



Analyzing discursive policy leadership using regime narratives in Sweden's emerging drone transport for sustainability transition

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ABSTRACT

Sweden aims for carbon neutrality by 2045, including a fossil-free transport sector. Radical innovations like civilian drones and eVTOLs offer potential for sustainable, electrified, and integrated transport, but integration is challenged by infrastructure, connectivity, regulation, and public concerns. This paper explores discursive policy leadership in governing drone innovation for sustainable transition, focusing on Sweden. Using a multi-level perspective and narrative discourse analysis, we conducted 18 expert interviews with national, regional, local, and private actors. We examine how drones are narrated within sustainable transport and how accounts reveal the presence or absence of niche leadership. Findings highlight four insights: (1) lack of public-sector leadership risks reinforcing division between private actors and regime lock-in; (2) ideological tensions frame drones as disruptive or conflictual; (3) fragmented responsibilities hindering policy coordination; and (4) new discursive models are needed to reflect complexity. We argue for active discursive policy leadership and inclusive governance to unlock drones' transformative potential.

1. Introduction

This article examines how competing scenario narratives in Swedish drone policy and regulation reflect and reinforce broader dynamics of discursive policy leadership and storytelling, in order to understand the political nature of sustainable transport transitions within a Multi-Level Perspective (MLP) framework. We aim to clarify how discursive leadership supports radical niche innovations such as civilian drones and electric vertical take-off and landing vehicles (eVTOLs). Discursive leadership and storytelling shape meaning and establish boundaries, framing what policy options are viable, desirable, or even discussable. These narrative frames can create lock-ins that either enable or constrain pathways toward sustainable innovation, especially in contested sectors such as aviation.

Geels [1] has sought to integrate power and politics into the MLP by highlighting “core alliances” between policymakers and incumbent firms, which may either counter or reinforce change. Understanding how policy and market elites collaborate across levels is vital, since

energy transitions involve controversial social and economic consequences and redistribute wealth [2]. Actors differ over who should exercise niche leadership to legitimize technologies such as drones, underscoring calls for more research on the politics of transitions [3]. Politics, in turn, plays an important role in the failure or success of experimental initiatives.

To capture the political dynamics at niche and regime levels, researchers increasingly apply political science theories [4]. These distinguish discursive, instrumental, and institutional forms of power between policymakers and industry, helping to clarify strategies available to niche actors. Equally important are social networks, which represent incumbent organizational capital and institutionalized power [5–7]. Their openness or resistance to change influences whether transport systems remain locked-in institutionally, socially, and technologically.

Sweden has committed to achieving carbon neutrality by 2045, including a fully fossil-free transport sector [8]. Resilience theory differentiates between adaptation (changes within existing systems) and

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transformation (shifts toward entirely new systems) [9]. Radical innovations such as drones or eVTOLs exemplify potentially disruptive technologies envisioned for passenger, cargo, and emergency operations across urban and rural areas [10]. They could contribute to energy transition by integrating ground and air networks, accelerating electrification, reducing emissions in certain contexts, and improving accessibility and cost-efficiency [11–13]. Globally, many countries are preparing for drones to function as niche innovations within larger transport systems.

European drone regulation is advancing rapidly. The European Aviation Safety Agency (EASA) sets rules for certification, operations, U-space, and vertiports, in collaboration with advisory groups [14]. National Aviation Authorities (NAAs) oversee compliance in each country, while the EU Drone Strategy 2.0 stresses the involvement of regional and local bodies to regulate implementation in lower airspace near citizens [15].

In Sweden, effective regulation requires coordination across national, regional, and local levels [16]. For emerging systems, a distinction exists between managers—who govern within existing structures—and leaders—who challenge current arrangements and promote systemic change [17]. Drones require multi-level participation, yet this depends on policy prioritization and research support. At present, there is limited scholarship on the role of leadership in shaping drone policy and its implications for sustainable transport transitions.

Literature increasingly combines MLP and discourse analysis to study sustainability transitions at the landscape level [18,19]. Our contribution expands this work by examining issue framing at the regime level, where it shapes deliberation and coalition-building. Frames and discourses structure rules and practices that constrain or enable multi-actor networks [20]. They also influence whether niche actors can advance ideas or technologies that deviate from existing practices and potentially lead to transitions [20–22]. Narratives thus play a central role in the ability of niche actors to attract markets and broader regime interest.

The aim of this paper is to analyze how relevant Swedish policy actors narrate niche leadership—or its absence—in managing drone innovation, through expert interviews and discourse analysis within the MLP framework. We use narrative as a discursive approach to explore policy leadership in the Swedish drone sector and its implications for sustainable transport and energy transitions.

We address two research questions:

RQ1. How do actors narrate drone innovation and the roles for drone policy development in Sweden?

RQ2. How do actor narratives suggest the presence or absence of niche leadership to manage drone innovation in Sweden?

Our empirical data is based on 18 semi-structured interviews with regime-level actors in the Swedish drone sector. Public actors from national, regional, and local levels were included, alongside one private stakeholder identified through an initial stakeholder analysis of the Swedish and European drone landscape. Snowball sampling further helped identify relevant interviewees. A scenario narrative approach was employed to examine how actors involved in or affected by drone development narrate its potential role in Sweden.

The added value of this article is to demonstrate how discursive policy leadership and storytelling shape the policy landscape around radical niche innovations such as drones. By focusing on Sweden, we highlight how discourses can either protect or neglect drone development as part of sustainable transition, and how the presence—or absence—of leadership influences these trajectories.

2. Theoretical framework

2.1. Drones, sustainability transitions and the multi-level perspective

This paper explores the under-researched area of discursive policy leadership in the governance of drone innovation, focusing on Sweden

using a Multi-Level Perspective (MLP) and narrative discourse analysis. Transport studies have been integral in socio-technical transitions research, such as the MLP [20]. The MLP entails three levels: niches, which are protected spaces where radical innovations emerge; regimes, which are dominant systems, practices, and rules characterized by self-reproduction; and the exogenous landscape, the broader external context (e.g., climate change, political crisis, economic trends) influencing both regimes and niches. Regimes are destabilized when landscape pressures create windows of opportunity for niche innovations to drive transformative change.

Sustainability transitions refer to “long-term, multidimensional, fundamental transformation processes” towards more sustainable socio-technical systems [23]. These often entail regime shifts, where dominant technologies, institutions, and practices are disrupted and reconfigured through novel alternatives [24,21], exhibiting co-evolutionary dynamics [25]. New technologies are nurtured by niche actors before reaching the market (regime level). Niche actors can cooperate or clash with regime actors when exposed to the regime environment [26,27]. Drone transport is located at the niche level, where alternative practices emerge. Drones disrupt current technologies, infrastructure, markets, policies, and social behavior because “current systems in the regime are locked-in and path dependent” [26].

Adoption of drone transport depends on permits, regulations, and infrastructural investments. Implementation is difficult without strong cooperation between niche actors and government. Active cooperation of industry as niche actor and government as regime actor is necessary, but not sufficient, for sustainable implementation. Co-evolution of entities is essential [26]. These perspectives are important to understand policy leadership in promoting niche innovations such as drone transport.

Institutions are pivotal, shaping actor behavior and technological trajectories while also transforming during transitions [28]. Strategic niche management, as outlined by Kemp et al. [24], highlights protected spaces for innovation to mature and challenge entrenched regimes. Actors’ social construction as outlined by Berger and Luckman affects tangible outcomes including. This actors’ social construction of innovations influences how niches and regimes evolve, and there is high dependence on the public sector to facilitate disruptive niche innovations that demand discursive leadership.

To understand if such leadership exists, focus is needed on actors, their social constructions of the innovation, and their reasoning within the MLP, applied across different analytical levels [29,20,5,30]. The interplay of ideas and interests determines the degree of policy divergence and innovation in transition governance [31]. Avelino et al. [32] highlight that such processes are political, involving struggles over power, legitimacy, and agency. Raven et al. [33] stress the political difficulties of “how emerging niche technologies face powerful incumbent socio-technical systems” and “how claims, counterclaims, and bargaining over risks and benefits of lower-carbon innovations shape their development.” Language plays an important role in structuring and hindering innovation, an integral aspect of the political nature of MLP – shaping agendas so that a transition is supported or prevented at a conceptual level. This paper therefore explores the narratives of actors related to drone innovation.

2.2. Discourse theory and narratives

Discourse plays a constitutive role in transition management, serving as a means for articulating visions, legitimizing pathways, and contesting incumbent power structures [34,35]. MLP has included discourse theory to analyze frames, narratives, and storylines to understand how these shape interpretations of problems, actors, innovations, and transition pathways [36]. Framing plays an important part in MLP studies, as it shows how issues are framed in particular ways, conveying different meanings and prompting varied social and policy responses [37]. Niche innovations are framed in competing matters, depending on whether

actors are close to regime incumbents and view them as “a drain on economic development, and system integration problems,” or niche advocates, who emphasize “climate mitigation, potential new business growth, new energy paradigm” [36].

To understand an innovation and gather support or resistance, MLP stresses including cultural dynamics in analysis, using narratives and storylines to assess support among the public, policymakers, and other stakeholders [38]. This means the attractiveness of niche and regime storylines will change during transitions [36]. Story appeal may depend on “empirical fit (how storylines fit with perceived facts about the world), experiential commensurability (how they resonate with lived experience), macro-cultural resonance (fit with cultural repertoires), actor credibility (knowledgeability and trustworthiness of actors promoting a storyline)” [36]. The idea is that positive salient discourses foster social and cultural acceptance of niche innovations [39,40], including increased policy support, while negative discourse creates “social acceptance problems for niche-innovations” [36].

Buschmann and Oels [41] define discursive lock-in as “institutionalized mechanisms of discursive reproduction that include mechanisms of reproduction related to a mental map (or discourse) based on increasing returns,” and to reach a discursive turning point “the mechanisms of reproduction of the hegemonic discourse must be disrupted effectively” [41]. They argue this can be achieved through deliberation, performative action, and external shocks [41].

Narratives constitute a form of discourse that does more than depict reality; they suggest, through linguistic patterns, what reality ought to be. Common to all narratives is a plotline organized in three parts: a beginning, middle (where the state of affairs changes), and an end [42]. The plot explains why change is happening and makes sense of it through characters given meaningful positions in the narrative, either as heroes or villains. We use narratives to construct versions of reality, making it possible to rewrite them with new plots, leading to new narratives [43,44]. Psychological research shows language in general, and narratives in particular, are central tools through which humans make sense of their social world [45–49]. Narratives function as “sense-making devices” where “people encode into narratives the problem that concerns them and their attempts to resolve these problems” [50]. As Ricoeur observed, a narrative as sensemaking tool “does not simply consist in adding episodes to one another; it also constructs meaningful totalities out of scattered events” [51].

Ochs [52] states that narratives are political activities, and rights to official storytelling are “asymmetrically allocated, granting reflective rights to some more than others” and, more importantly, “the meaning of experience and existence ... tends to be defined by some more than others” [52]. It therefore matters who the storyteller is, and narratives must show a change of state [52]. All narratives need a “key event that disrupts equilibrium of ordinary, expected circumstances” [52], enabling transition from broken equilibrium to a new one through plot twists. A plot needs characters and forces pitched against each other [52, 53]. As Todorov [52] argues, characters can be human subjects, nature, animals, or time. Three key steps construct characters and a plot: “introducing legible differences between the actors (a hero and an opponent); attributing a function to single events; and finding an interpretive theme that subsumes the events and links them in a meaningful sequence (‘near success’, ‘near failure’, etc.)” [43].

3. Methodology

This paper is a qualitative study that uses interviews as the main source of data and conducts a narrative analysis to explore the policy leadership or lack thereof for drone transport from a multi-level perspective. As we are interested in actors and their social construct of the regarded innovation and their reasoning within the MLP, this paper sets off from a social constructionist ontology which stresses the role of actors in shaping social reality and how they deal with the emergence of an innovation or event [54,55]. For this, semi-structured interviews are

conducted with experts in the field with relevant regime level actors for drone innovation.

3.1. Interviewee selection

The selection criteria for the respondents were that the respondents should be relevant actors for drone transport implementation. This includes Swedish aviation and transport authorities, Swedish regional and local public bodies, Swedish regional airports, and global researchers in the field (as shown in Table 2). One private actor in the frontier of Swedish electric aviation was also included in the list as they are a major driver of innovation and techno-scientific knowledge and thus can be considered both niche and regime-level actors [20]. Since this is an emerging innovation, we did not expect many of the actors that are not directly involved with drones to have much experience or knowledge of drone transport. However, as their role is still relevant and important in shaping the regulatory landscape of drones, their narratives were crucial. This is important as it also helps in providing valuable insights into how proactively these actors are involved in topics of such emerging innovations and in receiving their valuable insights in the roles of innovation in relation to sustainable transitions from their day-to-day operational standpoint. Inspired by Raghunatha et al. [56], relevant public actors from national, regional, and local levels were selected, in addition to a private actor after conducting a quick stakeholder analysis of primarily the Swedish and European drone transport landscape. Snowball sampling was used where some interviewees also suggested relevant actors to interview.

3.2. Data collection

Our data collecting process began with creating a structured set of questions to guide the interviews, which ensures consistency and relevance in the data collected while doing the interviews in the next stage [57]. The interview questionnaire was open-ended and prepared using points of departure and rules of thumb from Bryman [54] to ensure that the interview was semi-structured, valid, and credible (as presented in the Appendix). The questionnaire was designed to facilitate actors to narrate their knowledge of drone innovation, how they perceive it in terms of benefits, challenges, and future images, policy needs that they perceive to be essential, and how they narrate their own roles as well as the role of other actors. The questions were primarily “how” and “what” concerned with drone emergence and policy landscape. These questions were sometimes also followed by “who” questions, to prompt the interviewee to reflect on roles of relevant actors, and in doing so, reflect on their own roles. Once the guide was ready, the researchers collected the data by performing the interviews with the selected participants. The interviews were conducted virtually using Microsoft Teams. They were recorded with interviewee consent and transcribed using NVivo software, followed by manual corrections for further analysis. The transcribed text was then organized and coded into categories based on emerging themes and topics. Finally, the categorized data was analysed to find key narrative plotlines. The steps are presented in Fig. 1.

3.3. Data analysis

Detailed narrative analysis was conducted for data from the transcribed material to identify patterns for different narrative frames. By reading the data several times, excerpts that were transition narrative plotlines were identified and extracted. Inspired by the narrative frame and the role of the policy storyteller from Nordensvärd and Ketola [58], the framework as shown in Table 1 was used as the skeleton for identifying and analyzing these narratives. The transition narrative plotlines were analyzed for key events that form the central plotline of the narrative, by identifying what the interviewee narrates as the first state of equilibrium, the disruption that creates change in this equilibrium, and the new equilibrium as a result. In addition, we identified main

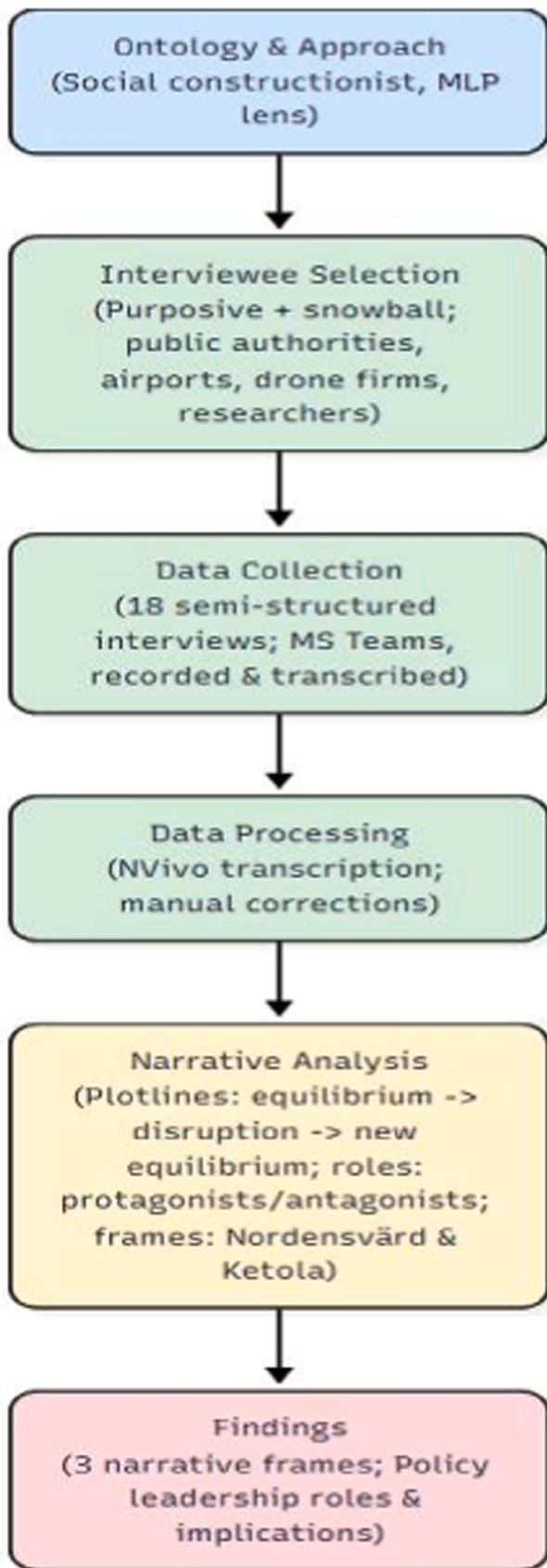


Fig. 1. Data collection process.

Table 1

The narrative frame used to analyze transition narratives in the study (inspired by Nordensvärd and Ketola, 2021).

	Transition narrative frame	Policy storyteller
Characters	Pitting a protagonist and antagonist against each other, e.g.: <ul style="list-style-type: none"> • Innovators vs. vested interests • Dominant technology vs. niche innovation • Status quo vs. change • Public sector vs. private sector 	The policy storyteller tells: <ul style="list-style-type: none"> • how this is a problem • why this is a problem
Plotlines		
EQ(A): Where is the first state of equilibrium in the story?	The current situation and the protagonists' interests are compared and understood to be a conflict of interest and transition statement	The policy storyteller tells: <ul style="list-style-type: none"> • what will happen if change does not occur
Change: What disrupts EQ(A) and creates change?	The protagonists' suggestions for the solutions to the conflict	The policy storyteller tells: <ul style="list-style-type: none"> • what is the solution • how will change happen • who will lead the change • who will be a hindrance to the change
EQ(B): Where is the next/last state of equilibrium in the plot?	The protagonists change the overall system by achieving change and challenging the status quo	The policy storyteller tells: <ul style="list-style-type: none"> • the ideal outcome – what this transition leads to • why this outcome is desirable

Table 2

List of interviewees.

Respondent	Position	Organization	Location
01	Senior manager	International public body	UK
02	Case manager	National public body 1	Sweden
03	Senior advisor	National public body 2	Sweden
04	Project manager	National public body 3	Sweden
05	Environmental economist	National public body 4	Sweden
06	Urban planner	Local public body 1	Sweden
07	Urban planner	Local public body 2	Sweden
08	Urban planner	Local public body 3	Sweden
09	Urban planner	Regional body 1	Sweden
10	CEO	Regional airport 1	Sweden
11	CEO	Regional airport 2	Sweden
12	CTO	Drone company 1	Sweden
13	Head of department	Drone company 2	Sweden
14	Program director	Drone company 3	India
15	Research manager	Research institute 1	Sweden
16	Senior researcher	Research institute 1	Sweden
17	Senior researcher	Research institute 2	Sweden
18	Director	Research institute 3	USA

characters, i.e., protagonists and antagonists in this transition. We therefore derived the three different types of narrative frames that answer RQ 1 and further discussed the roles and leadership of policy actors and its policy implications from the narratives to answer RQ 2.

3.4. Potential and delimitations

This methodology has several strengths and limitations. The study's social constructionist approach and use of narrative analysis are well-suited for exploring how actors' beliefs shape drone policy. The semi-structured interviews and snowball sampling help to capture rich, in-

depth data from a diverse group of relevant stakeholders, including public and private sector actors. The primary limitation is the limited number of interviewees, which affects the generalizability of the findings. The reliance on self-reported narratives means the data may be subject to participant bias. Additionally, conducting interviews virtually via Microsoft Teams may have limitations compared to in-person interactions.

4. Results and analysis

Our analysis focuses on understanding the interviews as acts of storytelling, and on finding out their perception and sensemaking of the development of drone transport. We draw out the principles of the interviewees’ storytelling approach before we outline the plotline of the narrative and how each storyteller narrates their truth about drone transport from different perspectives. By doing so, we present how the different actors tell their story about the drone transport situation by adapting the same socio-technical narrative frame to understand the crisis, the characters, the events and the plot in different ways. The socio-technical narratives frame for drones is presented in Table 3.

4.1. Market frame – private actors lead drone implementation

In this frame, the leading actors are the private sector, aviation industry and startup companies that are developing the technology for sustainable drones to transport goods and people. This narrative puts corporations in the driving seat and it is up to these private actors to develop, demonstrate, and convince other companies of the need for a particular technology. An outcome is a symbiosis where companies rely on each other and earn capital.

Companies that very, very much would like to sell drones, probably and earn money on it. Other organizations and companies will mostly look at what is the most efficient solution because it will always be, no matter what kind of new technology is driving it, the companies that will try to make it work. – Respondent 4

A few of the actors also argued that the leading actors in the private sector would most likely be startup companies that will come in and change the market with new groundbreaking technology and Respondent 18 estimated it to be “1000 to 5000 startups who would play an active role in drone transportation and infrastructure building”. In this case it is about active actors that will turn around a particular technology and make it attractive to invest in Respondent 15 argued further that there will be particular companies such as Tesla needed to bring drones further: “But I think there’s a good reason why Tesla was the one that pushed forward and succeeded in electrifying so many cars. And I think it’s partly because they’re not confined by old ways and a big legacy of doing things in a certain way. I think we’re going to see a bunch of new players in this field.” Here, one actor also compares the development of electric cars with drone transport to highlight how much the market can change by one new actor who presents new technology and pushes the rest of the market to change as well. The respondent is talking about new technical actors who will come into the socio-technical regime of drone transport and lead the development [59]. We can see here a belief in a disruptive innovation that will happen, but there is less of a reliance on creating a protective space as often suggested in the MLP literature. The narrative instead focuses on the strength and power that comes with new entrants on the market that will turn the market upside down. Therefore, we can see that change will come from outside the public domain and remain within the private sector to make a case for why drones will change the transportation system. It is therefore the task of the firm/entrepreneur to promote niche innovation and to gather support from policymakers and the government, leaving the public organization in a more passive role. Respondent 9 that investment into new space is a “market issue” to create and test eco-systems and efficient services: “the services that you develop and deploy and test in Sweden will also be viable for other locations, and it’s

Table 3 Applying the socio-technical narrative frame in the drone transport change storytelling.

	Market frame – private actors lead drone implementation	Collaboration frame – public actors co-learn with private actors to lead drone implementation	Non-priority frame – public actors’ priority is limited to pre-existing technologies
Characters	<u>Protagonist:</u> technology, innovators, aviation industry, startup companies <u>Antagonist:</u> hackers, security issues <u>Side characters:</u> society, acceptance	<u>Protagonist:</u> private actors, public actors <u>Antagonist:</u> trains, politicians that want to close down airports, public organizations that don’t cooperate <u>Side characters:</u> society, lack of knowledge	<u>Protagonist:</u> trains <u>Antagonist:</u> drones and aviation <u>Side characters:</u> flight shame
Plotlines			
EQ(A): Where is the first state of equilibrium in the story?	Using drone technology is in the nascent stage due to ecosystem development (supporting technologies for infrastructure) <u>Worst case scenario</u> – Drones will not get a chance to safely contribute to issues with ground transportation and business.	Drone technology and its ecosystem are already developed and can contribute to society and business, but lack policy support. <u>Worst case scenario</u> – Drone transport won’t be available for everyone if only private actors control it, only wealthy people will have access and be potentially dangerous to citizens and society.	Drones are only relevant for delivery of medicine or extinguishing forest fires, not delivering goods or transporting people. We already have road transport that is more suitable. <u>Worst case scenario:</u> Consumers will continue travelling with aviation and we will not achieve our environmental goals.
Change: What disrupts EQ (A) and creates change?	The private actors, aviation companies and startup companies will lead the way and present new drone technology.	Private and public sector will collaborate and present regulations and infrastructure that will make the transition easier.	Climate change will mean moving away from aviation towards trains. We need to focus our resources on building fast trains
EQ(B): Where is the next/ last state of equilibrium in the plot?	Drones will be a solution to transport goods and people, bringing society closer, and contribute to business interests. The technology and private sector will lead the way; the rest will follow and sort itself out	A safe space is created with clear regulations and infrastructure that will make drones useful and contribute to society and business interests. Public actors learn from private actors to then support them, while private actors enable public actors to take the lead	Society will use fast trains instead of aviation, which will lead to a more sustainable way of living

difficult to only develop one part of this ecosystem”.

The respondent highlights that drone technology is very much a part of an ecosystem that is not isolated from society, but an integral part of it, and that it is hard to develop technology in isolation without considering the various actors that will be affected by drone transport. Geels [59] describes socio-technical regimes as protective spaces where actors can develop niche innovation. However, differing from

technological regimes, socio-technical regimes also involve other actors from academia and public organizations [59]. The actor also indicates that the current regime needs to make space for this niche innovation to be further explored, developed and deployed into the transport regime. This space-making will be closer to some measures for policy support or protective measures, but it is not so well developed in this narrative. A market-based approach is seen to be used for orienting and justifying the need for investments in drone transport so that businesses can offer safe and emission-free services to society.

The actors argued that the development and implementation of drones, with innovation leading the way, will lead to a whole other society with better connections to different parts of society and make rural areas come closer.

We have this problem in Sweden, that all those rural areas are becoming more and more isolated, which is really a social problem. Drones could actually be a way to reverse that trend for Sweden, to really socialize and to reconnect small villages and together because look, maybe it's not affordable to have a bus line between some small town that is 50 km away from a bigger town, but maybe it would be feasible with drones in the future. I think that it could actually become a way of reconnecting rural areas in Sweden. – Respondent 10

The actor draws different problem areas such as marginalization, accessibility, and affordability within the current ground transportation system predominantly governing the socio-technical regime of local and national transport. Here, drone implementation is envisioned as a niche innovation that holds a public purpose for rural and isolated communities and is advocated contextually through a community-based approach. Policy is deemed necessary in this frame due to the antagonists mentioned: Respondent 9 argues that if the “the regulation is there, I foresee that drone deliveries will become a natural occurrence in every city”. The actor acknowledges the danger of creating and operating the niche innovation and needs the regulations to be set up to minimize the risks and challenges: a safe learning environment where technology can thrive as a narrative, without any risks of collisions or other dangers of safety. .

4.2. Collaboration frame – public actors co-learn with private actors to lead drone implementation

The second narrative frame entails both public and private actors as the protagonists. It highlights that change can only come if public actors are in the driving seat, and policymakers take the lead. Technological innovation such as drones can only be integrated into society and the transport system if the legislation and also the transport system have been adapted for it. Respondent 6 discusses that if drones should be used in large scale it is not down to limitations in technology: “shortcomings are mainly on the regulation aspect, because we have to make sure that it is done safely”.

In this frame, actors consider the niche technology not to be the main challenge, but rather that the landscape of regulations and the infrastructure in society is a barrier and needs to be in place. There were several actors that insistently argued that the public sector needs to be more involved to lead the implementation of drone transport in society. While the technology is developed by the private sector, the public institutions will need to take the lead to facilitate possible implementation. There needs to be strong policy leadership for drone transport to be able to function in a sustainable manner in practice.

If the private companies controlled the world before, then they will only do what is right for their business. If the public entities lead, then they will make sure that all operators can actually access the workforce. – Respondent 16

If drone transport is to be made equally accessible for the public and benefit society then there is a belief that public authorities need to be behind the steering wheel. It is insisted in this discourse that if the public take a back seat and the private sector is leading drone implementation, this will lead to a transport system governed by corporate interests and

less focused on the public good. This will mean a drone transport system that will price out poorer segments of the market and will be a service mainly designed and delivered to a prime market segment, that is, the wealthier stakeholder section of the market. This argumentation highlights the importance of not solely relying on private sector actors to behave as change agents, and that there needs to be support from public actors to push through the inertia of the socio-technical regimes and lobby interests in a way that benefits the whole of society. Public actors are seen as trusted institutions that can instrumentalize the change in regime in positive ways. The problem in this narrative is that public actors lack the initiative to prioritize and interact with niche innovations, and to create political strategies to ensure a community-based approach.

“You know, we have self-government in Sweden when it comes to municipalities, so if they don't take a decision, nobody else will. So they have to be behind the steering wheel, right?” – Respondent 1

It all has to be incorporated into the legal framework, which is managed by the local authorities, so they need to work with them very, very closely. I mean, I'm talking about working with the regulators, and they aren't just about those for two reasons. One is that they need them to be able to implement new business processes. Secondly, they also need them because, I think, they need to educate them as well. The local authorities may not necessarily know where the benefits are for businesses. So, it's a chicken and egg situation, and they need to educate the local authorities so the local authorities can help them later on in implementing efficient business operations. – Respondent 17

There are different views on who should be the ones leading the transition towards drone implementation in society, although they all agree that it should be either the municipalities or the government. There is an understanding that the private sector has the expertise in the new drone technology; however, public authorities dictate the implementation of the technology through infrastructure and regulations. Co-learning is seen as an efficient strategy for public actors to get up to speed with the technology and business needs, to take leadership on creating safe space for the technology and further support business interests. Here, even when public actors take the lead, private actors will play a major role in influencing the policy landscape. Additionally, respondents also indicate that public authorities are the ultimate decision-makers in implementing drones, and a market-based approach requires the same too. The key point in the MLP is that niche innovations come about through the coordination between different levels and “link up with ongoing processes and tensions at the regime and landscape level” [59]. The niche innovation either gets accepted and is a success, or is a flop, depending on internal and external drivers. The internal drivers are affected by prices and investors, while the external drivers are about policies and regulations in the society and user preferences that are influenced by the society and cultural changes [59]. Therefore, drone technology can be the next important tool in sustainability transition; however, that does not matter if there is a lack of scientific knowledge for implementation, regulation, infrastructure, or acceptance in society. The respondents in this frame emphasize that there is a need for collaboration between the different sectors in society for a successful implementation of drones. In this frame, the actors in the socio-technical regime are seen as the ones who also impact drone deployment. Among the antagonists of this frame are politicians and people who believe in flight shaming, who intend to stop aviation and use fast-speed trains instead.

This [drone transport] could be a very cost-efficient way of reaching people. What we are now about to decide is whether to invest heavily in hundreds of billions in rail infrastructure. – Respondent 8

In Europe, there is a movement towards trying to limit mitigation and the shaming and all that. I think that's temporary. I don't really see a replacement for aviation. – Respondent 16

Everybody is moving and getting international and global. I still think that aviation has a bright future, but it will take some years for people to stop shame in Sweden. - Respondent 10

Many such arguments for the deployment of drones are provided by actors, where decreasing regional greenhouse gas emissions is seen as an exogenous reason due to which the public authorities will have to rethink conventional transport technologies. The infrastructure needed for drones is seen as the reuse of pre-existing infrastructure and/or minimal land use. Hence, it is reasoned to be an environment-friendly strategy for transportation. Niche innovations alone won't take us all the way, but coalition-building through active participation and cooperation of regime actors with niche innovators (private actors) is observed as a prerequisite of change in regimes.

4.3. Non-priority frame – public actors' priority is limited to pre-existing technologies

In this frame, the actors don't believe in the new drone technology and see it as a distraction. We can see a strong linkage to the overall negative political discourse of conventional aviation, since conventional aviation is perceived by many not to have the same future as that which is assumed for drones. The premise here is that drones, like aviation, cannot be sustainable and investment here will detract from more sustainable transport such as trains or bikes in cities.

I do not believe that it [drone transport] will be with passengers, and I'm not sure it will be with goods either, because there are other, better solutions. – Respondent 4

There is a belief that drones, like conventional airplanes, are never sustainable and that it cannot become sustainable either. Instead, the actors believe that other transport means are a better, more sustainable solution than drones. The narratives in this frame instead think that:

We have to prioritize the transport means which are best suited for a fossil-free future. – Respondent 3

We want high-speed trains to replace that. The domestic air, let's say, instead of flying from Stockholm, the government will have a high-speed train. – Respondent 7

The actors compare transport modes with each other and believe that one can replace the other. There has been a hot debate in Sweden about aviation and high-speed trains, which we can see parallels within this frame. Kulanovic and Nordensvärd [60] highlight this discussion in Swedish society and the political parties, where the government has reached a locked-in situation, since the political parties cannot decide on which way to choose in sustainable energy transition in aviation. In the non-priority frame, we can see how some actors link up experience from conventional aviation to make sense of a new technology without knowledge of the innovation or how this innovation can impact systemic transition of transportation [61,62]. Sensemaking can be a backward-facing process, like linking up frames of conventional aviation as dirty and then linking it to a new technology as a basis for policy decisions [62]. Kulanovic and Nordensvärd [60] defined this as a discursive lock-in relating to linking all aviation to a political discourse of being forever dirty and that there is no way to imagine sustainable aviation – either conventional aviation or with new technologies such as drones.

Furthermore, the actors continue by explaining why and what the future roles of drone transport will be:

If we will have any civil aviation at all it is going to be very, very limited, extremely limited. And most people today, I mean, middle class who now are like the Swedish middle class have been used to going, not in COVID times but except for that, going abroad twice or three times a year. I can hardly see this kind of lifestyle in the future. – Respondent 3

We will get so much railway infrastructure in Sweden for the same money or by improving the existing railway infrastructure, and to do it sustainably. And we can also build new conventional railways for the same way as that high-speed rail. – Respondent 3

In this frame, actors address the very same exogenous – of the need to rapidly reduce greenhouse gas emissions differently. The actors find the need to prioritize technologies for a low-carbon future. However, prioritization is within the realms of existing regimes, and the way forward

is seen as continuing to build further within these regimes with existing technologies that are considered low emission. Skepticism about the use of new technologies is seen, especially if it is tied to a previous innovation that historically connotes environmental unfriendliness. Niche innovations are thus disregarded or disapproved of.

5. Concluding discussion

From the interviews three narratives emerged:

- Narrative 1, the market frame, emphasizes private actors and start-ups as the main drivers, with regulation considered secondary to technology-led transitions, and institutional issues expected to be resolved through market forces.
- Narrative 2, the collaboration frame, highlights co-creation between startups and public bodies, with airports or municipalities positioned as leaders through policy, regulation, and infrastructure. Here, public leadership is viewed as essential both to prevent solely profit-driven developments and to foster cooperation with business interests.
- Narrative 3, the non-priority frame portrays drones as unsustainable and unnecessary, arguing that resources should instead be directed toward established systems like trains.

In narratives 1 and 3, public leadership for an innovation is undermined. Narrative 2 emphasized public leadership, though mainly in support of business interests rather than energy transition. This aligns with Kulanovic and Nordensvärd, on political parties' different stands on sustainable aviation [60]. Respondents reflected little on their own role, focusing instead on others. Thus, we see the risk of active public leadership stepping into a secondary role.

These three discourses may be seen as social constructions as stressed by Berger and Luckman [55]. These narratives show consensus on the need for sustainability transition. Yet, the role of emerging technologies in this transition is deeply contrary and polarizing. It raises questions about what disruption means to actors and what future pathways are imagined. On a socio-technical scale, narrative 1 and 2 imply disruption as the degree of novelty and modernity drones can bring, and narrative 3 imply disruption as limiting the use of emerging technologies and aviation overall. Narrative 1 and 2 advocate for incremental change through sustained business while narrative 3 advocates for incremental technological change, steering away from market formation or political support for an emerging technology. In the narrative 1 and 3, regime actors draw on analogies with other technologies [61,62]. Such sense-making links drones either to electric cars as a sustainability success or to aviation as environmentally dirty, shaping policy decisions [62], though evidence for these comparisons remain subjective [63,16] as civilian drones remain nascent without a dominant design.

In Sweden, the negative aviation discourse has reached hegemony, securing institutional reproduction [63–65]. Narrative 3 emerges from this discourse hegemony, impacting legitimacy for niche innovations to drive transitions [20]. Kulanovic and Nordensvärd [60] highlight political parties in Sweden are caught in discursive lock-in, unable to decide on sustainable aviation pathways. Such discursive lock-ins risk portraying technology as having a singular, path-dependent trajectory. Narrative 1 and 2 relate to the discussion around the state's role vis-a-vis the market. Narrative 2 harks back to a strong state steering technological change, reflecting a Green Keynesian frame consistent with ecological modernization. The approach emphasizes regulation, innovation, and carbon taxation, stressing that government leadership in collaboration with industry is essential [60]. Narrative 1 relies more on a liberal hands-off model which implies that the market could handle this better. Aligning with a market liberal perspective, it believes that economic growth, driven by technology and science is seen as key to environmental improvement, with policy correction and market-based incentives as solutions to environmental challenges [66,67].

Underlying presumptions and ontologies contribute to lack of consensus on the role of emerging technologies in cross-sectoral energy transition, and what systems transition means for different actors. This reflects broader socio-technical imaginaries in aviation- namely behavioural change, alternative fuels, and radical modernization, advocating for policymaking to address technological uncertainties that hinder rapid climate action [68,69]. These ontological differences create discursive lock-ins, leading to polarization and bottlenecks that block “windows of opportunities” in emission-intensive sectors. Beyond such deterministic notions, emerging technologies must be critically explored for their potential to address lock-ins [70] and to reshape social practices, for e.g., using electric drones to improve multimodal transport, reduce personal vehicle dependency, reduce business reliance on conventional aviation, address inefficient and increasing ground transport, etc. Conflicting regime doxa reproduces a policy habitus [71,72] that avoids leadership and adaptive governance for exploring niches.

5.1. Implications for policy and policy leadership

The narrative frames identified influence policy on emerging technologies and niche innovations with implications for sustainability transitions beyond Sweden.

5.1.1. Nuanced discourses

Strong narratives are crucial for transitions. When regime actors delegate responsibility to private industry (market frame) or disregard drones (non-priority frame), the resistance discourse dominates [38]. Without legitimacy for regulation, drones cannot develop as tools for societal or environmental challenges, nor integrate with transport systems. Acceptance depends on how innovations align with actors’ worldviews. The attractiveness of narratives depends on resonance with cultural repertoires and trust on lobbying actors [36]. Positive discourses predominantly address innovation as inherently good, and build legitimacy, while negative ones produce acceptance problems that hinder niche development. Negative discourses, however, bring forth critical reflection on the meaning of what is regarded as sustainable. Hence, nuanced discourses both critical and constructive are necessary for creating safe spaces for policy complex innovations.

5.1.2. Innovation policy leadership

Public authorities are often accustomed to managing established systems and reproduce existing habitus of policymaking [73]. However, transformation requires going beyond existing regimes [20], and an innovation may not be equipped to utilize a window of opportunity due to high complexity. Insufficient policies and weak leadership risk undermining innovation and may hinder pathways toward a sustainable transition. Under a short transformative period, policymakers must shift from governance-oriented managers to policy-driven leaders. As systems stabilize, policymakers can shift from leadership to management and governance, requiring innovation policy to alternate between leader and manager roles [17].

5.1.3. Involve cross-sectoral regime actors

Power dynamics are increasingly recognized as central to the MLP. Geels [37,36] and Avelino [2] highlight how “core alliances” between policymakers, incumbents, and other dominant actors stabilize existing socio-technical configurations or enable selective change that largely preserves regime interests. Avelino [2] terms the capacity to reproduce institutional arrangements thereby hindering systemic transformation as reinforcing power. Therefore, scholars emphasize the role of peripheral actors such as start-ups, municipalities and regional agencies in opening alternative transition pathways [74,75]. Positioned at the

regime’s margins, these actors can challenge dominant regimes, introduce novel practices, and act as intermediaries linking niche innovations with institutional change [76,77].

While drones transport brings together aviation and logistics, the discourse remains anchored in the aviation regime. Incumbent aviation actors drive technology and infrastructure development, while end users remain less involved. This leaves a gap in policy coordination between aviation and logistics, fostering fragmented meso-level ‘patchwork regimes’ that shape drone niche development [20].

5.3. Recommendations for future work

We see that a significant part of sense-making for emerging niches echoes opinions and insights on mature innovations and values of environmentalism, which Kulanovic and Nordensvärd highlights [60]. Future research is needed to understand such processes, particularly the origins of social constructions and their implications for transition policy development and the role of emerging innovation.

The role of policymakers as leaders during system transformations is crucial for disruptive innovations that move beyond incremental adaptation towards transformation [35]. A lack of leadership may stem from uncertainties around technology as a decarbonization solution. Yet, as new technologies emerge, they bring both opportunities and complexities that demand attention. Understanding their role and reliability in achieving climate goals remains a landscape-level question, requiring further research through case studies on radical innovations. Another interesting aspect is how policymakers’ cognitive frames and “mind maps” shift analogously to distinctions between management and leadership and how such shifts influence policy transitions.

Another critical practicality is that of sustainable finance for emerging innovations like drones, to broaden the interdisciplinary scope for policy making, which is delimited in this paper and recommended for future research.

Based on our findings of this Nordic case of drone transport, we see that if we are to address the complexities and influence path dependency of radical innovation in the interest of addressing today’s wicked problems and transformation challenges for energy and transport, policy actors need to take more proactive leadership in the early developmental and implementation phases of such technology.

CRediT authorship contribution statement

Aneta Kulanovic: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Aishwarya Raghunatha:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Conceptualization. **Johan Nordensvärd:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Formal analysis, Conceptualization. **Patrik Thollander:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests Aneta Kulanovic reports financial support was provided by The Swedish Energy Agency. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1. Interview and organizations sample

Type of organization (state, municipality)	Organization/actor	Narratives	Role vis-à-vis Drone
	Respondent 1	The goal is to have drones as an integrated part of infrastructure in society. Municipalities, regions and the government need to cooperate, every municipality cannot have different rules and regulations and make their own decisions. Today there is a lack of cooperation between public authorities. Public authorities need to be behind the steering wheel. The majority of the airports are owned by municipalities and regions, which is why they should lead the way, with a lot of support from the government and European Commission. Airports are needed and it's stupid to close them down.	Collaboration frame
	Respondent 2	The challenge is to get the right infrastructure. The infrastructure should be financed with tax money. [There] needs to be a collaboration between the private and the public sector; the government needs to focus on the infrastructure and the security questions while the private sector focuses on developing the product. We need the competence to make this happen; also, educate people in public institutions. Put the money in developing this and not building multimillion-kroner railways.	Collaboration frame
	Respondent 3	We need to focus on moving from roads to railway. Moving towards fossil-free aviation is too resource consuming. Electric aviation will maybe be possible for shorter distances, but never for long range flights, and we already have buses and railways for that so there is no need for electric aviation. Flying cars was an idea already 50 years ago, but it is not reality. It is still just wishful thinking and we don't have the technology for that. Aviation is energy consuming, it demands too much energy.	Priority frame
	Respondent 4	Drones are not suited for transporting people or goods; we have better solutions on the ground. Conventional aviation with fossil fuels or electric are better suited than drones, or other transport modes. Drones only for military or rescue purposes. Technical issues and security questions are the problem. Don't need airports for drones, since you can land anywhere, but regulations and infrastructures need to be addressed. Government, regional or local, needs to finance it. Regulations need to be set globally and then nationally by the government. There is a need for cooperation between the government and the companies and not just between the companies.	Priority frame, collaboration frame, technical frame
	Respondent 5	Risks and regulations: society needs to decide what risks they will accept. The ideal is to have autonomous drones. An infrastructure to try this safely is needed, where they can recharge and land. Regulations need to be decided by the European Union and then the Swedish government. Drones could be a future alternative for transporting individually, like rental bikes are. Based on taxes. It will all depend on the costs, functionality and regulations that will decide the future of drones.	Collaboration frame
	Respondent 6	The technology is there but the regulations are the problem and infrastructure, where power stations will be, etc. Need to be tested securely before installed in society. Start in smaller villages, where there is not as much other air traffic above and then move to larger cities, where the right infrastructure is already in place. Every municipality in Sweden needs to come together; for instance, have one representative from each municipality and come together to the same regulations. Drones will be a part of aviation.	The collaboration frame
	Respondent 7	Fast trains will replace domestic flights. The technology needs to be developed further; also [there are] obstacles, with regulations in the air. We already have a lot of air traffic. Aviation is needed for long flights but drones are not a necessity.	Priority frame
	Respondent 8	It is a technical and societal question. Can drones carry people or heavy objects? What is accepted by society? Infrastructure is a problem; we don't want more air traffic. Drones are a cost-effective mode of transport; don't cost as much as building roads or rails. Private actors and delivery companies/businesses would be the leading actors. Regulations and safety risks need to be addressed by the government. The infrastructure should be financed by the government, and later by people who are using it, through self-taxation. The government, regions and municipality need to make the decisions over the infrastructure. The municipalities will have more power. Aviation industry is dirty, and they need to focus more on becoming climate friendly before we can have a future with aviation and drones.	The technical frame, the collaboration frame, the priority frame
	Respondent 9	We will fly less domestically in the future because of the climate problems aviation causes. EU regulations open up for delivery in urban environments, which provides the baselines for further regulations in Sweden. Technical issues that still need to be addressed about manned and unmanned aviation, to avoid collisions, etc. The operators need to address the question about what infrastructure is needed, which then needs to be supported by the government. The municipalities and the regions need to address where the drones can fly and how they can cross between. Need to build a new ecosystem where companies need to be able to test the drones in a safe environment, supported by the public sector.	Collaboration frame, technical frame
	Respondent 10	Rural areas, small villages outside are isolated from the bigger cities. Drones can solve that and bring them closer. Regions, municipalities and urban planning authorities will have the power over the infrastructure. Tax funding. Think that it will be a global infrastructure on a national level and the municipalities won't have a role in this. The private sector and the public sector need to organize themselves and collaborate to make this work to be able to implement this in society. Need new legislation and regulation; municipalities and the government need to address this issue while the private sector works on developing sustainable drones.	Collaboration frame
	Respondent 11	Private actors should steer the development of AAM, and public authorities need to coordinate with them regarding the airspace and regulations. Only talk about trains and electric vehicles, but not aviation, we need more focus on aviation. Small airports are needed where drones can land and recharge. The government needs to take more responsibility – cannot only be on regions and municipalities.	Technical frame, collaboration frame

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(continued)

Type of organization (state, municipality)	Organization/actor	Narratives	Role vis-à-vis Drone
	Respondent 12	The private market steers the development and collaboration with public authorities regarding infrastructure, accountability and regulations. Aviation needs to become more sustainable; not sustainable as it is today.	Collaboration frame, technical frame, the priority frame
	Respondent 13	Possible that drones will carry cargo and groceries, but not people. The technology is not there yet or the safety regulations. The industry should lead the development, and the public authorities should only support and be more involved regarding infrastructure and safety regulations in the future.	The technical frame
	Respondent 14	AAM will be helpful to deliver goods in the near future, to help the citizens. Personal transport with AAM is further away. Don't have to build roads or railways, which makes it more sustainable compared to trains in that regard. Regulations for airspace are needed. More support from public authorities; need to discuss questions about security, accountability, infrastructure, etc. The state needs to address legal questions.	Collaboration frame
	Respondent 15	Don't put taxes on aviation; put taxes on emissions. Municipalities and regions need to present their wishes/needs/requirements to private actors. To reach the goal of fossil-free aviation we need support from the public sector and drive the technical development of different solutions; educate people. Make way for startups that will lead the way instead of the traditional airlines.	Collaboration frame
	Respondent 16	The public authorities need to be involved in the development and implementation of drones in society – if not, businesses will do what is best for them and it will not be for society or for everybody. Only rich people will be able to use drones.	Collaboration frame
	Respondent 17	Drones already deliver groceries from supermarkets in Ireland. Education and awareness is needed among people to be able to believe in drones. Collaboration between industry and public organizations and society — they will be key stakeholders. The biggest challenge is political regarding regulations. Business needs to work closely with public authorities.	Collaboration frame
	Respondent 18	Startup companies will lead the way with support from the government and financial support. These startups will, in 15 years, be the leading companies with AAM. Authorization should come from airports.	Technical frame, collaboration frame

Appendix 2. Questionnaire

- Help me envision the future of VTOLS or drones for goods and passenger transport - what would it be like? What will it entail? Who will be involved? What will it do? Who will do it? What role will it play in society?
- Would there be any potential risks, challenges and uncertainties involved?
- What investments in infrastructure will be needed, and who will finance such investments?
- What roles will municipalities, regions and urban planning authorities play?
- What will it take to deploy drones to be part of the solution for fossil-free aviation, and what kind of organizations will be the main players?
- Do you believe Swedish business should develop in the fossil-free aviation and drone sector? What role should business have in relationship to public authority, regions and municipalities?
- Say from 2035- 2045, what does the future of conventional aviation hold? What does it look like?
- Describe what the role of aviation will be compared to other transport modes.
- How will people value drones/conventional aviation? Will there be a difference between drones and airplanes in the future?

Finally, who else to talk to?

Data availability

The data that has been used is confidential.

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