stuck at the level of pilots without scaling up because many success factors of a pilot (such as enthusiasm, additional resources, proprietary methods) are precisely the failure factors of scaling up (Groenendijk, 2017). Organizational issues are also important here; which governments and other stakeholders are responsible and involved in hub development? And how are policy dilemmas dealt with? What policies contribute to/incentivize the use of hubs? What is the optimal location of hubs and what is the impact of additional facilities such as a supermarket or a community center on hubs? These types of governance questions are still open.

In MOVE21, several governance-related challenges arise. In the Living Labs, handling resource constraints is challenging, especially when it regards long term financing as well as spatial implementation and competing claims (Baeza & Naue, 2022; Rostoft & Jensen, 2022; Sobiech & Schnur, 2022). Oslo is developing a concept where mobility

on demand for people is integrated with freight, using the same vehicle for transportation of people and goods. This concept however will be operationalized by Ruter, Oslo's public transport authority, which is fully owned by public entities. This new concept will compete with private services, while being subsidized with public money. Oslo's Living Lab will need to find out what possible legal and regulatory issues this creates and how to involve these private parties in the process (Rostoft & Jensen, 2022). In Gothenburg, with regards to policy and regulation, they are finding out how to organize permits for their hubs and Test Site activities. This relates to the fact that it is expected that organizing permits for pilots will not cause too much friction – since it is temporal. However, when scaling up, or working towards lasting solutions, permanent permits might make more sense, though this also means that you have to organize a different process, involving all key stakeholders (e.g. real-estate owners and landowners) (Sobiech & Schnur, 2022). Hamburg also recognizes this trade-off. In one of their pilot locations, they will use a building that is temporarily available, but will be demolished. This means that the maximum duration of the contract is 2 years (Baeza & Naue, 2022). Therefore taking into account how to scale the solution, in cooperation with stakeholders is already part of the process.

3.4. Lacking and undisclosed knowledge

Lack of knowledge is the last bottleneck. This is not to say that there is no knowledge available, but that it is incomplete and fragmented across different disciplines, scale levels and stakeholders; there should be more switching between them. The shortcomings in fundamental as well as applied and practical knowledge about future-proof, integral hubs ensure that in hub development navel-gazing occurs and that people often try to reinvent the wheel. In hub development, much use is still made of qualitative images, without solid foundations. At the same time, new knowledge about hubs is now being developed at a rapid pace. However, finding, unlocking and applying it is also a challenge.

One of the knowledge gaps is realizing behavioral change resulting in the use of the hub. We currently do not know who exactly uses/will use a hub for what purpose. We also do not know enough about how to steer this behavior. Making a hub look nice and attractive and making it easy to use is not enough to realize behavioral change, but it is what is currently receiving a lot of attention. Research is being done into which factors influence the willingness to use a new technology in the mobility domain. This shows that both extrinsic motivation (expectations about the performance, how easy it is, social influences, linked services and the perceived risk), intrinsic motivation (which includes sustainability, health and the fun factor) and demographic characteristics of the intended users are all important (Alonso-González, 2020; Schikofsky, 2020; Zijlstra, 2020). Stakeholder advocacy and behavioral change of both travelers and businesses thus requires a strong strategy that convinces them to use hubs - even when this involves an additional transfer or transshipment. Additionally, the social impact and contribution of hubs and its functions to broad prosperity have not yet been sufficiently researched. However, its importance is increasingly recognized (Liao & Gorreia).

Also in MOVE21, this will be challenging since the project is working in a context that is a) prone to uncertainties (both in terms of the outcomes of the project as well as the future needs and context in the Living Labs) and b) developing and implementing innovation in a new collaboration structure that is highly context dependent. One of the specific knowledge gaps is how to determine the contribution of hubs to societal goals such as reduction in emissions. This is challenging to measure, as not all data is readily available, but crucial to make impact explicit. Another challenge is that the involvement of the end-users – citizens – is challenging to organize and to be further anchored in the operations of the Living Labs. It is an integral part of the approach that in the project a quadruple helix stakeholder representation is present. However, this is specifically challenging when it comes to the involvement of citizens (When to involve them? Do you use proxies? On what level (test site or Living Lab) are they involved? What is their role?, etc.). Another knowledge gap relates to the long term economic viability and business models of the to be developed hubs. This is specifically important when regarding the sustaining of the hubs after the project lifetime. The hubs – and ideally also the quadruple collaboration structures that have been set up during the project – should not only be able to survive with public investments but have a viable business case and long term financing strategy. (Baeza & Naue, 2022; Rostoft & Jensen, 2022; Sobiech & Schnur, 2022).

4. Futureproof and integral hub design

To overcome the barriers a different approach is needed. We propose an approach based on four main principles: 1) integral goals with room to learn, 2) a multidisciplinary and future-proof system perspective, 3) adaptive governance, and 4) area-oriented and fact-based work. All this in collaboration with stakeholders.

4.1. Integral goals with room to learn

First, it is important to work integrally in the design and development of hubs. This requires looking beyond system boundaries. A first step is to secure this integrality within the mobility domain by making the link between logistics and passenger transport and by coordinating individual modalities (TNO & Province of North Holland, 2020). There will also need to be a broad consideration of the (social) goals to which hubs could contribute and the effects that hubs have, directly or indirectly, on the environment. In order to be able to work integrally and across system boundaries, it is helpful to be able to visualize this. Serious games or simulation environments (digital twins) can help to step out of one's own perspective and arrive at joint choices (TNO & Provincie Noord-Holland, 2020). Finally, it is important to maintain space for learning in order to optimally use resources to achieve a certain goal (Berkers et al., 2017). This is also called a 'living lab' approach, where changes can be applied during the process based on lessons learned (iterative and adaptive) (Quak et al., 2016). This living lab method is applied, among others, in the European Commission-funded project MOVE21. Here TNO supports the living labs in Oslo, Gothenburg and Hamburg in the development of multimodal hubs that combine passenger mobility and freight to contribute to zero emission targets, liveability and social cohesion (MOVE21 (a), 2021).

4.2 A multidisciplinary and futureproof system perspective

A multidisciplinary and future-proof system perspective is essential to avoid sub-optimizations. This requires a strong strategy and integral vision that goes beyond the mobility domain. For example: not forgetting the energy sector when developing a mobility hub with electric (partial) transport, and the impact as well as the added value for the immediate environment. The spatial perspective should also be well secured here. Space should not only be considered at the location of the hub, but also in the network perspective of hubs; when space is at a premium somewhere, functions may be better distributed over a network of hubs. The time factor is also of great importance: not only looking at the here and now, but also at the future with additional trends and developments and future effects at the system level. It is therefore important to involve different sectors (including mobility, logistics, economy and space).

4.3 Adaptive governance

In many cases, governance is addressed in the development or design process, but this often includes only one or a few elements. In addition, there is also a difference in governance of steering hub development from a policy perspective (facilitating, stimulating and/or regulating) versus management of hubs. TNO has developed a governance framework for 'new mobility' which covers the full breadth of governance aspects. These are: strategy and approach, goals, motivation and desired outcomes, stakeholders and interests, market structure and market characteristics, and finally policy and steering mechanisms. In addition, it is also important to identify the contextual factors (drivers and barriers, timing, context and culture) (TNO, 2021). Adjustments over time are also necessary to remain in line with current needs and to respond to trends and developments. To this end, all governance aspects will also need to be periodically reassessed to remain proactive and flexible. In this way, the process (such as the commitment and role of parties), the content (such as the use of measures) and the timing of the actions can be handled flexibly" (TNO & Province of North Holland, 2020). Going through the learning cycle (plan, do, check, act) in projects and pilots can contribute to using experiences to improve in this way (Berkers et al., 2017). In this way, closing the learning circle can also contribute to scaling up hubs beyond the pilot phase.

4.4. Work area-oriented and fact-based

Finally, it is important to work in an area-oriented and fact-based manner. In an area-based approach various authorities and parties work together on the tasks of that specific area. This way of working forces parties to look beyond the boundaries of their own organization and to develop solutions that are more broadly applicable than only those that concern their own interests and domains (TNO & Province of Noord-Holland, 2020). It is important that fact-based information is used and that the geographical scope of the hub is not too limited. The effects of the hub may be more widely felt than the immediate area where the hub is located. Fact-based information can be both quantitative (for example, using models to clarify the intended effects and impact of the hub) and qualitative (for

example, with regard to the necessary governance and agreements to resolve barriers in the chain).

5. Next steps

Giving the complex societal challenges urban areas face and that need to be addressed within the space that is already scarce, we have formulated the following four recommendations for municipalities, regional governments, national governments involved in the design and development of urban mobility hubs:

1. Define which hubs we are talking about and what are the (possible) goals, functionalities, target groups, areas and time periods to which they contribute. It is also important here that existing hubs are recognized and acknowledged!
2. Start now with an integral and future-proof design (instead of a global hub concept with potentially disappointing effects). It must be prevented that castles in the air are built and the actual contribution to objectives and the impact of the realized effects of the hubs are not highlighted.
3. Pay attention to the adaptive governance of hubs for the purpose of steering hub development from a policy perspective (facilitating, stimulating and/or regulating) and the management of hubs. This creates room for learning and scaling up hubs beyond the pilot phase.
4. Paint a real picture of the knowledge base, formulate open knowledge questions for the future and make use of the knowledge that is now being built at a rapid pace. This is not only about scientific knowledge but also about area knowledge. Complexity is precisely about bringing together the right knowledge that can support hub design and decision-making.

Despite the fact that a hub is not a simple, quick fix solution, it is expected that there is great potential contributions to urban challenges around mobility, livability and sustainability by the implementation of hubs. If designed and developed adequately, a hub can be more than a mobility solution. A future-proof, hub is an intersection of social tasks, domains, functions, target groups (quadruple helix), areas, space claims and between now and later.

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