Narratives and counter-narratives in sustainability transitions

A study on the Port of Rotterdam from a multi-level perspective

Ninan, Johan; Stam, Kees; van Marrewijk, Alfons

DOI
10.1016/j.ijproman.2025.102766

Publication date
2025

Document Version
Final published version

Published in
International Journal of Project Management

International Journal of Project Management 43 (2025) 102766

Contents lists available at ScienceDirect

International Journal of Project Management

journal homepage: www.elsevier.com/locate/ijproman

Narratives and counter-narratives in sustainability transitions: A study on the Port of Rotterdam from a multi-level perspective

Johan Ninan [a,*], Kees Stam [a,b], Alfons van Marrewijk [a,c,d]

[a] Delft University of Technology (TU Delft), the Netherlands
[b] Rotterdam University of Applied Sciences, The Netherlands
[c] BI Norwegian Business School Oslo, Norway
[d] Vrije Universiteit Amsterdam, The Netherlands

ARTICLE INFO

Keywords:
Infrastructure projects
narratives
sustainability transition
multi-level perspective
port of Rotterdam

ABSTRACT

Infrastructure projects can act as niches for innovation development, contribute to strategic goals of network owners, and drive broader systemic transitions. However, limited research has examined how sustainability transitions are shaped through narratives and counternarratives around infrastructure projects. Using a case study of the port of Rotterdam, we analyze how three embedded projects - Maasvlakte 2, RDM Campus, and the Hydrogen Pipeline - reflected and shaped evolving narratives and counter-narratives over 20-years. Grounded in the Multi-Level Perspective (MLP), the study demonstrates how an infrastructure owner like the Port of Rotterdam Authority (PoRA) strategically mobilized narrative framing to reshape existing regimes over time. The study contributes to the debate on project management and transition studies by highlighting how infrastructure project owners respond to transition-related tensions by shaping, defending, and adapting project narratives over time, thereby influencing sustainability trajectories.

1. Introduction

Recently, interest in the relationship between sustainability transitions and project management has increased (Locatelli et al., 2023; Papadonikolaki et al., 2023; Sovacool and Geels, 2021; Winch et al., 2023). Scholars have asked for active responses of project management to sustainability challenges, such as the energy transition (Eitan et al., 2023) and transition to circular construction (Charef & Lu, 2021), as the physical assets and capital goods underpinning these transitions are principally delivered through projects (Sydow et al., 2004). Projects can function as spaces for experimentation (Lenfle & Söderlund, 2019; Papadonikolaki et al., 2023), stimulating change in the participating organizations and acting as a catalyst (Eikelenboom & van Marrewijk, 2023), thus navigating sustainability transitions.

In this paper, we focus on the role of multiple infrastructure projects contributing to the sustainability transition. Diverse scholars (e.g. Martinsuo et al., 2022; Nylen, 2021) already pointed out how projects can contribute to strategic and systemic transition. For example, Papadonikolaki et al. (2023) studied six UK infrastructure projects over a period of 30 years and showed how the adoption of digital technologies in UK construction is driven by regime incumbents, seeds the processes of adaptation, aggregation, and system transformation. Nevertheless, research on what exactly is the relation between infrastructure projects and the broader systemic transitions is limited (Locatelli et al., 2023; Winch et al., 2023).

To address this gap, we consider infrastructure projects that contribute to sustainability transitions from a Multi-Level Perspective (Geels, 2004). This perspective suggests that transitions emerge in the interaction among three primary levels: niche (where groundbreaking innovations develop), regime (the established order with dominant technologies, institutions, and customs), and landscape (broader societal changes and external influences) (Geels, 2002). Tensions, defined as the clash of ideas, principles, and actions that lead to discomfort, are an inherent aspect of sustainability transitions (Fairhurst et al., 2002) and have to be actively managed by owners (Winch & Leiringer, 2016) of infrastructure projects. A significant source of tension arises in the interplay between dominant narratives that promote projects as drivers of progress and counter-narratives that critique their environmental and social consequences (Frandsen et al., 2017). This interplay can influence project legitimacy, stakeholder engagement, and the eventual success or failure of transition efforts (Frandsen et al., 2017).

The discussion above prepares a central research question: *how does*

* Corresponding author at: Faculty of Civil Engineering and Geosciences, Delft University of Technology (TU Delft), the Netherlands.
E-mail address: j.ninan@tudelft.nl (J. Ninan).

https://doi.org/10.1016/j.ijproman.2025.102766
Received 28 September 2024; Received in revised form 30 August 2025; Accepted 19 September 2025
Available online 20 September 2025

an infrastructure project owner navigate the tensions which arise from narratives and counter-narratives in a sustainability transition from a multi-level perspective? Answering this question, we use a single case study methodology (Yin, 2009) to explore how multiple projects in the port of Rotterdam, the Netherlands, contribute to the port's sustainability transition over a period of 20 years (2004-2024). This longitudinal empirical coverage has been asked for by others (see Locatelli et al., 2023; Winch et al., 2023). This study conceptualizes the Port of Rotterdam Authority (PoRA) as the unit of analysis, examining how it operates as a strategic infrastructure owner navigating sustainability transitions. As a semi-public entity, the PoRA plays a unique role in shaping transitions, yet it must operate within the constraints of national policies, European regulations, and market forces. To analyze this role, we followed a nested case study approach where multiple subcases, i.e., Maasvlakte 2, RDM Campus, and Hydrogen Pipeline as instances of the tensions and paradoxes of sustainability transitions, are embedded within a broader context (Lieberman, 2005). Data was collected through port vision documents, social media page of the Port of Rotterdam, newspaper articles, and semi-structured interviews with various stakeholders including promoters and protestors of the port's sustainability efforts. The findings highlight the dynamic process in which infrastructure projects serve as key platforms for testing and integrating radical technologies, and that their use can, influenced by changes in the landscape, change over time, thus connecting niche innovations with broader socio-technical regimes. We argue that narratives act as mediating mechanisms through which owners interpret landscape pressures, stabilize regime practices, and experiment with niche innovations.

2. Theoretical framework

2.1. Multi-level perspective (MLP)

MLP is a valuable framework for analyzing sustainability transitions because its concepts accommodate radical change, dynamic stability, and influences from broader contexts (Geels, 2020). Sustainability transitions are here understood as "long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption" (Markard et al., 2012: 956). The MLP perspective has gained significant traction as a framework for examining socio-technical transitions, which encompass movements toward novel systems like energy (Eitan et al., 2023), mobility (Bohn & Braun, 2021) and circular construction (Charef & Lu, 2021). The MLP encompasses technological advancements as well as alterations in consumer behaviors, policies, cultural significance, infrastructural aspects, and business models (Smith et al., 2010).

In the debate on MLP, the role of projects slowly emerged (van Bueren & Broekhans, 2013, Eitan et al., 2023), acknowledging that transition activities are performed through strategic projects (Lundin et al., 2015). Strategic projects aim to initiate radical innovation, change and transformation in intra- and interorganizational collaboration (Martinsuo et al., 2022). Opposed to the narrow agenda of project execution, strategic projects contribute to broader societal transitions (Gasparro et al., 2022). Within such projects, new ways to meet societal needs can be explored through the interaction of diverse actors (Eikelenboom and van Marrewijk, 2023), which can eventually lead to institutional change (Munck af Rosenschöld, 2019; Sengers et al., 2019). By moving from vanguard projects to executing programs of related projects, organizations can develop and improve their knowledge base and ultimately achieve strategic transitions (Grabher, 2004). In sum, projects can be understood as a valuable contribution to the MLP perspective.

2.2. Projects for transitions

The importance of projects as vehicles of niche innovation has long been recognized in the Strategic Niche Management (SNM) (Smith and Raven, 2012; Schot and Geels, 2008). Geels and Raven (2006) emphasized projects as protective spaces for learning, network-building and articulation of visions, which are key processes that shape socio-technical trajectories. They highlight how sequences of projects can form lineages that gradually exert influence on incumbent regimes. There is also a growing body of literature merging project management and sustainability transitions research (Daniel, 2022; Gasparro et al., 2022; Locatelli et al., 2023; Nylén, 2021; Winch et al., 2023). This body provides additional understanding of the importance of projects to sustainable transitions by highlighting how conventional project organizing may need to change in the context of sustainability transitions (Gasparro et al., 2022). Studies linking projects with the MLP have described projects as learning environments between the niche and the regime (Eikelenboom & van Marrewijk, 2023). For example, Gasparro et al. (2022) conceptualize projects, particularly vanguard projects, as spaces where technological innovations can develop and take hold within the regime and, ultimately, the landscape. Achieving this involves what the authors term 'transition intermediation', which is a process where key internal and external players and resources come together and coordinate to facilitate the translation of goals, actions, and project results across the different levels of the transition. The authors propose that project members can, next to their core project responsibilities, take on such intermediary roles by building social networks, becoming involved with early expectation setting, and exchanging knowledge.

Daniel (2022) broke down project organization into three levels. First is the micro/niche level, where project members and teams focus on effectively delivering outputs impacted by socio-technical operations. Second is the meso/regime level, where project owners combine project outcomes in project programs or portfolios that can reconfigure functional operations. Third, the macro/landscape level includes systems driving project stakeholders' value priorities towards achieving socio-economic benefits (Daniel, 2022). Whereas the importance of projects has been recognized in the sustainability transitions literature (Gasparro et al., 2022; Nylén, 2021), scholars also acknowledge that development through projects can be challenging due to difficulties experienced in sharing learnings from these projects (Munck af Rosenschöld, 2019; Nylén, 2021).

In line with previous studies (Munck af Rosenschöld, 2019; Nylén, 2021), Eikelenboom and van Marrewijk (2024) confirm that transferring the outcomes of vanguard projects, related to sustainability transitions, to regime level is a complex process. To manage this process, increased attention to the embeddedness of projects inside permanent organizations is needed (Eikelenboom and van Marrewijk, 2024). Members of permanent organizations should no longer perceive and manage projects as closed endeavors with limited influence on their activities. In contrast, projects and programs can drive transitions such as by functioning as spaces for experimentation (Papadonikolaki et al., 2023; Sengers et al., 2019), by producing outputs that are used as inputs for new projects, which is called project lineage (Maniak & Midler, 2014), or by the bundling of projects in programs (Martinsuo et al., 2022).

Discourses shape these transitions, particularly through their influence on legitimacy, acceptance, and meaning making across MLP levels (Roberts and Geels, 2018). While our work builds on this discourse foundation, we focus explicitly on narratives (Hermwille, 2016) specifically how project-level narratives are used by infrastructure owners to stabilize contested futures and address tensions in situated transition contexts.

2.3. Narratives and counter-narratives in sustainability transitions

We conceptualize project narratives as performative instruments that stabilize a preferred version of the future, enabling stakeholders to align around shared expectations and resource commitments (Sergeeva and Winch, 2021). Unlike broader discourses that reflect societal-level

frames and ideologies (Hajer, 1995), narratives are project-specific, situationally constructed, and temporally bounded, often emerging in response to local contestation and practical concerns (Sergeeva and Ninan, 2023). Narratives are powerful meaning-making devices that shape organizational life, structure decision-making, and mobilize stakeholder support or resistance and are not just reflections of reality but are constitutive of stability and change in organizations, helping actors make sense of complex, ambiguous contexts such as sustainability transitions (Upham & Gathen, 2021). Narratives and counter-narratives play a crucial role in shaping sustainability transitions, particularly in infrastructure projects as they serve as meaning-making mechanisms that influence stakeholder perceptions, policy decisions, and public sentiments (Zilber, 2007). While dominant narratives often align with the interests of the project promoter, counter-narratives emerge from opposition groups, challenging the perceived benefits and underlying assumptions of these projects (Ninan & Sergeeva, 2021). Narratives structure human understanding and communication, serving as vehicles for framing issues, defining problems, and proposing solutions (Frandsen et al., 2017). Counter-narratives emerge as resistance to dominant narratives, offering alternative perspectives on projects and policies (Andrews, 2002). They expose the constructed nature of dominant stories, challenging their assumptions and presenting competing visions. For instance, in the case of High Speed 2 (HS2), promoters labeled the project as 'fast' and 'low carbon,' while opponents framed it as a 'vanity project' for the wealthy (Ninan & Sergeeva, 2021). This dynamic illustrates how counter-narratives can shape public sentiments and influence project trajectories. The instability of narratives is a key theme in literature. Narratives shift from one equilibrium to another as stakeholders contest and renegotiate meanings (Harper, 2009). The boundary between dominant and counter-narratives is fluid, with counter-narratives sometimes gaining enough traction to reshape the mainstream narrative (McLean & Syed, 2016).

Infrastructure projects involve multiple levels of governance, economic interests, and social dynamics, making them fertile ground for contestation (Van den Ende & Van Marrewijk, 2019) and particularly susceptible to narrative struggles. The interplay between narratives and counter-narratives can influence project legitimacy, stakeholder engagement, and the eventual success or failure of transition efforts (Frandsen et al., 2017). Within sustainability transitions, narratives help shape visions of change, mobilize stakeholders, and legitimize certain courses of action while delegitimizing others (Geels, 2011; Rhodes & Brown, 2005). Existing studies on MLP focus on technological and policy shifts (Geels, 2011), but they rarely consider how narratives and particularly the tensions between narratives and counter-narratives shape the interactions between niche innovations, regimes, and landscape pressures.

2.4. Tensions in sustainability transitions

Tensions, defined as the clash of ideas, principles, and actions that lead to discomfort, are an inherent aspect of sustainability transitions (Fairhurst et al., 2002). These tensions manifest at multiple levels, i.e., between stakeholders, within organizations, and across broader socio-technical systems, as actors attempt to reconcile competing objectives, such as economic growth and environmental responsibility (Putnam et al., 2014). Contradictions within sustainability transitions are particularly pronounced, as opposing elements, such as short-term profitability and long-term sustainability investments, simultaneously depend on and challenge each other (Hargrave & Van de Ven, 2017). These tensions surface at the interface of different actors negotiating roles, positions, and influence (Thomas et al., 2011).

A significant source of tension arises in the interplay between dominant narratives that promote projects as drivers of progress and counter-narratives that critique their environmental and social consequences (Frandsen et al., 2017). Narratives are fluid and evolve over time, reflecting shifting power dynamics and stakeholder contestation (Zilber, 2007). While project proponents often emphasize economic growth and technological advancement, opposing voices highlight issues of greenwashing, social displacement, and environmental risks (Ninan & Sergeeva, 2022) leading to tensions in the project. Change designers may overlook the entanglements between organizational actors and technological systems, leading to resistance, misalignment, and unintended consequences (Pasmore et al., 2019). Sustainability transitions can create unforeseen tensions, such as increased stress due to new environmental policies or competition over compliance measures. Understanding these tensions and their interplay with narratives is critical for navigating sustainability transitions effectively, requiring strong governance structures and adaptive management strategies (Martinsuo et al., 2022). Despite growing recognition of these tensions, existing literature has yet to fully explore how they evolve across different levels of the Multi-Level Perspective (MLP) and how project owners actively mediate such conflicts within sustainability transitions (Geels, 2020; Winch et al., 2023).

3. Research setting and methods

We utilized a case study methodology to explore how multiple infrastructure projects contribute to the larger sustainability transition of the port of Rotterdam and beyond as it is necessary to understand transitions developing over time. Many of the project studies, except maybe for projects which can run for decades (Sovacool & Geels, 2021), are limited in their time scope. Opting for a single case was deliberate as it offers an in-depth understanding of the context, allowing for comprehensive data collection and analysis, and thereby understanding how a project owner captures value over time to support the sustainability transitions. We followed a nested case study approach where multiple cases, i.e., Maasvlakte 2, RDM Campus, and hydrogen pipeline, are embedded within a broader context providing ample material for further theoretical development (Lieberman, 2005). Such a design allows for a more intricate examination of distinct and significant components of the primary case (Yin, 2009).

3.1. Selection of primary case and embedded cases

The port of Rotterdam, in Dutch policy often viewed as the 'gateway to Europe' (Nefs et al., 2023), is our primary case for three reasons. First, ports are worldwide under pressure to reduce emissions and the use of fossil fuels, and to become more circular (Bosman et al., 2018). With 22.6 megatons of carbon emissions (Port of Rotterdam Authority, 2023), which is approximately 21% of carbon emissions in the Netherlands (Van den Elshout et al., 2022), the port of Rotterdam is a significant polluter. At the same time, with a total cargo throughput of 438.8 million tons and an added value of €30.6 billion, the port of Rotterdam represents 3.2% of the Dutch gross domestic product (Port of Rotterdam Authority, 2023). At the local level, the port provides 91,760 direct and 74,859 indirect jobs, and those figures rise to 140,001 and 111,961 if the port of Rotterdam is viewed as part of a regional maritime cluster (Streng et al., 2023). Second, PoRA has committed to become carbon neutral in 2050, and actively participates in multiple projects that contribute to the port's sustainability transition. On its website, the PoRA states that:

> "*At the port of Rotterdam, the UN's Sustainable Development Goals are at the heart of what we do. We firmly believe it is our responsibility to contribute to a healthier living and working environments for all. We are committed to creating a climate-neutral port, where safety has been, and always will be, our top priority. The only way forward is a sustainable one." (Website Port of Rotterdam Authority, n.d.)*

The strategy of PoRA is grounded in the need to reposition itself as a sustainable industrial cluster (Schneider et al., 2020) through initiatives spanning hydrogen infrastructure, digital logistics, and carbon capture, suggesting a deliberate and evolving strategic direction towards

sustainability. Third, its proximity to and infrastructure integration with the city makes the port of Rotterdam an ideal candidate for exploring how projects align with sustainability in the port city territory (Jansen and Hein, 2021). The Dutch government selected the port of Rotterdam as one of 16 major transition areas, the so-called NOVEX-areas, with a focus on the energy transition of the port-industrial complex, the port's environmental space to operate in relation to residential development in the city, and the accessibility for goods and passengers in the port and to the hinterland. Finally, the presence of counter-narratives provides a critical perspective on the sustainability transition of the port of Rotterdam. While the PoRA, in its role as the strategic infrastructure owner of the port, has positioned itself as a leader in green innovation, it has faced considerable criticism from environmental organizations, academics, and local activists. These actors challenge the dominant narratives of progress and argue that PoRA's sustainability focus often masks continued reliance on fossil-based industrial operations. These counter-narratives highlight the limitations of the PoRA's current approach, including concerns that green initiatives serve as 'greenwashing' rather than structural transformation. Including these counter-narratives is essential for this study, as it provides a more comprehensive understanding of the port's transition dynamics. Rather than viewing sustainability transitions as linear progressions, the presence of conflicting perspectives reveals the contested nature of change. For these four reasons, our study focuses on the sustainability transition of the port of Rotterdam. The starting point of our study corresponds with the start of the PoRA as a semi-independent actor in 2004.

For our nested case study approach (Lieberman, 2005), we have selected three projects (see Table 1 and Fig. 1) upon the following criteria: their relation to the sustainability transition of the port of Rotterdam, the availability of public information, the author's access to the field, and the period of the projects' execution. Maasvlakte 2 focuses on eco-system restoration (environmental sustainability), RDM campus focuses on education-business interactions and innovation systems (socio-economic sustainability), and Hydrogen Pipeline focuses on carbon reduction (enviro-economic sustainability) as shown in Fig. 1.

The timeline in Fig. 1 shows that even though there were numerous strategic projects by PoRA, the selected projects reflect key inflection points in PoRA's broader transition journey. They were chosen not for their comprehensiveness, but for their representative diversity in type (environmental, socio-economic, enviro-economic) and level of strategic intentionality as different infrastructure projects can reflect varying levels of integration into long-term transition pathways (Geels & Locatelli, 2024). These projects thus allow us to explore how a single infrastructure owner navigates transitions across different sectors and time periods. While each of these projects contribute to a different aspect of the sustainability transitions, they are all part of a broader shift towards a sustainable region (Chopra et al., 2024). However, it is important to note that these cases are not equivalent in terms of their strategic intent or transformative scope. Only the Hydrogen Pipeline is a deliberate, regime-level intervention aligned with the port's broader decarbonization agenda. In contrast, Maasvlakte 2 retroactively adopted sustainability to justify and legitimize an expansion initially driven by economic imperatives. Thus, the focus on three distinct nested case studies as a structured approach provides comparability across the cases and enhances clarity on sustainability transitions. This allowed for an in-depth study to understand how these projects, over time, operate and contribute to the port's sustainability transition. The details of the port of Rotterdam and the location of the three projects are shown in Fig. 2 and the overview of the three embedded projects are in Table 1.

Table 1
Overview of the three selected embedded cases.

	Maasvlakte 2	*RDM Campus*	*Hydrogen Pipeline*
Execution	2008 – 2013	2007 - 2017	2023-2025
Budget	€1,850 million	€100 million	€100 million
Project goal	Creating 2,000 hectares for growth and replacing industry from the city	Redevelopment of the 30 hectares of abandoned shipyard	Transport of hydrogen from electrolyser to the refinery and refilling stations

3.2. Data collection methods

In the study, one of the authors has a long-standing relation with the PoRA since 2016. Since 2019, he has worked as an engaged scholar (Van Marrewijk & Dessing, 2019) with the organization on a weekly basis to support collaboration in the spatial port-city interface between the PoRA and the municipality of Rotterdam. Another author has studied infrastructure projects in the Rotterdam region for more than 20 years and thus has contextual knowledge of the cases. Humphreys (2005) calls these insights self-reflexive personal vignettes, which add authenticity and exposure to interpretations, and, importantly, are useful for others.

We collected four sets of data from the port of Rotterdam. The first set was collected through secondary document analysis, in which we collected all the port vision documents from the beginning of the PoRA (see Table 2).

The second set of data was collected from the social media page of the PoRA to understand the multiple interventions undertaken by the port to bring about sustainability transitions. First, the port's actions and engagement are summarized on its social media Twitter page in less than 140 characters (Mathur et al., 2021). Most of the actions are realized and supported with photos or links to publications. Second, social media provides all the activities within a study period in a holistic and documented electronic format. Hence, we got an overview of the different projects the port has undertaken over a long period. Finally, social media data can be considered online naturalistic data, which exist without the researcher's intervention or bias and are significant data sources for studying projects in the 21st century (Ninan, 2020). We retrieved 3,127 tweets from the PoRA page in the X platform (previously Twitter) from 3 May 2011 (date of first post) to 31 Dec 2022 (end of study period). Through a qualitative analysis, we saw how multiple projects and initiatives within the port of Rotterdam contributed to the sustainability transitions.

Our third set of data consists of a series of 14 semi-structured interviews with stakeholders from the PoRA, including directors of the Port Development department (2), strategists (4), business managers (1), sustainability activists (3), and project managers (3) who have been involved in the Maasvlakte 2 and RDM Campus projects (see Table 3). The semi-structured interviews were based on a protocol asking respondents for the perception, challenges and learnings in sustainability transitions regarding the Port of Rotterdam.

Our fourth set of data included archival data from local and national Dutch newspapers. We selected the Dutch newspapers *NRC Handelsblad* and *Algemeen Dagblad* for this data collection. We selected these two newspapers because they are of high quality, have their roots in Rotterdam, give a balanced representation of different political orientations, and with availability in an electronic format. We tracked articles between 2004 to 2024, the period of our study, from LexisNexis, using 'all content types' with the keywords; Port of Rotterdam Authority, transition Rotterdam, hydrogen Rotterdam, second Maasvlakte and RDM. Each keyword resulted in several articles, of which we selected the ones relevant to our study (see Table 4). This search resulted in 107 relevant articles in the *Algemeen Dagblad*. The historical data of *NRC Handelsblad* in LexisNexis ends in 2022, for news of 2022-2025 we had to search in the newspaper's archive (https://www.nrc.nl/search/), resulting in 156 (2005-2022) and 30 (2023-2025) relevant articles. In total, 293 articles were selected of which 12 double results were deleted, leaving 281 articles available.

This archival news analysis helped satisfactorily track any significant evolution of the transition of Rotterdam harbor over time. The in-depth use of published newspaper articles enhanced the richness of the case study.

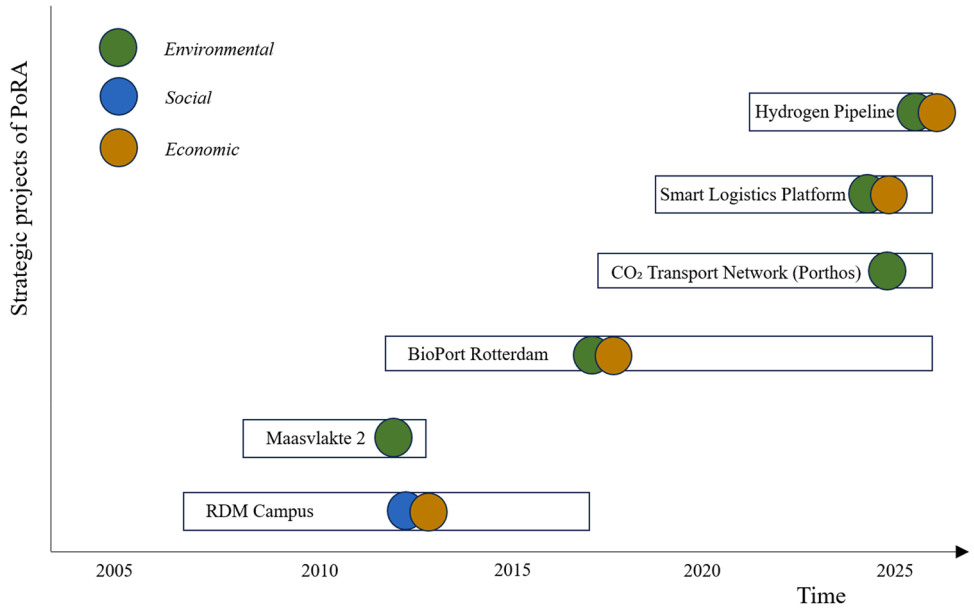

Fig. 1. Timeline of strategic projects of PoRA.

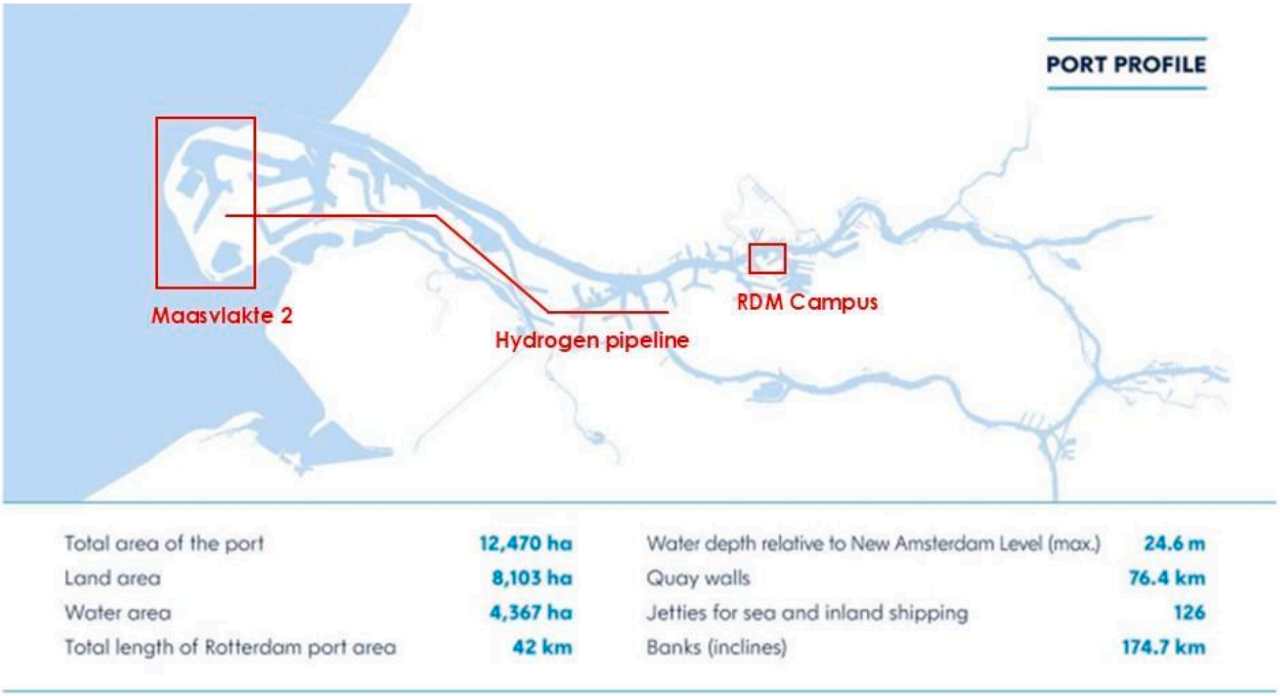

Fig. 2. Facts and figures of the port of Rotterdam and the location of the three projects.

Table 2
Port vision documents.

Name	Year
Port Plan 2010	2004
Port Plan 2030	2011
Revised Port Plan 2030	2019
NOVEX Port	2023

3.3. Analysis of research data

To ensure rigorous analysis of the field data, a holistic approach to inductive concept development was followed (Gioia et al., 2013). Such interpretative methods for analyzing data are no less systematic than positivistic-informed research. For executing the interpretative analysis process, a five-step interpretive method was used. This methodology aligns with Eisenhardt's (1989) framework of building theories from case study research, allowing us to ground our new theories in existing literature. In the first step, the authors carefully read all collected data from the four data sets and conducted text queries to search for keywords and phrases regarding the three projects and their relation to the

Table 3
Interviews with stakeholders from the PoRA.

Interview #	Position	Length
1.	Project manager I	1h:35m
2.	Project manager II	1h:42m
3.	Strategist/area manager I	1h:12m
4.	Strategist/area manager II	1h:25m
5.	Director port development I	1h:37m
6.	Strategist/area manager III	1h:25m
7.	Strategist/area manager IV	49m
8.	Business manager	1h:0m
9.	Project manager/area developer	53m
10.	Director port development II	1h:5m
11.	Climate crisis and green policy expert	1h:10m
12.	Energy and sustainability activist	52m
13.	Extinction rebellion (anti-port) activist	1h:0m
14.	Construction manager	50m

Table 4
Historical data from Dutch newspapers.

Search topic	NRC Handelsblad			Algemeen Dagblad	
	2005-2022	2022-2025	Selected	2005-2025	Selected
Port of Rotterdam Authority	656	96	74	505	38
transition Rotterdam	172	146	29	57	10
hydrogen Rotterdam	91	91	21	125	25
second Maasvlakte	337	62	42	256	26
RDM	220	6	20	79	10
Total	1766	382	186	1011	107

sustainability transition trajectory. While the port vision document as a strategy document provided the 'thinking' and 'saying' behind the transition, the social media, news articles and interviews as actions provided details of the 'practice' of execution and critics given on this execution. We also analyzed news articles to identify narratives and counter narratives through multiple readings. In the second step, we employed open coding techniques to analyze the data in connection with the MLP (Geels, 2002) as shown in Fig. 3, delving into the historical artifacts provided invaluable insights into setting the vision and progression of strategic thinking in the port regarding sustainability transitions. We were also able to unearth recurrent patterns such as the gradual decarbonization of port activities and the infrastructure developments, pivotal shifts like the integration of renewable energy technologies, and emergent trends such as the evolution of open-access energy networks and the collaborative efforts among industrial players for green energy solutions. In the process we worked by combining multiple first-order concepts to a second-order theme. For example, we combined an instance of organizations facing complex bureaucratic approval processes and another instance of compliance costs hindering experimentation with new models into a second-order theme 'regulatory challenges.' In the third step, we discerned various pathways by which the three studied projects facilitate the sustainability transition of the port of Rotterdam, such as how landscape pressures contributed to the Hydrogen Pipeline project and how the project contributes to landscape by addressing global climate targets driving port decarbonization. In the fourth step, through multiple coding cycles, cross-referencing, and theoretical examination (Strauss & Corbin, 1990) we came to niche innovations, regime adaptations, landscape pressures, and dynamic interplay in sustainability transitions. These MLP level coding are then extended to capture narratives, counter-narratives, and narrative responses. In the fifth step, we compared our findings with existing theories to enhance the internal validity and potential applicability. These theories were an initial guide and an integral part of an iterative process throughout our data collection and analysis, ultimately contributing to the research outcomes (Walshham, 2002). Finally, we wrote down our findings in a storyline.

4. The tense transition of the port of rotterdam

The strategic location in the Rhine-Meuse-Scheldt delta and the direct connection to the North Sea, without locks or bridges, are the main competitive advantages of the port of Rotterdam, the largest port of Europe. For a long time, the port's focus has been on growth of scale and volume, fueled by the growth of global trade and fossil fuel based

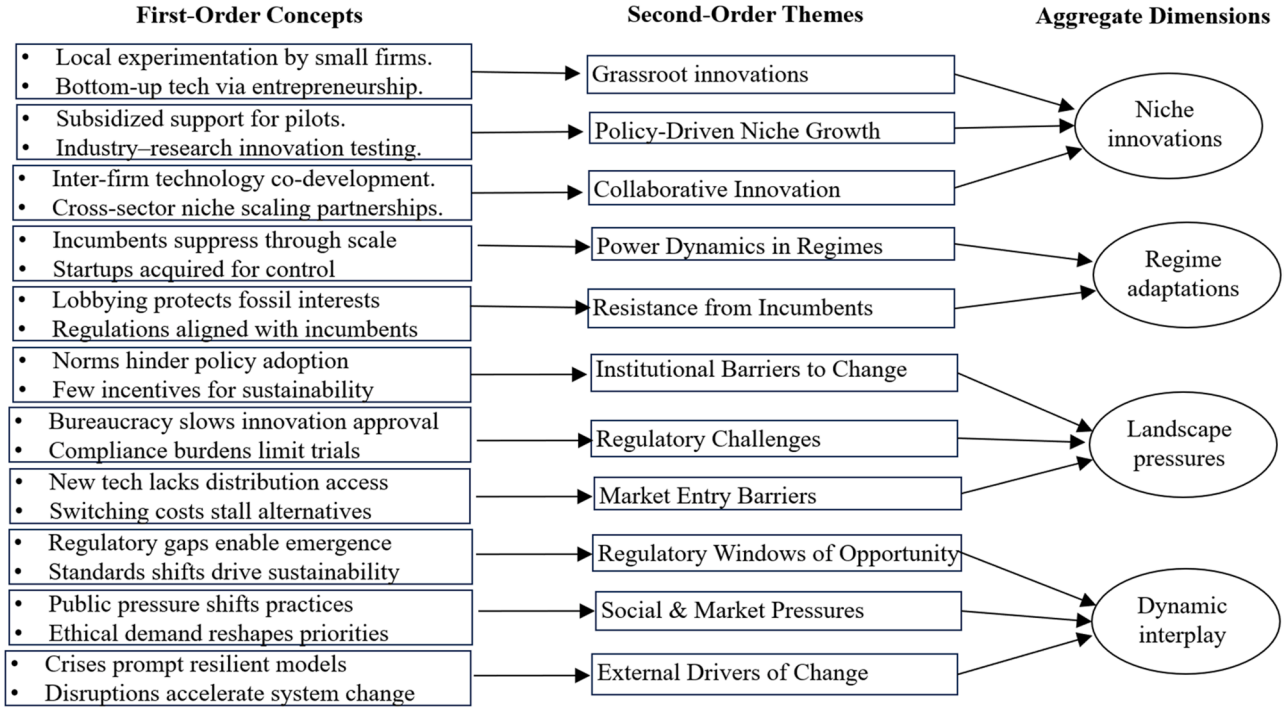

Fig. 3. Sample coding.

industrial activities (Port of Rotterdam Authority, 2023). To remain competitive the municipal port department that managed the port of Rotterdam was transformed into the semi-public PoRA in 2004 to operate more entrepreneurial and to take larger investment risks (De Langen & Heij, 2014). PoRA, owned by the municipality of Rotterdam (~70%) and the Dutch government (~30%), is responsible for the development, management, and operation of the port, as well as ensuring a safe and efficient handling of shipping. In 2023, PoRA had 1, 332 employees and a turnover of €361 million (Port of Rotterdam Authority, 2023). PoRA's traditional focus on scale and volume has been increasingly pressured by a need for sustainability transition towards a circular and climate-neutral port (Bosman et al., 2018). Therefore, PoRA participated in the NOVEX-trajectory together with the Dutch government, the Province of South Holland, and the municipality of Rotterdam to develop the port as a major transition area (Rijksoverheid et al., 2023). Meanwhile, PoRA is involved in a wide variety of projects that are initiated to support the port's transition, including projects related to carbon capture and storage, hydrogen, offshore wind, biorefineries, and shore-power.

Despite these initiatives, critics have argued for more than a decade that the sustainability transition of the port remains slow, fragmented, and without structural CO_2 reduction (Meyer et al., 2012). A common critique is that while sustainable initiatives are being introduced, these are often insufficient to drive systemic change. Three main actors are blamed for this: PoRA, private companies and the Dutch government. Activist groups and critical professionals have voiced concerns over PoRA's approach to prioritize economic growth over genuine environmental progress. For example, the Dutch based Mobilization for the Environment (MOB) has legally challenged PoRa's key sustainability projects, arguing these '*entrenching the fossil-based economy rather than dismantling it*' (NRC Handelsblad, 16 August 2023). Furthermore, Lagendijk and Landsman (NRC Handelsblad, 14 September 2023) opinionated that despite a decade of sustainable policies, PoRA still focuses upon the old strategy of scale and volume and lacks a clear transition strategy and radical knowledge development. The CEO of PoRA tried to disprove these arguments (BNR, 25 September 2023) by pointing to lack of investments by private companies and is supported by Geerlings who states that PoRA does develop sustainable projects, but that private companies hardly invest in these projects (NRC Handelsblad, 23 March 2023). The criticism extends to the hesitant role of the Dutch government. Extinction Rebellion highlights that "*The Dutch government needs to step in. The port's CO2 measurements are not correct - they exclude ship emissions, which form a major share of pollution*" (Interview #13). Urban sociologist Marc Schuilenburg agrees and continue: *"Rotterdam is one of the largest polluters in the world. On the new list of most polluting cities, Rotterdam is at the top, just ahead of metropolises such as Mexico City"* (NRC Handelsblad, 2 October 2022). Not surprising, the port has recently been the scene of multiple climate demonstrations demanding all actors to accelerate the speed of the transition.

In the next sections, we present our findings on how the three selected projects supported the sustainability transition of the port of Rotterdam.

4.1. Maasvlakte 2 – creating new space for sustainable industry

The Maasvlakte 2 project (2008-2013) was initiated by PoRA to create new areas to accommodate the world's largest container ships. This port expansion project estimated to cost €3 billion, reclaimed 2,000 hectares of land from the North Sea in the west of the port of Rotterdam (see Fig. 1). However, due to economic turbulence in world markets much less space was needed for container shipping than predicted, thus giving room for other, more sustainable, developments. PoRA first negotiated and finally cooperated with environmentalist groups to combine port expansion with nature development (Koppenol, 2014). A new sea park of 25,000 hectares to protect underwater sea life was created. This sea park and the new land attracted kitesurfers, bikers, hikers, fossil tourists, but also seals, sea eagles, and fish (NRC Handelsblad, 27 June 2020). PoRA promoted this ecological location by posting photos of kitesurfing on their social media page.

However, counter-narratives suggest that the promised ecological benefits of Maasvlakte 2 have not completely materialized. Environmental groups and researchers highlight that the expansion project has resulted in increased shipping traffic, exacerbating CO_2 emissions and pollution; "*a missed opportunity for radical improvements in sustainability in the port region.*" (interview #11). According to these critics Maasvlakte 2 has mostly reinforced existing industrial paradigms: *"they* [PoRA] *support existing companies and only allow incremental efforts, rather than pursuing meaningful change."* (interview #12)

At Maasvlakte 2, PoRA combined the provision of physical space and green policies, such as restricting non-Euro 6 certified trucks, in an attempt to reduce environmental impact; *"Only trucks with Euro 6 are allowed at #Maasvlakte2, new port territory of #PortofRotterdam which will be open by the end of 2013"* (Quoted from a Tweet dated 04 July 2011). The new land provided opportunities to effectively facilitate clients that were willing to contribute to the port's sustainability transition. For example, PoRA facilitated the market leader in the production of monopiles for large offshore wind turbines (Port of Rotterdam, 2021a) with sufficient land and depth of the waterways, and later, a new 200-metres deep-sea quay (Port of Rotterdam, 2021b). Furthermore, PoRA increasingly views Maasvlakte 2 as a hub to produce green hydrogen and transform the fossil-based petrochemical industry. In 2022, Shell announced that they will build the first green hydrogen plant at Maasvlakte 2, and others have already followed (Port of Rotterdam, 2022). However, this is criticized; "*executives of the port should be held accountable for keeping land empty. If sustainability is the goal, why not reserve these areas for green innovation instead of fossil-dependent industries?*" (interview #11). Furthermore, other sustainable innovations were attracted to the new area, such as energy-generating kites and remote-controlled mega cranes, as noted in the tweet; *"#APMTerminals orders remote controlled mega cranes for #Maasvlakte2 #container terminal €125 mln #portofrotterdam"* (Quoted from a Tweet dated 13 June 2012). These new activities in the Maasvlakte 2 all supported the transition towards a carbon-neutral port. In this way, the expansion project created physical space for experimentation, sustainable technologies and transport, and for new organizations. In Table 5 we provide insight into how the project impacted the port's sustainability transition and is influenced by regime and landscape levels.

4.2. RDM campus – development of knowledge and innovation for transition

The RDM Campus project (2007-2017) concerns the redevelopment of the 30 hectares of abandoned shipyard of the former Rotterdam Drydock Company (RDM). After the company's heydays in the 1950s and 1960s, it went bankrupt in the early 2000s (Van Tuijl & Otgaar, 2017). PoRA acquired the abandoned shipyard for prospects of urban redevelopment (when it was still a municipal department). Only later, it focused on redeveloping this area into a RDM campus, which has *"an important role to play in growing into the innovation center where education and business come together"* (Port Plan 2030, 2011; 71). This redevelopment project did not start with a master plan but with two educational institutes convincing PoRA to transform the former shipyard into a campus for research, design and manufacturing, combining education, research and entrepreneurship. The RDM Campus would provide the port with technical-skilled workers and attract new tenants to the area (Van Tuijl & Otgaar, 2017; Vries, 2014). In 2009, the two educational institutes moved their technical education programs to the renovated RDM Campus.

For the first time in its history, PoRA operated as an active real estate developer (Vries, 2014) by developing, renovating and upgrading the former shipyard. PoRA adopt this role with caution because of what is publicly known as the *'largest public bribery in history'* (Algemeen

Table 5
Impact of Maasvlakte 2 project on sustainability transition of port of Rotterdam.

Maasvlakte 2		
Instance	*Enablers (Influenced by)*	*Impact (Influences transition)*
Landscape		
Global trade growth	Expansion of terminal capacity, demand for larger port infrastructure	Increased shipping traffic, economic growth, but also higher CO_2 emissions and pollution.
Climate change & sustainability goals	International climate agreements, EU emissions targets	Pressure to adopt greener policies, increased investment in sustainable infrastructure.
Regime		
Port expansion and land reclamation	Port Plan 2010 (1993), Port Plan 2030 (2011), National & Municipal Authorities	Increased capacity for port activities, supporting economic growth but reinforcing industrial paradigms.
Environmental compensation measures	Protests by Milieu Defensie, Legal regulations, Negotiations with NGOs	Creation of a 25,000-hectare sea park but concerns over its effectiveness.
Infrastructure development	Boskalis & van Oord (seawall), BAM & VolkerWessel (quays, roads), €3 billion investment	Improved logistics, resilience, and economic competitiveness.
Green transportation policies	Euro 6 truck regulations, PoRA policies	Reduced transport emissions, but limited impact on overall industrial emissions.
Regulatory challenges	Municipality's partial ownership, Debates on governance	Calls for increased municipal oversight and sustainability accountability.
Niche		
Renewable energy initiatives	PoRA land reservations, Shell's green hydrogen plant, Offshore wind production	Transition towards renewable energy, but slow shift from fossil fuels.
Technological innovations	Investments in automation, Remote-controlled mega cranes, Energy-generating kites	Increased efficiency, automation, and potential for greener logistics.
Sustainability experimentation spaces	Physical space allocation for green industries, Support for innovation	Attracted sustainable businesses but concerns over slow implementation and land usage.

Table 6
Impact of RDM project on sustainability transition of port of Rotterdam.

RDM campus		
Instance	*Enablers (Influenced by)*	*Impact (Influences transition)*
Landscape		
Search for new function	Decline of shipbuilding industry led to closure of RDM shipyard	Seeking new functions for the RDM campus
Need for innovation	Growing need for innovation and skilled technical workers in port-related industries.	Provided a new function to the abandoned shipyard, turning it into an innovation hub.
Climate change & sustainability goals	Increasing global focus on circular economy and reusing industrial heritage for innovation.	Positioned the port within broader sustainability and knowledge economy developments.
Regime		
Active developer	PoRA's shift from traditional landlord role to active developer.	Strengthened the role of PoRA in fostering innovation and education.
Collaboration between different stakeholders	Collaboration between PoRA and educational institutes in transforming the site.	Created new partnerships between the port, academia, and industry.
Harbor scandal	Historical 'harbor scandal' made PoRA hesitant about large-scale real estate investments.	Demonstrated a new model for redeveloping industrial areas.
Niche		
Innovation Dock	Development of Innovation Dock as a space for startups and technical education.	Facilitated the development of new sustainable technologies and processes.
Space for experimental technologies	Introduction of experimental technologies like 3D-printing, exoskeletons, and magnetic anchor points.	Provided a platform for emerging businesses to experiment with and implement green innovations.
Port as sustainability hub	Port's promotional campaigns emphasizing RDM as a sustainability and innovation hub.	Inspired international replication of industrial heritage reuse for sustainability.

Dagblad, 7 September 2010). In 2003, the RDM wharf bribed the director of PoRA with €1.5 million for giving an unauthorized loan (€180 million). Both were brought to court and sentenced for bribery and money laundering. Although the bribery took place before the start of the RDM project, it can be argued that the bribery caused a 'shadow of the past' (Ligthart et al., 2016), dominating Dutch newspapers between 2005 and 2013. The RDM project emphasized the importance of knowledge and innovation for the port's new carbon-neutral development model. Over time, all RDM-buildings are renovated and occupied by tenants, while PoRA continues to invest in the campus. They announced the construction of The Warehouse, a new multi-tenant building of 4,000 square meters (Port of Rotterdam, 2023c) and organized events to connect innovative businesses.

The RDM case showed that innovative technologies are relevant for the port's sustainability transition, even though these are not directly port-related (Vries, 2014). For example, the official page of the port of Rotterdam tweeted; *"First #refinery parts produced with #3D-printing at #RDM Makerspace. #Changeyourperspective #portofrotterdam"* (Quoted from a Tweet dated 27 February 2014). The RDM project has now become an internationally known example of reusing industrial heritage as a breeding ground for innovation and entrepreneurship, such as magnetic anchor points used in steel construction and the upper body exoskeleton to support industrial workers, with PoRA as an accelerator. In Table 6 insight is given into how the studied project impacted the sustainability transition and is influenced by regime and landscape levels.

While the campus emphasizes circular economic initiatives and maritime technologies, skeptics contend that its impact on the broader port system remains limited. They call for the port to distance itself from fossil energy investments altogether and take a stronger stance in driving a green transition, rather than relying on incremental changes. Some voices within activist groups suggest that PoRA should invest in truly independent sustainability research rather than initiatives that primarily serve existing industrial players.

4.3. Hydrogen Pipeline – the decarbonization of the port

The third project contributing to the sustainability transition of the port of Rotterdam is the construction of the Hydrogen Pipeline. In 2020, PoRA, Shell Netherlands, the Ministry of Economic Affairs and the Gasunie (operator of the Dutch natural gas network) agreed to construct a subsurface hydrogen transport network over 30 kilometers. The goal of this project is to transport CO2-neutral hydrogen, so-called green hydrogen, from the Maasvlakte 2 to the Shell Pernis refinery and refilling stations (see Fig. 1). Shell commissioned the building of the first 200 MW electrolyser in Europe to transform electricity generated with wind farms at the North Sea into green hydrogen. The electrolyser is planned to be upgraded to 1 Gwatt powered by offshore wind farms near the sea. By doing so, the Shell refinery and part of the road transport of containers can be decarbonized. The official page of the port of Rotterdam tweeted, *"Shell is the first company to sign an agreement to use HyTransPortRTM, the hydrogen pipeline that @Gasunie and the Port Authority are laying from the Maasvlakte to Pernis to make the industry in the*

port more sustainable #hydrogen" (Quoted from a Tweet dated 13 April 2022). The Hydrogen Pipeline project is an important step in the decarbonization of the port of Rotterdam.

The Gasunie, commissioned to build this first step towards a national hydrogen network, tendered the €100 million project to market in the summer of 2023. On Friday, 27 October 2023, the King of the Netherlands performed the official ceremony to start construction of the Hydrogen Pipeline. This event made the Energy Transition Infrastructure Programme Manager at PoRA declare; *"six years ago, energy transition was still a pipe dream, so to speak. Green hydrogen was not even an option as it was too expensive. Now there is another mindset"* (Port of Rotterdam, 2023a). PoRA is heavily involved in the Hydrogen Pipeline project, acknowledged Gasunie's executive board member; *"a word of thanks also goes to the Port Authority, Shell Nederland and the Ministry of Economic Affairs for their constructive cooperation"* (Gasunie, 2023). To PoRA the hydrogen pipeline is an important first step in the decarbonization of the port. The port's ability to transport large volumes of hydrogen incentivizes new industries to produce, and fossil-based industries to use CO_2-neutral hydrogen. Furthermore, diesel trucks can be transformed into hydrogen trucks. Therefore, the energy transition program manager states that '*as a port industrial complex, we are well on the way to creating a complex that runs on green energy*.' (Port of Rotterdam, 2023a).

The hydrogen network in Rotterdam will operate as an open-access pipeline, available for all companies involved in hydrogen transportation. The primary transport infrastructure has sufficient capacity to handle both the anticipated hydrogen imports and the green hydrogen produced within the port. Consequently, the port of Rotterdam solidifies its position as Europe's foremost green energy hub. The program manager overseeing electrification and hydrogen initiatives at PoRA, underscores this achievement by stating: "*What I'm proud of? Wherever I go, everyone sees Rotterdam as the number one hydrogen hub. It's great that Shell has chosen our Maasvlakte for green hydrogen production.*" (Port of Rotterdam, 2023b). The Gasunie plans to extend the green hydrogen network to 1,200 kilometers, largely consisting of transformed gas pipelines, covering five large industrial regions in the Netherlands. This nationwide hydrogen network will cost around €1.5 billion. This Dutch hydrogen network connects with industrial clusters in the Netherlands, Germany and Belgium with storage facilities and international supply from 2030 onwards, for which PoRA asks political support (NGInfra Magazine October 2023).

However, there are concerns that this initiative is a form of 'greenwashing' as critics argue that the continued dependence on fossil fuels by the port contradicts the promise of a true energy transition; "*the biggest polluters are the broad refineries of oil, who have no plans to shrink their operations. They focus on electricity or hydrogen, but oil is still there"* (interview #13). This skepticism is echoed by local residents in newspapers; "*that stuff [hydrogen] is new in the port and needs careful, safe storage. I would like to know what is ahead of us. What will happen with for example the pipelines for the transport of hydrogen?"* (NRC Handelsblad, 9 March 2023). Additionally, critics question the pipeline's long-term impact as the port is polluting by itself. It drives global transportation based on oil-powered ships and encourages consumption rather than sustainability. More broadly, climate activists emphasize the need for systemic change rather than technological fixes; "*We as a society are realizing that we are very dependent on everything around the world. We need to organize better in a circular process. Only transport vital necessities. All other things should be sourced locally. That's real sustainability, not just green pipelines"* (interview #12). In Table 7 we give an overview of how the Hydrogen Pipeline project impacted the sustainability transition and is influenced by regime and landscape levels.

Table 7
Impact of Hydrogen Pipeline project on sustainability transition of port of Rotterdam.

Hydrogen Pipeline		
Instance	*Enablers (Influenced by)*	*Impact (Influences transition)*
Landscape		
Global push	Global push for decarbonization and renewable energy	Focus on hydrogen pipeline
Demand for alternative to fossil fuels	Increasing European demand for hydrogen as an alternative to fossil fuels.	Strengthened Rotterdam's role as a key hydrogen hub in Europe.
Government commitment	Dutch government's commitment to building a national hydrogen network.	Positioned the port as a leader in large-scale hydrogen infrastructure.
Regime		
Collaboration between stakeholders	Collaboration between PoRA, Shell Nederland, Ministry of Economic Affairs, and Gasunie.	Provided infrastructure to incentivize industries to shift towards green hydrogen.
Initial investments	Investment of €100 million in the first 30 km of the hydrogen pipeline.	Raised concerns about long-term sustainability and potential 'greenwashing.'
Open-access network	The pipeline is an open-access network, available for all industrial players.	Encouraged fossil fuel-based industries to transition by offering hydrogen transport solutions.
Niche		
New technological advancements	First 200 MW electrolyser powered by offshore wind farms.	Enabled new technological advancements in green hydrogen production and storage.
National hydrogen network	Expansion plan to 1 GW electrolyser and a 1,200 km national hydrogen network.	Opened new possibilities for hydrogen-powered transport and industrial processes.
Systemic sustainability focus	Transformation of existing natural gas pipelines for hydrogen transport.	Sparked debates on systemic sustainability versus technological fixes.

5. Analyzing sustainability transitions from an multi-level perspective

To fully understand the impact of the three studied infrastructure projects on the overarching sustainability transition of the port of Rotterdam, we analyze the interplay between narratives and counter-narratives influencing sustainability transition efforts (Frandsen et al., 2017) with the help of the MLP framework (Geels, 2002). This dynamic discursive interaction of the three studied infrastructure projects at multiple levels significantly influences how transitions unfold and are managed, and are discussed below.

5.1. Niche innovations: incubating radical technologies in projects

Niche innovations, which involve the development of radical technologies in protected spaces (Lenfle and Söderlund, 2019), play a crucial role in the sustainability transition of the port of Rotterdam. The RDM Campus, designed as a hub for education and innovation, became a fertile environment for experimenting with groundbreaking technologies aimed at reducing environmental impact such as magnetic anchor points and exoskeleton technologies. From a narrative lens, these niche experiments were framed in PoRA communications as clear evidence of Rotterdam's innovative capacity and willingness to lead. However, critical voices questioned whether such experiments remained too isolated, or whether they risked creating a techno-utopian facade without structural change. In this way, counter-narratives raised concerns about the replicability and systemic embeddedness of these innovations.

Furthermore, collaborative partnerships between academia, industry, and government bodies have accelerated the transition from experimental concepts to real-world applications, reinforcing RDM as an incubator for cutting-edge technological advancements. And although not a niche project, the Maasvlakte 2 unintendedly also created space for niche innovations such as the introduction of remote-controlled mega cranes, which revolutionized the handling of goods, enhancing both operational efficiency and environmental sustainability.

In addition, the Hydrogen Pipeline project demonstrates the role of projects as incubators for niche innovations, as was observed earlier (Eikelenboom & van Marrewijk, 2023; Papadonikolaki et al., 2023). PoRA's narratives position the port of Rotterdam as future hydrogen hub, with the project as a radical shift toward renewable energy solutions. The integration of electrolysis technology, underground hydrogen storage, and dedicated transport corridors highlights how such projects not only foster technological innovation but also establish the foundational infrastructure necessary for large-scale sustainability transitions. However, counter-narratives combat this positive view, particularly regarding the uncertainty of returns on early-stage technologies and fears of stranded sustainable ambitions of private companies.

Public-private collaborations, regulatory frameworks, and financial incentives are important in driving niche innovation adoption. Investment in digital twin simulations, carbon capture and storage (CCS) experiments, and circular economy solutions within the port further illustrate the broad spectrum of technological advancements being incubated within these initiatives. As these innovations mature, they can pave the way for broader systemic shifts, reinforcing the port of Rotterdam's position as a global leader in sustainable port operations. These initiatives are often propelled by compelling narratives that frame experimentation as essential to future-proofing port infrastructure. PoRA, has strategically endorsed such narratives to position the port as a pioneer in sustainable innovation.

5.2. Regime adaptations: shaping socio-technical systems in infrastructure projects

The socio-technical regime refers to the established industrial systems, institutional arrangements, and dominant technologies that structure projects (Geels, 2002). In the case of the port of Rotterdam, the regime is characterized by large-scale industrial operations, traditional maritime activities, and long-standing practices that prioritize economic growth and logistical efficiency. Although it was not an intentional goal of the Maasvlakte 2 project, PoRA implemented sustainability-focused policies in this project, such as the restriction of non-Euro 6 trucks representing an incremental shift within the existing regime. Such external pressures to reduce emissions and comply with new environmental regulations have been observed by others (e.g. Eikelenboom and van Marrewijk, 2023).

The findings demonstrate how regime adaptation can involve a more profound shift in how industries operate, as was, for example, the case with the RDM Campus. By fostering collaboration between academia and industry, the project strategically narrated how it helped to reconfigure existing systems toward a development model that supports both economic performance and sustainability. However, counter-narratives highlight that despite these promising developments, the pace and scale of upscaling niche innovations in the port remain limited, constrained by institutional inertia, fragmented interests, and regulatory complexity. This raises critical questions about the port's capacity to deliver systemic change at the speed required by pressing climate goals. In addition, the RDM Campus has played a pivotal role in accelerating circular economic initiatives, such as the reuse of decommissioned port materials. These efforts required adjustments in procurement regulations, certification standards, and material traceability practices to ensure the viability of sustainable production methods. Indeed, innovation in such strategic projects can transform organizational and interorganizational collaborations (Martinsuo et al., 2022). However, PoRA's dominant narrative on growth of transshipment of goods can limit the extent to which the sustainability transitions are fully realized. This tension illustrates a central counter-narrative: that economic growth and sustainability may not always be fully compatible. Critics express concerns over the economic risks of rapid transition. Here, PoRA plays a crucial role by mediating between conflicting stakeholder priorities and reframing sustainability as aligned with long-term competitiveness. By actively shaping public sentiment and policy, PoRA mitigates resistance and enables regime adaptation (Winch & Leiringer, 2016; Zhang et al., 2023). Economic growth and sustainability transition are strived for in the energy transition in the port as exemplified by the Hydrogen Pipeline project. As PoRA moves from fossil fuels to hydrogen, the existing regime is reconfiguring to integrate renewable energy sources into its industrial operations. The Hydrogen Pipeline project also necessitated new risk management frameworks and cross-border regulatory coordination, given the complexities of transporting hydrogen at scale. Legal frameworks surrounding hydrogen infrastructure had to evolve rapidly, addressing safety protocols, financial incentives, and grid integration challenges to support a broader shift toward renewable energy. This highlights how projects serve as critical sites for regime-level adjustments that support sustainability (Gasparro et al., 2022).

5.3. Landscape pressures: external drivers of change in infrastructure projects

The socio-technical landscape refers to the broader context in which projects operate, including global environmental challenges, climate policies, and societal expectations for sustainability (Geels, 2002). Landscape pressures often create an impetus for change, pushing infrastructure projects, and the regimes they operate within, to adopt new technologies and practices. At the port of Rotterdam, landscape pressures such as the Dutch climate agreement (van Vuuren et al., 2017) and EU sustainability commitments have been key drivers behind the port's projects. The Hydrogen Pipeline projects, for example, is a response to national and international climate policies that emphasize the need for reducing emissions, improving air quality, and transitioning to renewable energy, and the Maasvlakte 2 project has been reframed as a project to provide space for sustainable transition. In addition to regulatory and societal shifts, political developments at the national and international levels introduce significant uncertainty into the transition landscape and cast doubt over the continuity and ambition of international climate agreements. These developments undermine investor confidence and introduce hesitation among private actors, who rely on clear long-term policy signals to justify high-risk investments in sustainable infrastructure. This uncertainty weakens the enabling conditions for niche innovations and pressures project owners like PoRA to assume greater risk-mitigation roles.

These pressures are embedded in dominant narratives of climate urgency and technological inevitability, which justify large-scale investment. PoRA has strategically leveraged these narratives to justify infrastructural transformation. Nevertheless, counter-narratives question the scalability and cost of such transitions, particularly regarding hydrogen infrastructure, demanding careful project framing and stakeholder alignment.

Moreover, financial institutions and investors play an active role in shaping infrastructure projects for sustainability. Green financing mechanisms, such as sustainability-linked loans and government-backed subsidies, have become essential in enabling large-scale transitions. The adoption of carbon capture and storage (CCS) technologies and the expansion of hydrogen production facilities have been accelerated due to the availability of such financial instruments, reinforcing the influence of economic landscape pressures on decision-making.

These external pressures have influenced both the design and implementation of the projects, encouraging the adoption of sustainable technologies and operational practices. PoRA's ambition to become the most sustainable port globally is also a reflection of broader societal expectations and environmental goals. Furthermore, emerging digital systems are being integrated to align with EU carbon reporting standards, which not only responds to regulatory requirements but also necessary adaptations to maintain global competitiveness in an increasingly climate-conscious economy.

5.4. Dynamic interplay in sustainability transitions for infrastructure projects

The interaction between niche innovations, regime adaptation, and landscape pressures is central to understanding sustainability transitions in infrastructure projects (Geels, 2002). The three levels are interdependent, with niche innovations often emerging in response to landscape pressures and challenging the established socio-technical regime (Markard et al., 2012). For example, the niche innovation of remote-controlled cranes was introduced as a response to both landscape pressures for greater sustainability and regime-level goals for operational efficiency (see Fig. 3 for a visual overview of the interplay). Over time, these technologies have the potential to influence broader regime practices, as seen with the gradual integration of sustainability policies into the project's operations. Similarly, the Hydrogen Pipeline represents a niche innovation that could eventually transform the port's entire energy system by aligning with global climate goals and renewable energy standards (see Fig. 3). However, this transition requires substantial regulatory adjustments, investment in large-scale hydrogen storage infrastructure, and cross-border collaboration to facilitate integration into existing energy markets.

Projects like the RDM Campus demonstrate how regime adaptation can facilitate the uptake of niche innovations by reconfiguring industrial systems and creating new markets for sustainable technologies. At the same time, these transitions are shaped by landscape pressures, which provide the overarching drivers of change through policy shifts and societal demands (see Fig. 3). As infrastructure projects like these continue to evolve, they contribute to long-term sustainability transitions by integrating new technologies into existing systems, adapting regimes, and responding to global environmental challenges. This was also noted by other scholars (Eitan et al., 2023; Papadonikolaki et al., 2023).

Thus, the studied infrastructure projects play a pivotal role in sustainability transitions by acting as arenas for experimentation, innovation, and the integration of new technologies into established systems (Lenfle and Söderlund, 2019; Papadonikolaki et al., 2023). These projects serve as catalysts that bridge niche innovations with broader socio-technical regimes (Gasparro et al., 2022), allowing radical technologies such as green hydrogen production and energy-generating kites to be tested and scaled. These projects enable adaptation within existing systems by providing physical and institutional space for sustainable practices, fostering collaboration between industries, governments, and educational institutions.

Yet, these transitions are not solely technical. The interplay between the dominant narratives of PoRA on growth and counter-narratives by critical stakeholders on PoRA's role in maintaining the fossil industry introduces a tension that must be actively managed. PoRA's role as an owner is vital here not only in project delivery but in maintaining legitimacy, fostering collaboration, and reframing sustainability in a way that aligns divergent interests. Addressing resistance by reflecting upon its underlying causes allows organizations in transitions to move forward amid uncertainty (Eikelenboom and van Marrewijk, 2023). This also underscores the value of narrative reflexivity. By understanding how their own dominant narratives are constructed, received, and resisted, infrastructure owners like PoRA can better navigate contested transition terrain. Rather than dismissing counter-narratives, engaging with them constructively can enhance learning and repositioning in alignment with broader societal goals. Moreover, projects are responsive to landscape pressures such as climate change policies and societal demands for sustainability, which shape their goals and execution. Additionally, these transitions highlight the complexity of sustainability efforts in projects, where change is driven by interactions across multiple levels of the socio-technical system. The inclusion of financial mechanisms, such as sustainability-linked investments and carbon pricing strategies further illustrates how economic incentives play a role in reinforcing long-term sustainability transitions. We visualized the dynamic interplay in Fig. 4.

There were also narrative dynamics. In the case of the Maasvlakte 2 Case, PoRA initially framed the ecological compensation measures as evidence of ecological leadership. However, following criticism from NGOs and scientific advisors, who argued that the compensation zones were insufficient and weakly enforced, PoRA adjusted the narrative to stress procedural legitimacy and partnerships with environmental institutes. This reframing aimed to regain credibility and soften opposition. In the case of the RDM campus project, PoRA promoted RDM as a symbol of inclusive innovation and regional revitalization. However, critics including local educators and social equity advocates challenged this framing, arguing that benefits were disproportionately captured by

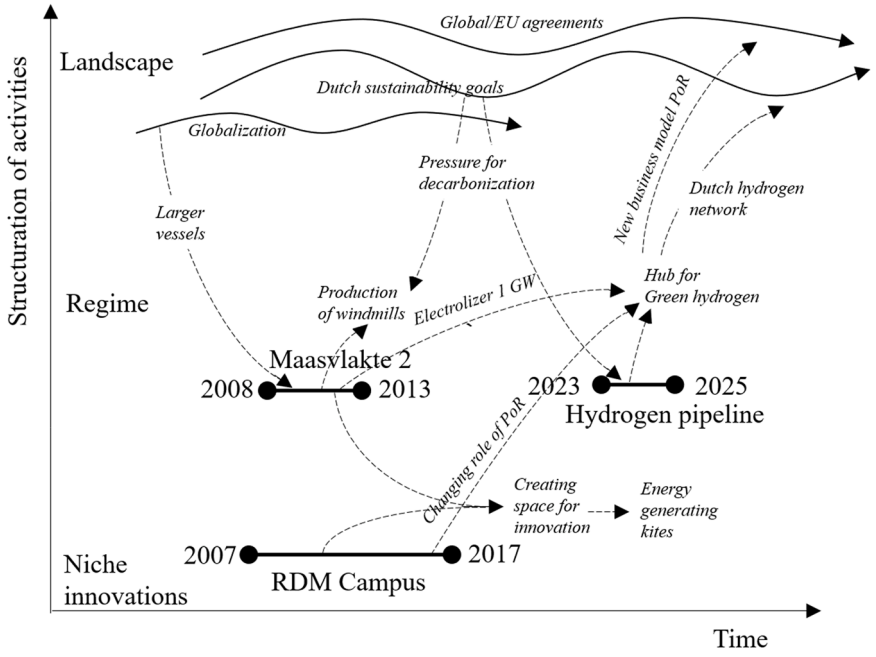

Fig. 4. Role of projects in sustainability transition of port/city of Rotterdam.

elite technical actors and that educational access remained uneven. In response, the narrative evolved as official communications began to emphasize inclusive education, and PoRA launched pilot programs for vocational integration. In the case of the Hydrogen pipeline case, the project was presented as a climate-forward innovation to align port infrastructure with Dutch decarbonization goals. Critics, however, framed the initiative as a techno-fix benefiting large incumbents without sufficient societal engagement or clarity about end-use. Following this, the narrative began to emphasize partnerships with new industrial actors and framed the pipeline as an enabling infrastructure rather than a solution in itself. Table 8 shows the narrative dynamics across the three embedded cases considered in this study.

Across the three cases, we observe that dominant narratives were not static. In each instance, resistance spurred narrative recalibration demonstrating a reflexive engagement by PoRA. These narrative adjustments suggest that transitions are shaped not only by technical feasibility or opposition strength, but by how effectively project sponsors reinterpret and reposition their narratives in response to contestation. These patterns align with emerging literature that view owners not as passive enablers but as institutional entrepreneurs (Leiringer & Zhang, 2021) who strategically shape trajectories through framing, partnerships, and resource orchestration in contested environments.

6. Discussion

In this study we used a case study methodology (Yin, 2009) and MLP approach (Geels, 2002) to show the dynamic process of how the three projects influence the sustainability transition of the port of Rotterdam over time and, vice versa, are influenced by the regime and landscape levels. These findings have four implications to the debate on project management and sustainability transitions (Daniel, 2022; Gasparro et al., 2022; Nylén, 2021) and one to the debate on transition studies (Geels, 2011; Frantzeskaki et al., 2017).

Table 8
Narrative dynamics across the three embedded cases.

Project	Dominant Narrative	Counter-Narrative	Reflexive Response by PoRA
Maasvlakte 2	A strategic expansion balancing economic growth and environmental responsibility through compensation zones.	Critics framed the project as greenwashing, arguing ecological offsets were inadequate and served to justify large-scale industrialization.	PoRA re-emphasized partnerships with environmental agencies, improved communication on ecological monitoring efforts, and framed compensation as part of long-term stewardship.
RDM Campus	An inclusive innovation hub revitalizing a disused shipyard and fostering new education-industry linkages.	Critics highlighted limited access for local communities and dominance of elite technical institutions, questioning claims of inclusivity.	PoRA adjusted messaging to foreground inclusive education goals, initiated outreach to vocational institutions, and launched small-scale pilot programs to engage broader publics.
Hydrogen Pipeline	Future-oriented infrastructure enabling the port's decarbonization and industrial leadership in the hydrogen economy.	Critics questioned who benefits, the vague end-use goals, and whether this represented genuine transition or a techno-fix supporting incumbents.	PoRA reframed the pipeline as enabling infrastructure for broader industrial transformation and emphasized collaborations with emerging hydrogen stakeholders.

6.1. Role of owners and flexible projects in sustainability transitions

Our first contribution extends literature on the role of projects in transitions (Daniel, 2022; Gasparro et al., 2022; Locatelli et al., 2023; Nylén, 2021; Winch et al., 2023) by demonstrating how different types of projects from environmental, socio-economic, and enviro-economic perspectives operate within a single infrastructure ecosystem to bring about sustainability transition. The planning and construction phases of most infrastructure projects typically span many years (Winch & Leiringer, 2016) in which they are influenced by regime and landscape developments, such as Dutch decarbonize policy. We have observed that during operation, infrastructure projects actively seek opportunities to be part of transitions and create value. Traditional megaproject management has been criticized for focusing too much on on-time delivery, on keeping within budget, and for satisfying requirements. Martinsuo and Hoverfält (2018)et al.,emphasize the importance of studying value creation and names this one of the most promising research directions in (mega)project studies. This highlights the importance of flexible and adaptive project management approaches that allow projects to respond dynamically to changing sustainability demands and emerging technological advancements (Eitan et al., 2023).

The second contribution to the debate on the role of projects in transitions is the insight that the role of an owner of infrastructure networks is essential in enabling projects to contribute to sustainability transitions. Previous insights highlighted the role of project actors in sustainability transitions (Gasparro et al., 2022; Eikelenboom and van Marrewijk, 2023). Our case study shows the capacity of owners to mobilize resources, align stakeholders, and integrate long-term sustainability goals into project governance is essential in acting as transition enablers. There have been calls for exploring how a responsible owner best wields its power since, in many contexts, infrastructure projects are monopsonists (Winch & Leiringer, 2016; Leiringer & Zhang, 2021). It is essential for infrastructure projects to move beyond conceptualizing themselves as transaction-orientated 'clients' towards 'owners'. Such a shift necessitates a re-evaluation of procurement strategies, investment priorities, and governance frameworks to ensure that infrastructure projects actively contribute to long-term sustainability transitions rather than merely complying with regulatory requirements. With a mission to enable sustainability transitions, the port of Rotterdam provided space to grow with the Maasvlakte 2 project, adapted a new role beyond being a landlord in the RDM campus project, and worked to turn its dream in its mission to reality with the Hydrogen Pipeline project.

Our third contribution to the debate is the insight that the narratives and counternarratives are essential in understanding the role of projects in sustainability transitions by showing how infrastructure owners use project narratives as performative tools to navigate tensions across MLP levels. Our case shows how PoRA as a reflexive owner deliberately crafts forward-looking storylines in vision documents (e.g., Port Plan 2030) to legitimize new regime adaptations, and how counter-narratives from activists force course corrections mid-project. PoRA's narrative practices can be seen as 'translation mechanisms' (Geels & Verhees, 2011) mediating between the expectations at niche levels and the institutional logics of the regime. Their reflexivity, observed in narrative repositioning, suggests a form of agency that shapes transition pathways from within incumbent institutions. Explicitly integrating this narrative layer into the MLP underscores that projects in sustainability transitions are as much battles over meaning and legitimacy as they are about technology.

The fourth and final contribution to the literature on the role of infrastructure projects in sustainability transitions is the understanding that projects unintentionally can create space for sustainability innovations. The Maasvlakte 2 project illustrates how sustainability can be retrofitted onto a largely economic initiative under external pressure, aligning with the 'hiding hand' concept from project management

literature (Hirschman, 1967), which suggests that project owners, when confronted with unforeseen challenges, are often compelled to develop innovative solutions. This idea remains a subject of active debate in project studies (Kreiner, 2020), but it provides a useful perspective for understanding how large-scale projects can become sites of transition-enabling innovation. However, infrastructure projects are often characterized by limited flexibility in supporting sustainability transitions, frequently the result of the 'carbon lock-in', which describes the self-perpetuating inertia created by large fossil fuel-based energy systems (Eitan et al, 2023). Addressing this challenge requires deliberate policy interventions and institutional support mechanisms to encourage adaptive reuse, technological innovation, and long-term sustainability planning within projects. The case of the Maasvlakte 2 project has shown the unintended outcomes of an infrastructure project over time, something that has also been observed in project studies (Frederiksen et al., 2021).

6.2. Role of narratives in sustainability transitions

Finally, the role of visions, narratives and counter narratives in transitions can add insights to transition studies (Geels 2011; Frantzeskaki et al., 2017). Narratives are fundamental to human understanding, and they can help make sense of transitions as one can gain insight into our own emotions, motivations, and goals (Rhodes & Brown, 2005). Transitions are often characterized by (radical) uncertainty and ambiguity and the vision enabled by narratives plays an important role in developing coping strategies for dealing with the ambiguity (Sergeeva & Ninan, 2023). The role of narratives in transitions has been discussed earlier (see Upham & Gathen, 2021). Our study builds on this by showing how the evolving visions on the port of Rotterdam (e.g., Port Plans 2004, 2011, and 2019) played a pivotal role in shaping RDM Campus as a key site where education and business would converge to foster technical innovation, addressing the port's sustainability goals. The narratives emerging from these visions were critical in mobilizing support and driving investments into projects like the RDM campus. Strong narrative framing not only influences public and private investment decisions but also enhances legitimacy and stakeholder engagement in sustainability transition efforts. This aligns with broader trends discussed by Green & Sergeeva (2020) about the role of future-oriented narratives in achieving a net-zero economy.

7. Conclusion

In this paper we asked the question of *how does an infrastructure project owner navigate the tensions which arise from narratives and counter-narratives in a sustainability transition from a multi-level perspective*? A nested case approach was chosen (Lieberman, 2005) in which three embedded cases were selected for an in-depth study: the Maasvlakte 2, RDM campus, and Hydrogen Pipeline. MLP (Geels, 2002) provided a structured way to analyze how different transition tensions emerge across niche, regime, and landscape levels. These tensions were constructed and negotiated through narratives developed by project owners. This study is unique for its empirical coverage of how infrastructure projects contribute to sustainability objectives over a period of 20 years. By adopting narrative perspective, this research offers insights into the evolving interactions between infrastructure projects and sustainability transitions, demonstrating how project dynamics shift in response to critical voices, external disruptions and policy changes.

The contributions of this study to practice for infrastructure owners and regional authorities is on how infrastructure projects (un)intently can contribute to larger sustainability transitions. This underscores the need for integrated governance frameworks of infrastructure projects that facilitate collaboration between infrastructure owners, policymakers, and urban planners to align long-term sustainability transition goals. A discussion that is only beginning now. Furthermore, we emphasize how being a reflective owner of infrastructures is essential for bringing about transitions in the different phases of infrastructure development. Future projects should consider embedding sustainability leadership within governance structures to ensure that transition-oriented goals remain a priority beyond the initial planning phase of a project. Looking forward, we recommend that infrastructure owners embed systematic narrative monitoring into project governance: tracking which storylines gain salience, proactively engaging counter-narrative voices, and adjusting project framing to sustain legitimacy. Such discursive governance can help manage tensions at niche, regime, and landscape levels - turning narrative struggles into opportunities for more resilient, adaptive transition pathways.

The study is limited in the number of embedded cases being studied. Expanding the scope to include additional infrastructure projects across different regions could provide comparative insights into how contextual factors influence sustainability transitions. Additionally, investigating the role of social movements and citizen-led initiatives in shaping sustainability narratives could offer a more holistic understanding of transition dynamics.

Funding

One of the authors received funding of the Dutch Research Council (NWO) under grant number 403.19.226.

CRediT authorship contribution statement

Johan Ninan: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Kees Stam:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation. **Alfons van Marrewijk:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Andrews, M. (2002). Counter-narratives and the power to oppose. *Narrative Inquiry, 12*(1), 1–6.

Bohn, S., & Braun, T. (2021). Field-configuring projects: How projects shape the public reflection of electric mobility in Germany. *International Journal of Project Management, 39*(6), 605–619.

Bosman, R., Loorbach, D., Rotmans, J., & Van Raak, R. (2018). Carbon lock-out: Leading the fossil port of Rotterdam into transition. *Sustainability, 10*(7), 2558.

BNR News Radio (25 September, 2023). Top of the Netherlands, Boudewijn Siemons (Havenbedrijf Rotterdam): 'Onze investeringen in de HES-terminal zullen uiteindelijk volledig van nut zijn' [Boudewijn Siemons (Port Authority): 'Our investments in the HES-terminal will be eventually completely useful].

Charef, R., & Lu, W. (2021). Factor dynamics to facilitate circular economy adoption in construction. *Journal of Cleaner Production, 319*, Article 128639.

Chopra, R., Agrawal, A., Sharma, G. D., Kallmuenzer, A., & Vasa, L. (2024). Uncovering the organizational, environmental, and socio-economic sustainability of digitization: evidence from existing research. *Review of Managerial Science, 18*(2), 685–709.

Daniel, P. A. (2022). Multi-level perspective framework in macro project studies: Towards a complex project organizing approach to sustainability transitions. *International Journal Of Project Management, 40*(8), 865–870.

De Langen, P. W., & Heij, C. (2014). Corporatisation and performance: A literature review and an analysis of the performance effects of the corporatisation of Port Authority. *Transport Reviews, 34*(3), 396–414.

Eikelenboom, M., & van Marrewijk, A. H. (2023). Transforming critical points of intersection into points of opportunity: Reflective interventions in inter-organizational collaboration. *Environmental Innovation And Societal Transitions, 48*, Article 100748.

Eikelenboom, M., & van Marrewijk, A. (2024). Tied islands: The role of organizational members in knowledge transfer across strategic projects. *International Journal of Project Management, 42*(3), Article 102590.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), 532–550.

Eitan, A., Itay Fischhendler, I., & Van Marrewijk, A. H. (2023). How does regret cost shape the irreversibility of renewable energy megaprojects? The case of the Ashalim thermal solar power station. *Environmental Innovation And Societal Transitions, 46* (100696), 1–14.
Fairhurst, G. T., Cooren, F., & Cahill, D. J. (2002). Discursiveness, contradiction, and unintended consequences in successive downsizings. *Management Communication Quarterly,, 15*(4), 501–540.
Frandsen, S., Kuhn, T., & Lundholt, W. (2017). *Counter-narratives and Organization*. New York and London: Routledge.
Frantzeskaki, N., Broto, V. C., Coenen, L., & Loorbach, D. (2017). Urban sustainability transitions: The dynamics and opportunities of sustainability transitions in cities. *Urban sustainability transitions* (pp. 1–20). Routledge.
Frederiksen, N., Gottlieb, S. C., & Leiringer, R. (2021). Organising for infrastructure development programmes: Governing internal logic multiplicity across organisational spaces. *International Journal of Project Management, 39*(3), 223–235.
Gasparro, K., Zerjav, V., Konstantinou, E., & Casady, C. B. (2022). Vanguard projects as intermediation spaces in sustainability transitions. *Project Management journal, 53* (2), 196–210.
Gasunie. (2023). Dutch national hydrogen network launches in Rotterdam. https://www.gasunie.nl/en/news/dutch-national-hydrogen-network-launches-in-rotterdam accessed on 08 Jan 2024.
Geels, F. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy, 31*, 1257–1274.
Geels, F. W. (2004). From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research Policy, 33*(6-7), 897–920.
Geels, F. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation And Societal Transitions, 1*(1), 24–40.
Geels, F. W. (2020). Micro-foundations of the multi-level perspective on socio-technical transitions: Developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory. *Technological Forecasting and Social Change, 152*, Article 119894.
Geels, F. W., & Locatelli, G. (2024). Broadening project studies to address sustainability transitions: Conceptual suggestions and crossovers with socio-technical transitions research. *International Journal of Project Management, 42*(7), 102646.
Geels, F. W., & Raven, R. P. J. M. (2006). Non-linearity and expectations in niche-development trajectories: Ups and downs in Dutch biogas development (1973-2003). *Technology Analysis & Strategic Management, 18*(3/4), 375–392.
Geels, F. W., & Verhees, B. (2011). Cultural legitimacy and framing struggles in innovation journeys: A cultural-performative perspective and a case study of Dutch nuclear energy (1945–1986). *Technological Forecasting and Social Change, 78*(6), 910–930.
Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods, 16*(1), 15–31.
Grabher, G. (2004). Temporary architectures of learning: Knowledge governance in project ecologies. *Organization studies, 25*(9), 1491–1514.
Green, S. D., & Sergeeva, N. (2020). The contested privileging of zero carbon: Plausibility, persuasiveness and professionalism. *Buildings and Cities, 1*(1), 491–503.
Hajer, M. A. (1995). *The politics of environmental discourse: Ecological modernization and the policy process*. Clarendon Press.
Hargrave, T. J., & Van de Ven, A. H. (2017). Integrating dialectical and paradox perspectives on managing contradictions in organizations. *Organization Studies, 38* (3–4), 319–339.
Harper, S. R. (2009). Niggers no more: A critical race counternarrative on Black male student achievement at predominantly White colleges and universities. *International Journal of Qualitative Studies in Education, 22*(6), 697–712.
Hermwille, L. (2016). The role of narratives in socio-technical transitions—Fukushima and the energy regimes of Japan, Germany, and the United Kingdom. *Energy Research & Social Science, 11*, 237–246.
Hirschman, A. O. (1967). *Development projects observed*. Washington DC: Brookings Institution Press.
Humphreys, M. (2005). Getting personal: Reflexivity and autoethnographic vignettes. *Qualitative Inquiry, 11*(6), 840–860.
Jansen, M., & Hein, C. (2021). Port city symbiosis: Introduction to the special issue. *Maritime Economics & Logistics, 25*, 211–229.
Koppenol, D. M. (2014). *Think global, act local: Maasvlakte II en het mainportconcept (1993-2008)*. Erasmus University Rotterdam.
Kreiner, K. (2020). Conflicting notions of a project: The battle between Albert O. Hirschman and Bent Flyvbjerg. *Project Management Journal, 51*(4), 400–410.
Leiringer, R., & Zhang, S. (2021). Organisational capabilities and project organising research. *International Journal of Project Management, 39*(5), 422–436.
Lenfle, S., & Söderlund, J. (2019). Large-scale innovative projects as temporary trading zones: Toward an interlanguage theory. *Organization Studies, 40*(11), 1713–1739.
Lieberman, E. S. (2005). Nested analysis as a mixed-method strategy for comparative research. *American Political Science Review, 99*(3), 435–452.
Ligthart, R., Oerlemans, L., & Noorderhaven, N. (2016). In the shadows of time: A case study of flexibility behaviors in an interorganizational project. *Organization Studies, 37*(12), 1721–1743.
Locatelli, G., Ika, L., Drouin, N., Müller, R., Huemann, M., Söderlund, J., Geraldi, J., & Clegg, S. (2023). A Manifesto for project management research. *European Management Review*.
Lundin, R. A., Arvidsson, N., Brady, T., Ekstedt, E., Midler, C., & Sydow, J. (2015). *Managing and Working in Project Society. Institutional Challanges of Temporary Organizations*. Cambridge University Press.
Maniak, R., & Midler, C. (2014). Multiproject lineage management: Bridging project management and design-based innovation strategy. *International Journal Of Project Management, 32*(7), 1146–1156.
Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research Policy, 41*(6), 955–967.
Martinsuo, M., & Hoverfält, P. (2018). Change program management: Toward a capability for managing value-oriented, integrated multi-project change in its context. *International Journal of Project Management, 36*(1), 134–146.
Martinsuo, M., Teerikangas, S., Stensaker, I., & Meredith, J. (2022). Managing strategic projects and programs in and between organizations. *International Journal of Project Management, 40*(5), 499–504.
Mathur, S., Ninan, J., Vuorinen, L., Ke, Y., & Sankaran, S. (2021). An exploratory study of the use of social media to assess benefits realization in transport infrastructure projects. *Project Leadership and Society, 2*, 1–10.
McLean, K. C., & Syed, M. (2016). Personal, master, and alternative narratives: An integrative framework for understanding identity development in context. *Human Development, 58*(6), 318–349.
Meyer, H., Nillesen, A. L., & Zonneveld, W. (2012). Rotterdam: A city and a mainport on the edge of a delta. *European Planning Studies, 20*(1), 71–94.
Munck af Rosenschöld, J. (2019). Inducing institutional change through projects? Three models of projectified governance. *Journal of Environmental Policy & Planning, 21*(4), 333–344.
Nefs, M., Zonneveld, W., & Gerretsen, P. (2023). The Dutch 'Gateway to Europe' spatial policy narrative, 1980-2020: A systematic review. *Planning Perspectives, 38*(1), 49–68.
Ninan, J. (2020). Online naturalistic inquiry in project management research: Directions for research. *Project Leadership And Society, 1*, Article 100002.
Ninan, J., & Sergeeva, N. (2021). Labyrinth of labels: Narrative constructions of promoters and protesters in megaprojects. *International Journal of Project Management, 39*(5), 496–506.
Ninan, J., & Sergeeva, N. (2022). Battle of narratives: Interaction between narratives and counter-narratives in megaprojects. *Project Leadership and Society, 3*, Article 100069.
Nylén, E. J. A. (2021). Projectified governance and sustainability transitions: How projects and framework programmes can accelerate transition processes. *Environmental Policy and Governance, 31*(6), 605–618.
Papadonikolaki, E., Morgan, B., & Papachristos, G. (2023). Megaprojects as niches of sociotechnical transitions: The case of digitalization in UK construction. *Environmental Innovation And Societal Transitions, 48*, Article 100728.
Pasmore, W., Winby, S., Mohrman, S. A., & Vanasse, R. (2019). Reflections: Sociotechnical systems design and organization change. *Journal of Change Management, 19*(2), 67–85.
Port of Rotterdam. (2021a). Giant wind turbine on Maasvlakte 2. https://www.portofrotterdam.com/en/news-and-press-releases/giant-wind-turbine-maasvlakte-2.
Port of Rotterdam. (2021b). Nieuwe kademuur Sif Group gereed. https://www.portofrotterdam.com/nl/nieuws-en-persberichten/nieuwe-kademuur-sif-group-gereed.
Port of Rotterdam. (2022). Shell to start building Europe's biggest green hydrogen plant. https://www.portofrotterdam.com/en/news-and-press-releases/shell-to-start-building-europes-biggest-green-hydrogen-plant.
Port of Rotterdam. (2023a). Energy transition in the pipeline. https://www.portofrotterdam.com/en/news-and-press-releases/energy-transition-in-the-pipeline accessed on 08 Jan 2024.
Port of Rotterdam. (2023b). Green hydrogen: Not so much a pipe dream, more a reality. https://www.portofrotterdam.com/en/news-and-press-releases/green-hydrogen-not-so-much-a-pipe-dream-more-a-reality accessed on 08 Jan 2024.
Port of Rotterdam. (2023c). Start bouw Het Magazijn op RDM Rotterdam. https://www.portofrotterdam.com/nl/nieuws-en-persberichten/start-bouw-het-magazijn-op-rdm-rotterdam.
Port of Rotterdam Authority (2023). Connecting the world. Building tomorrow's sustainable port: highlights Annual Report 2023.
Putnam, L. L., Myers, K. K., & Gailliard, B. M. (2014). Examining the tensions in workplace flexibility and exploring options for new directions. *Human Relations, 67* (4), 413–440.
Rhodes, C., & Brown, A. D. (2005). Narrative, organizations and research. *International Journal of Management Reviews, 7*(3), 167–188.
Rijksoverheid, Province of South Holland, municipality of Rotterdam & Port of Rotterdam Authority (2023). Ontwikkelperspectief NOVEX-gebied: Samenwerken aan de toekomst van het Rotterdamse havengebied [Development perspective NOVEX-area: Collaborating on the future of Rotterdam's port area].
Roberts, C., & Geels, F. W. (2018). Public storylines in the British transition from rail to road transport (1896-2000): Discursive struggles in the Multi-Level Perspective. *Science as Culture, 27*(4), 513–542.
Schot, J. W., & Geels, F. W. (2008). Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda and policy. *Technology Analysis & Strategic Management, 20*(5), 537–554.
Schneider, C., Lechtenböhmer, S., & Samadi, S. (2020). Risks and opportunities associated with decarbonising Rotterdam's industrial cluster. *Environmental Innovation and Societal Transitions, 35*, 414–428.
Sengers, F., Wieczorek, A. J., & Raven, R. (2019). Experimenting for sustainability transitions: A systematic literature review. *Technological Forecasting and Social Change, 145*, 153–164.
Sergeeva, N., & Ninan, J. (2023). Megaproject narratives: Directions for research. In G. Winch, M. Brunet, & D. Cao (Eds.), *Research Handbook on Complex Project Organizing*. Edward Elgar.
Sergeeva, N., & Winch, G. M. (2021). Project narratives that potentially perform and change the future. *Project Management Journal, 52*(3), 264–277.

Smith, A., & Raven, R. (2012). What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy, 41*(6), 1025–1036.
Smith, A., Voß, J. P., & Grin, J. (2010). Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. *Research Policy, 39*(4), 435–448.
Sovacool, B. K., & Geels, F. W. (2021). Megaprojects: Examining their governance and sociotechnical transitions dynamics. *Environmental Innovation And Societal Transitions, 41*, 89–92.
Strauss, A., & Corbin, J. M. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. California: Sage Publications.
Streng, M., Van der Lugt, L., & Van Houwelingen, R. (2023). Havenmonitor 2023: De economische betekenis van Nederlandse zeehavens [Port monitor 2023: The economic relevance of Dutch seaports], Erasmus Center for Urban, Port and Transport Economics.
Sydow, J., Lindkvist, L., & DeFillipi, R. (2004). Project-based organizations: Embeddedness and repositories of knowledge: Editorial. *Organization Studies, 25*(9), 1475–1489.
Thomas, R., Sargent, L. D., & Hardy, C. (2011). Managing organizational change: Negotiating meaning and power-resistance relations. *Organization Science, 22*(1), 22–41.
Upham, P., & Gathen, L. (2021). Actors in transitions: Narratives of roles and change in the German e-mobility transition. *Environmental Innovation And Societal Transitions, 40*, 450–460.
van Bueren, E., & Broekhans, B. (2013). Individual projects as portals for mainstreaming niche innovations. *Constructing Green*, 145–167.
Van den Elshout, S., Ameling, M., De la Vieter, V., Voerman, J., & Willers, S. (2022). Uitstoot naar de lucht in de Rijnmond: Wat is er verbeterd in 50 jaar? [Emissions to the air in the Rijnmond: What has improved in 50 years?], DCMR.
van den Ende, L., & van Marrewijk, A. (2019). Teargas, taboo and transformation: A neo-institutional study of community resistance and the struggle to legitimize subway projects in Amsterdam 1960–2018. *International Journal Of Project Management, 37*(2), 331–346.
Van Marrewijk, A. H., & Dessing, N. S. S (2019). Negotiating reciprocal relationships: Practices of engaged scholarship in project studies. *International Journal of Project Management, 37*(7), 884–895.
Van Tuijl, E., & Otgaar, A. (2017). 10 RDM Campus (Rotterdam). In L. Carvalho, B. Van den Berg, H. Galal, & P. Teunisse (Eds.), *Delivering Sustainable Competitiveness*. Ashgate: Farham.
Van Vuuren, D. P., Boot, P. A., Ros, J., Hof, A. F., & den Elzen, M. G. (2017). *The implications of the Paris climate agreement for the Dutch climate policy objectives*. PBL Netherlands Environmental Assessment Agency.
Vries, I.M.J. (2014). From shipyard to brainyard: The redevelopment of RDM as an example of a contemporary port-city relationship, Partie II, Retours d'expériences internationals, 107-126.
Walshham, G. (2002). Interpretive case studies in IS research: nature and method. In M. Myers, & D. Avison (Eds.), *Qualitative Research in Information Systems*. London: Sage Publications.
Winch, G., & Leiringer, R. (2016). Owner project capabilities for infrastructure development: A review and development of the "strong owner" concept. *International Journal Of Project Management, 34*(2), 271–281.
Winch, G. M., Geels, F., Locatelli, G., & Sergeeva, N. (2023). Projecting for sustainability transitions. *International Journal of Project Management, 41*(3), 1–4.
Yin, R. K. (2009). *Case study research: design and methods*. Los Angeles, CA: Sage Publications.
Zhang, X., Liu, M., Le, Y., Wei, J., Zhu, Y., & Li, Y. (2023). Deconstructing organizational capabilities of megaproject owners: Dimensions and levels. *Journal of Construction Engineering and Management, 149*(7), Article 04023055.
Zilber, T. B. (2007). Stories and the discursive dynamics of institutional entrepreneurship: The case of Israeli high-tech after the bubble. *Organization Studies, 28*(7), 1035–1054.