Integrating the energy transition & climate adaptation trajectories: How collaboration between sectors and implementation phases improve planning practices of Dutch municipalities

Rob Daniël Raijmakers[12]

16-09-2022

Abstract

The implementation of local climate action agendas requires major interventions in the built environment. The energy transition (ET) and climate adaptation (CA) are two elements of climate action but follow separate trajectories. As key players in the built environment, local governments must integrate both trajectories to prevent suboptimal paths. However, it is unclear what local governments can do to improve the situation. Earlier research focussed on improving specific phases of these trajectories. Consequently, little is known about the connections between the phases and their effect on the integration of two trajectories. Therefore, this case study research zooms in on three cases in the eastern part of the Netherlands where municipalities experiment with integrating both trajectories. This paper shows how municipalities can integrate the trajectories of the ET and CA by connecting their policy, design and asset management activities. Subsequently, four interventions are proposed to exemplify how the collaboration between sectors and implementation phases can lead to a better integration of the ET and CA trajectories. This study adds to the existing knowledge by showing the importance of coordinating the implementation phases for the integration of the ET and CA. By integrating the ET and CA trajectories, local climate action agendas can become more affordable, less time- and space-consuming and cause less construction nuisance. For society, this contributes to a more sustainable and climate-resilient built environment.

Keywords: energy transition; climate adaptation; integration; collaborative planning; municipalities

1 Introduction

The consequences of climate change are becoming increasingly visible all over the world. For example, CRED (2022) estimated that natural disasters affected 101.9 million people, caused 10,492 deaths and caused US$ 252 billion in economic losses. With increasing levels of global warming, it is expected that the consequences of climate change will only get worse. Combatting the consequences of climate change is called climate action and requires two strategies: climate mitigation and climate adaptation (CA). Climate mitigation is the strategy to reduce greenhouse gas (GHG) emissions to prevent further increases in global temperature (NASA, n.d.). While this strategy prevents future consequences of climate change, it does not prevent already experienced or imminent consequences. Therefore, CA is needed to limit the experienced consequences of climate change (NASA, n.d.).

[1] Corresponding author: Rob Daniël Raijmakers; r.d.raijmakers@gmail.com; Dept. of Construction Management and Engineering, Faculty of Engineering Technology, Univ. of Twente, P.O. Box 217,Enschede 7500 AE, Netherlands

[2] This paper is the result of the MSc. thesis Civil Engineering & Management; it is supervised by André Dorée (University of Twente), Karina Vink (University of Twente) and Remko Cremers (Municipality of Hengelo)

Combatting climate change is a worldwide issue and all countries need to address it. One of the countries which is committed to climate action is the Netherlands. First, the Dutch national government signed the Paris agreement in 2016 and implemented its goals in the 'Climate agreement' ("Klimaatakkoord") (Rijksoverheid, 2019). This means that the GHG emission levels need to be reduced by 95% in 2050 compared to 1990 levels. The main way to achieve this is to switch the use of fossil energy sources to renewable energy sources, which is also called the energy transition (ET). An example of this is changing the heating source of buildings from natural gas to a renewable energy source. Besides climate mitigation goals, the Dutch national government also is committed to reducing the consequences of climate change, which is called climate adaptation (CA). Specifically, the national government is committed to the Delta Programme for Spatial Adaptation ("DPRA") (DPRA, 2021) which goal is to be climate resilient in 2050.

While the Dutch national government has set the goals for the ET and CA agendas, municipalities need to implement both strategies. The implementation phase of both timelines is parallel because both trajectories start in 2018 and need to be completed in 2050 (DPRA, 2021; Rijksoverheid, 2019). Therefore, it would save a lot of time, costs, space, and construction nuisance if municipalities could combine measures of both strategies. Instead, both strategies are implemented as separate trajectories. Consequently, there is the risk that a municipality implements ET measures in a neighbourhood today and the same neighbourhood needs to have CA measures ten years later (or vice versa).

1.1 Problem – Gap in the literature

If local governments want to realise climate action goals at the lowest societal costs, then the ET and CA trajectories need to be integrated. While municipalities do not know how to do that, the part of the scientific literature which studies integration is able to provide insights. This is a body of literature which focusses on coordinating decision-making processes by (semi)-autonomous actors like policy subsystems. The following sections will review existing literature to get an overview of what previous research has already achieved. This review consists of four parts. First, a short overview of the existing perspectives on integration is given. Second, the expected advantages and disadvantages of integration are elaborated. Third, the ways in which previous research identifies and measures integration are shown. Lastly, a reflection is given on the strengths and limitations of the existing research.

Perspectives on integration

Many researchers have studied the concept of integration and integration means at a basic level the coordination of separated aspects. However, the concept has been applied to many fields and the interpretations of integration differ considerably. Nilsson & Persson (2003) provide three useful perspectives to distinguish between interpretations of integration in the field of environmental policy integration (EPI): policy integration can be seen as a 'process', an 'outcome' and an 'output'. When interpreted as a process, policy integration is a matter of coordinating and communicating between sectors within the government. In contrast, the outcome perspective sees integration as the results of the implementation. Lastly, the output perspective focusses on the political aspects of integration. The output perspective is out of the scope of this study for two reasons. First, there is a weak link between the substantive process and the output (Falkemark, 1999). Second, the focus of the output perspective lies on the political aspects which are excluded from this study. The distinction between the

perspectives is not always clear but it shows the different interpretations of integration well. Therefore, this distinction is a recurring theme in the following sections.

Advantages and disadvantages of integration

Both the process and the outcome perspectives recognise the advantages and disadvantages of integration. One of the first studies about integration from a process perspective is Underdal (1980). According to the author, the purpose of integration is to internalise externalities. This internalization has two benefits: the number of positive externalities can be increased, and the number of negative externalities can be limited. Another benefit of integrating policies is that it improves the coherence of those policies (May et al., 2006). However, there are also disadvantages to integration. According to Underdal (1980), policy integration in one area can result in resources being taken from another area. This, in turn, leads to a lower performance for the area with fewer resources. On top of that, the author says that policy integration may conflict with "democratic values such as decentralisation and broad participation" (Underdal, 1980, p.165). The opposite might also be true: an integral approach is less effective in top-down steering than a sectoral approach. According to Ohemeng & Ayee (2016), this is why the Ghanese government chose a sector-driven approach over the more integral whole-of-government philosophy.

Compared to the process perspective, the benefits and drawbacks of the outcome perspective are more concrete. Demirkesen & Ozorhon (2017) studied the project management performance of integration management during construction projects. After conducting a survey among Turkish contractors, the authors found that integration management is associated with benefits on time, costs, quality, safety and client satisfaction. However, these benefits are not universally shared. In a study about Dutch spatial planning, van Straalen (2012) found that including more stakeholders increases the complexity of spatial planning and makes the process more time-consuming.

Overall, the expected advantages and disadvantages differ significantly in the consulted literature. These differences might be explained by the context of the research and the disciplinary background of the researchers. It is also not clear whether these expected benefits and drawbacks are related to each other. Thus, while the literature mentions many positive and negative effects of integration, no definitive conclusions can be drawn.

Identifying and measuring integration

While there is little agreement on the benefits and drawbacks of integration, several studies support the use of scales to identify and measure integration. The main difference between the studies is how they operationalise integration. For example, Duguma et al. (2014) and Grafakos et al. (2019) operationalise integration as the level of functional compatibility of measures. Kapousouz (2019) on the other hand uses 22 factors to measure goal intertwinement on an ordinal scale. The previous authors conceptualise integration as a linear concept. However, according to Candel & Biesbroek (2016), integration is a non-linear process where one dimension can move independently from another dimension. Therefore, the researchers propose a framework with four dimensions consisting of eight scales in total.

Although operationalising integration as a concept with different levels enables researchers to compare cases, some researchers keep their conceptualisations of integration qualitative. Domorenok et al. (2021) for example use a new institutionalist framework to causally link several components of

institutional capacity with policy integration. As a result, one of the functions of this framework is to distinguish different kinds of policy integration measures. Another way of identifying different forms of integration is by the use of hierarchies. One of the earliest examples of a hierarchy of integrated policy making is the hierarchy of Geerlings & Stead (2003). This hierarchy has three levels with increasing levels of intensity: policy co-operation, policy coordination and policy integration. A more recent hierarchy comes from the action research of Uyterlinde et al. (2022) which describes three synergy levels. The least impactful synergy is the procedure-oriented coordination ("afstemming") level. This is followed by the efficiency-oriented co-coupling ("meekoppelkans"). The highest level is the goal-oriented coupling ("koppelkans").

In general, the method of measuring integration depends on the goal of the study. Empirical studies like that of Uyterlinde et al. (2022) use relatively simple conceptualisations of integration while the theorizing study of Candel & Biesbroek (2016) use a relatively complex conceptualisation of integration. Research like that of Domorenok et al. (2021) seem to strike a middle ground by interpreting integration by a framework which has been "validated by both scholarly research and policy guidance" (Domorenok et al., 2021, p.8).

Strengths & limitations of the existing literature

In general, the concept of integration has been applied to a wide range of contexts. This has resulted in many perspectives with useful insights. On the one hand, policy integration shows for example how sectoral policy sub-systems behave and how they can cooperate to become more coherent. On the other hand, a field like integration management shows how fragmented decision-making at construction sites can be coordinated to achieve better results. As a result, it is well-established within the literature that the functional separation of sectors in policy domains and specialists in other fields, like at construction sites, is a barrier to integration.

Although these different perspectives have a variety of uses, their main weakness is that they are too fragmented to effectively integrate the ET and CA trajectories. This is because municipalities are involved in many phases of the implementation such as formulating policies, planning and designing interventions, and realising and maintaining assets. Consequently, the involved disciplines are not only fragmented over parallel sectors, but they are also fragmented over the implementation process. In contrast, the literature tends to focus on just the fragmentation over sectors. Therefore, the main limitation of the previous research is that it does not consider the full implementation process.

1.2 Going forward – Thesis and structure

While the existing literature provides many useful insights, it lacks the ability to adapt to the context of municipalities. This research aims to close that gap, by including all implementation phases while studying the integration of the ET and CA trajectories. Most importantly, this study shows how municipalities can integrate the ET and CA by implementing measures which combine knowledge from different sectors *and* from all phases of the implementation process.

The following sections will therefore first show how the data was collected and analysed in the methodology. Subsequently, the first result shows the constructed conceptual framework which is used to understand the integration of the municipal ET and CA trajectories. After that, three pieces of evidence supporting the thesis of this study are presented:

1. Why the integration of the ET and CA is currently not widely happening.

2. What aspects of integration are already visible and why that is the case.
3. How the designed interventions can help municipalities integrate the separate trajectories.

After presenting the evidence, this paper continues to discuss the interpretation, contributions and limitations of this study. Lastly, this article concludes the findings, and recommendations of this research.

2 Methodology

The methodology starts with a description of the data that is required for this study. Subsequently, it is explained why case study research is a good fit and what the cases are. This is followed up with a section about the data collection methods. Lastly, the design process for the interventions is elaborated.

Research goals and necessary data

The aim of this research is to study how municipalities can integrate the trajectories of the ET and CA. Therefore, the findings of this study need to include four aspects:

1. A conceptual framework which describes the ways in which involved civil servants can contribute to the integration of the ET and CA trajectories.
2. The conditions which facilitate or hinder integration.
3. Measures which municipalities (potentially) employ to increase the level of integration.
4. New interventions which help municipalities integrate the ET and CA trajectories.

Thus, the findings need data about *how* and *why* civil servants use more or less integral practices.

Case study research

As mentioned in the last paragraph, this study mainly asks how- and why-questions about integration. Many reasons exist why participants in the implementation process decide (not) to coordinate with each other. These choices depend on a collection of often uncontrollable factors which might not be well documented. Grasping integration therefore requires a closer look at contemporary implementation process. According to Yin (2018), this combination of how and why questions, contextual and behavioural factors which are difficult to control, and the necessity to focus on contemporary events is a good fit for a case study research. Therefore, a case study research design is used for this study.

Cases

This case study consists out of three cases to make a comparison between cases within the available amount of time. This way findings are relatively generalisable without sacrificing the depth of this study. Three neighbourhoods are chosen as cases: “de Nijverheid”, “het Twekkelerveld” and, “Hart van Zuid” (see Table 3). These areas are appropriate for the study because the local municipalities are trying to combine the implementation of their ET and CA goals in those neighbourhoods. The cases are in two neighbouring medium-sized municipalities in the east of the Netherlands: the municipalities of Hengelo and Enschede. While the cases share several similarities, there are two important differences between Hart van Zuid and the rest. First, the implementation of the ET and CA goals of Hart van Zuid began in 2000 [HVZ-1] whereas implementation in de Nijverheid and het Twekkelerveld started in 2017 [NIJ-1] and 2020 (Uyterlinde et al., 2020) respectively. Consequently, most of the work in Hart van Zuid is already done while the other two cases are still in the beginning of the implementation. Second, the

organisation structure behind Hart van Zuid has the most extensive integral steering capabilities. Following the definition of van Buuren et al. (2010), Hart van Zuid is a type 3 programme because each project is a means to realise the goals of the urban restructuring programme [HVZ-1]. In contrast, the organisation of de Nijverheid uses a project structure [NIJ-1] and the organisation of het Twekkelerveld uses a relatively light steering programme meant to optimise individual projects [TWE-2].

Table 1: Characteristics of the three cases

#	Case	Municipality	Inclusion of ET and CA goals?	Organisation structure	Current phase
1	De Nijverheid	Hengelo	Yes, but CA is implemented in a later stage	Project structure	ET: Definitive design CA: needs to be included
2	Het Twekkelerveld	Enschede	Yes, but most measures are mostly physically separated	Programme structure (Type 1)	ET: Programme of requirements CA: Delivery
3	Hart van Zuid	Hengelo	Yes, measures are implemented together	Programme structure (Type 3)	ET & CA: Asset management

Data collection: interviews & document analysis

The data is gathered by conducting four explorative unstructured interviews before the case study and 11 semi-structured during the case study. For every case, three to four interviews are conducted with at least one expert of the design & preparation level (like a project manager) and one expert of the policy level (like a policy advisor). The interviewees are selected by snowball sampling because each case only has a relatively small and hard-to-locate group of civil servants participating in it. The main benefit is therefore that enough experts can be found within the time constraints. On top of that, interviewees might refer to experts who might have been overlooked otherwise. One example during this study is the interview with a city district coordinator ("*stadsdeelregisseur*") who knows a lot about the different disciplines working in a neighbourhood. The main threat to the validity is that the sample is non-representative. This is mitigated by the requirement to interview at least one policy and one implementation expert. The interviews themselves are conducted in a semi-structured fashion. This set-up provided the structure to systematically gather the relevant data but also provided the flexibility to incorporate unanticipated data.

Another method to collect data during the case study was to analyse documents such as municipal policy documents, development plans and project plans. These documents have been found in two ways: (1) by searching information about the case by using online search engines, or (2) by asking interviewees for relevant documents. These documents are selected if they provide (1) additional information about the context, (2) working methods or (3) goals w.r.t. the ET, CA or working integrally. The quality of the documents is assessed on the level of depth of the document and whether it is published by the municipality or secondary sources. Within the case study, the main purpose is to triangulate data (Yin, 2018). This way, the validity can be checked, and information can, when possible, be complemented.

Data processing: coding factors and methods

The collected data from the interviews and documents were coded into factors which influence integration and methods with which municipalities integrate. The existing literature provided very little

guidelines in which methods to integrate could be recognised. Therefore, the coding of the methods is done by using the following working definition: "a product of unprescribed coordination involving more persons than is strictly required". This definition aims to include novel ways of collaborating and coordinating between semi-autonomous specialists or groups, while it precludes potential methods which are already standard practice within existing management techniques or sectoral routines.

The coding of the factors which influence integration is done in two steps. First, an interviewee needs to describe a condition which has a positive or negative influence on collaboration or coordination. Second, the potential factors are placed within the “exogenous variables” and the “action arena” components of Ostrom (2009)’s Institutional Analysis and Development (IAD) framework. The main benefit of this framework is that it provides a structure in which the conditions of a decision to integrate can be explained. Therefore, the recognised factors can be compared with each other, and if they are similar then the number of times that they have been mentioned can be counted.

Design process

The design process aimed to use the found factors and methods to create new integration measures. The first step in this design process was to summarise the findings and use its lessons to create preliminary interventions. Afterwards, four semi-structured interviews with managers were held to check the reliability of the analysis and the usefulness, applicability, and relevance of the preliminary interventions. Like the other interviews, these interviews use snowball sampling to select participants. Although snowball sampling was used, there are several requirements to select the interviewees. First, the interviewees needed to have experience with working integrally and must not have been interviewed before. On top of that, the selection of interviewees also needed to consist of:

- one expert with experience about the policy level;
- one expert with experience about the preparation & design level;
- one person from each involved municipality.

These requirements aimed to include a diverse range of perspectives. After conducting the four interviews, the interviewees started to repeat each other, and no more interviewees were planned. The final interventions were designed based on this feedback.

3 Results

3.1 Conceptual framework

In contrast to other studies, this study includes a wider range of implementation activities and perspectives in its scope. Therefore, the conceptual framework needs to define which activities and perspectives are included and how they are related to the concept of integration. The following section elaborates on how this conceptual framework is constructed. First, the rationale behind the framework is elaborated. Second, the phases and the related abstraction levels of the implementation process are defined. Lastly, integration is defined and operationalised.

Purpose of the framework

The conceptual framework is shown in Figure 1 and has three purposes:

1. The framework needs to describe the context where all stakeholders fit in.
2. The framework needs to define integration in a manner where all stakeholders can contribute to.

3. The framework needs to identify integration measures with their expected benefits.

The first purpose of the conceptual framework is to describe the context in a manner which includes every municipal civil servant who substantively contributes to the implementation of the ET and CA. This way, the framework provides an overview of which stakeholders are relevant and how they are related to each other. The second purpose of the framework is to define integration in such a way that all stakeholders understand what it means. This is done to guarantee that all stakeholders can give their perspective, regardless of whether they are city planners or civil engineers. The last purpose of the framework is to also identify the expected benefits of integration measures. The identification of potential benefits is especially important because the benefits and drawbacks of integration are ambiguous, and disintegration is as much of a problem as a lack of integration (Candel & Biesbroek, 2016). When stakeholders understand why measures are helpful, then they are also more likely to implement integration measures.

Abstraction levels & phasing

As said in the previous section, there are many municipal civil servants involved in the implementation of the ET and CA. In this framework the following three abstraction levels are distinguished:

1. Policy: this abstraction level is relatively abstract and translates the political balance of interests into long-term strategies.
2. Preparation & Design: this abstraction level translates long-term strategies into tactical measures.
3. Realisation & After-care: this abstraction level realises the tactical measures and makes sure that the measures keep functioning as intended over their lifespans.

These abstraction levels are relevant in different phases of the implementation and each phase ends when the respective milestone is reached (see Table 1). For example, the "definitive design" phase starts after the programme of requirements (PoR) is finished and ends when the final drawings are made.

Table 2: The phasing of the implementation process

Milestones	Explanation
Policy	The phase in which visions, legal frameworks and mechanisms are formulated.
Project Start Up (PSU)	The phase in which the scope and preliminary goals of a project is formulated.
Programme of Requirements (PoR)	The phase in which the exact goals, boundary conditions and delimitations are determined.
Definitive Design	The phase in which the project team iteratively makes designs until the final design is finished.
Specifications & Planning	The phase in which the design is translated in instructions for a construction contractor and the planning for the realisation is prepared.
Delivery	The phase in which the contractor realises the design.
Asset Management	The phase of a structure where it is used and maintained until the end of its lifespan.

Integration & couplings

In this study the short working definition of integration is: "*the process of coordinating and tuning to realise synergies*." In this working definition, the definition of synergies is borrowed from Kapousouz

(2019) because the focus on cooperation fits in the scope of this research. This makes the longer working definition of integration as follows: *"the process of coordinating and tuning the actions of multiple actors to realise better results than working separately."*

However, this working definition does not elaborate on the different ways in which the separate ET and CA trajectories can be brought together. The hierarchy of Uyterlinde et al. (2022) is therefore used to differentiate between forms of integration. The types of couplings are defined as:

1. Coupling ("koppelkans"): A transdisciplinary approach by searching for substantive synergies during the formulation of challenges and their potential solutions.
2. Co-coupling ("meekoppelkans"): The inclusion of measures with additional benefits during the design and implementation.
3. Coordination ("afstemming"): The tuning of existing working processes without additional investments or taking extra measures.

One issue with this hierarchy, however, is that it sees formulating integral goals as more important than implementing them integrally. This is a problem because it devalues the impact of tactical and operational work. Therefore, these types of couplings are interpreted not as a hierarchy but as a sequence of contributions of different abstraction levels. Thus, the types of couplings can be associated with different phases (see Table 2). In short, couplings are associated with defining problems and setting goals, co-couplings with designing solutions and, coordination with the implementation and maintenance of the measures.

Table 3: The types of couplings and the phases that they are associated with

Type of coupling	Associated milestones
Coupling	Policy, PSU and PoR
Co-coupling	PoR, Definitive Design and Specificiations & Planning
Coordination	Delivery and Asset Management

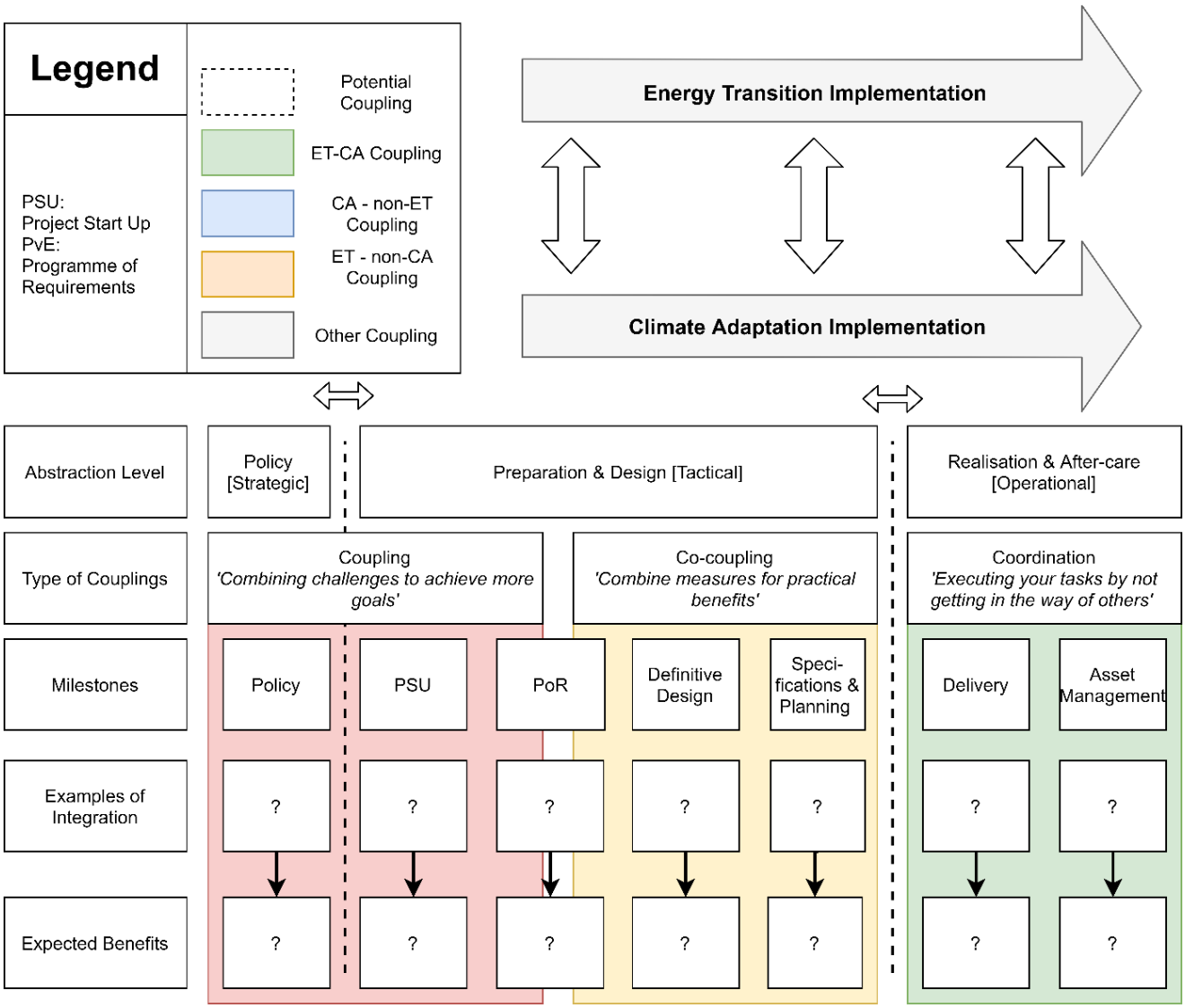

Figure 1: Conceptual framework to describe the integration of the ET and CA trajectories

3.2 Why the integration of the ET and CA is currently not widely happening

Currently, a common situation among the municipalities of Enschede and Hengelo is that CA activities are combined with the replacement of roads and sewers. While such combinations are efficient and desirable, they are relatively sectoral because both types of activities are often done by the same group of disciplines. Consequently, several sectoral aspects can be recognised in these seemingly integral projects (see Table 4).

First, the necessary budget for CA measures is earmarked to sectoral subthemes such as “water” and “green” [VER-3; NIJ-2; TWE-1; HVZ-3]. As a consequence, an integral CA measure is hindered when a subtheme like “green” does not have enough funds to pay its share. Thus, the presence of dominating and weak sectoral themes hinders the realisation of integral measures.

Another problem in these types of projects is that participants recognise opportunities to integrate too late or not at all. For example, when asked whether the project team of a CA project can contribute to ET goals, interviewees answered that it might be possible, but they simply did not know any ET expert within the organisation who can support them [VER-2; TWE-4; HVZ-2]. This is remarkable

because both municipalities have a team of policy advisors dedicated to the ET. There are two causes which explain this situation: (1) projects tend to have a narrow scope and work within their sector and, (2) project teams tend to rarely interact with policy advisors. The result of these boundaries between sectors and implementation phases is that opportunities to integrate the ET and CA are not recognised in time.

Lastly, while these types of projects aim to include the simultaneous replacement of roads and sewers for a more efficient implementation, practice shows this is often easier said than done. Usually, project teams search for this type of opportunities at the start of a project. However, when project teams do this, they often discover that the replacement or maintenance periods of assets diverge too much to simultaneously combine activities. It is remarkable that this occurs because asset managers can converge these timelines by for example using lifespan-extending measures on the assets which need to be replaced in the near future [TWE-1]. Municipalities do not do this currently because there is often no comprehensive overview to coordinate the inclusion of asset management activities within projects [VER-3]. Therefore, the diverging timelines of maintenance and replacement activities hinder integration.

Table 4: Factors which hinder integration

#	Hindering factors	Sources
1	The presence of weak (1) and dominant (2) themes in the process preventing the implementation of synergetic measures	1: [NIJ-1,2; TWE-1] 2: [VER-3; NIJ-2; HVZ-3]
2	(Co)-couplings are discovered and included too late in the design process	[NIJ-1; TWE-3,4]
3	Diverging timelines of expected maintenance and replacement activities	[VER-1; NIJ-1; TWE-1,3,4]

3.3 What aspects of integration are already visible and why that is the case

Found methods for integration

All three cases have the ambition to implement CA and ET measures in an integral manner. Consequently, many methods to integrate aspects of the ET and CA can be seen over the whole implementation process (see Figure 2). While there is a wide range of methods to integrate distinct themes, two related strategies were recognised in which participants integrate the trajectories of the ET and CA.

The first strategy occurs during the policy, PSU and PoR phases. In this strategy, participants put much effort in exploring sectoral problems in order to formulate a coherent and comprehensive problem or ambition. This has two purposes: (1) opportunities and threats can be better addressed by incorporating intersections between themes and, (2) more resources, and especially expertise, can be mobilised by formulating integral goals. The first purpose is the most visible in the case of Hart van Zuid because the masterplan (Projectbureau Hart van Zuid, 2002), spatial development map (Hengelo's Weekblad, 2020) and processual arrangements (Gemeente Hengelo, 2019) coordinate how the limited space of the area is optimally used. This is done by developing a comprehensive vision for the area and creating a framework in which the subareas are developed coherently. The second purpose is the most visible in the related urban investment deliberation (SIA) and dynamic investment agenda (DIA) strategies of the municipality of Enschede. The SIA is a framework which creates an overview of potential synergetic public investments for every neighbourhood and the DIA is a neighbourhood-oriented implementation programme (Uyterlinde et al., 2020). The goal the SIA/DIA approach is to use

resources of different municipal sectors and external parties, like social housing corporations and utility companies, to invest in cost-efficient interventions.

The second strategy happens during the subsequent phases when participants try to combine physical measures and activities. While the cases of de Nijverheid and het Twekkelerveld have not (fully) finished the definitive design phase, the participants attempt to deliver integrated results in three consecutive steps. First, the programme of requirements needs to include and specify all goals. This is a time-consuming process where many different disciplines are involved, and this is a problem when there is limited time available. The municipality of Enschede copes with this by using quick scans and quickly-applicable norms for CA (climate labels, “klimaatlabels”) [TWE-1] (Gemeente Enschede, n.d.). These requirements can then be used to include the different themes in the same design cycle. In de Nijverheid for example, the design process of the alternative for the natural gas grid will be combined with the process to design CA measures. If the previous two steps are executed correctly, then the designed measures can also be realised at the same time. In de Nijverheid this means for example that the municipality and utility companies could simultaneously replace all aging infrastructure.

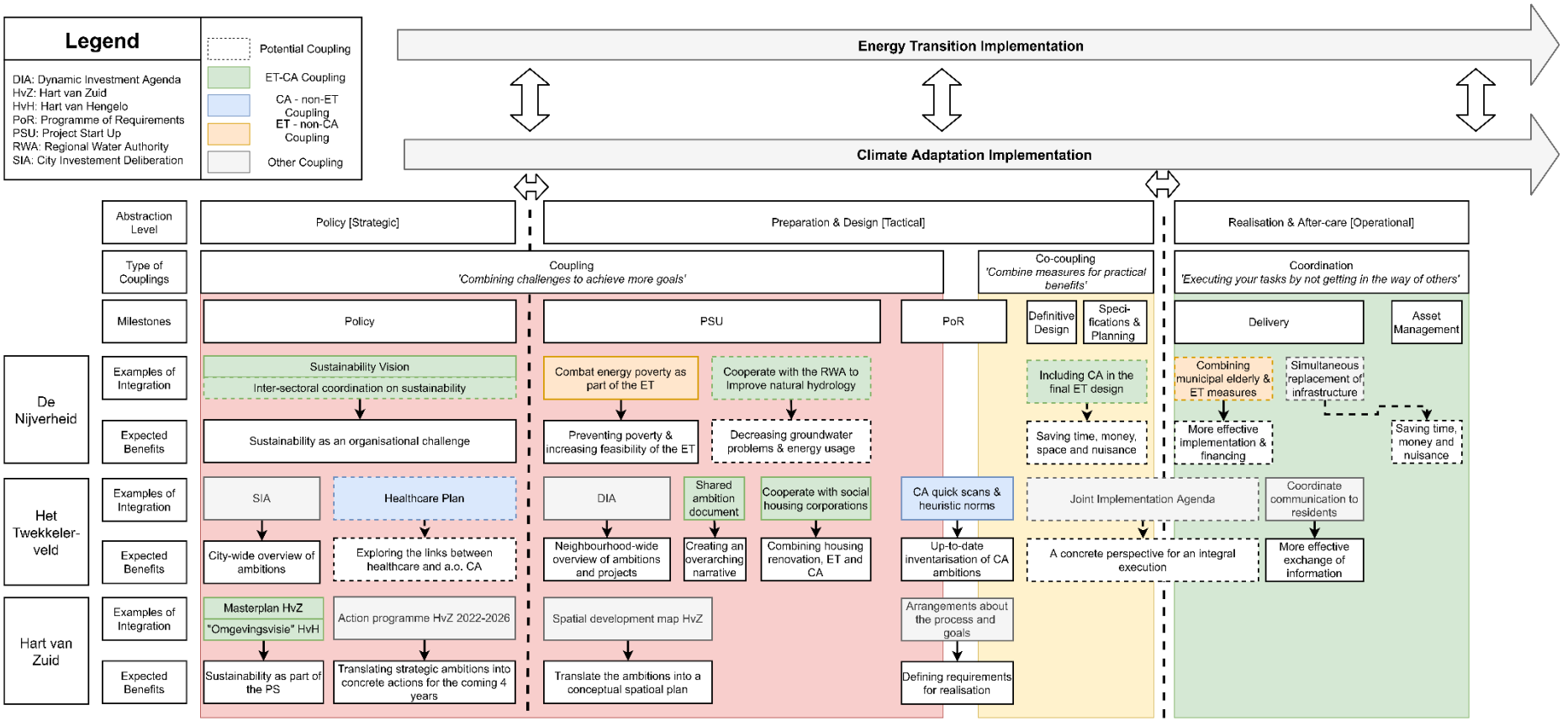

Figure 2: Overview of all found methods to increase integration

Factors helping integration

The two strategies of the last section do not happen in a vacuum. In fact, there are three factors which are crucial to implement these strategies (see Table 5). First, the participants need to work towards an overarching goal as opposed to a fixed sectoral goal. While this may seem obvious, it takes a lot of effort from individuals and the municipal organisation at large to reflect on existing (sectoral) goals and procedures. This reflection is necessary because sectoral conflicts in projects tend to be caused by conflicting policies and expectations.

The next two factors, which are crucial to the integration of the ET and CA, are about stimulating the exchange of information within the organisation. The second factor is that the ambitions and planned activities need to be visible to participants outside their respective sectors and implementation phases. Currently, the information about the ambitions and planned activities are not accessible to the complete organisation but potential coordination still depends on that information. However, according to most interviewees, the presence of formal plans, guidelines and planning tools makes this information more accessible to the rest of the organisation. Besides exchanging information via formal means, the third factor focusses on exchanging information via informal personal interactions. In short, professionals from different disciplines and implementation phases need to be involved in, and see the interdependencies of, each other's work. This is important within project teams, but it is especially important when project team members depend on the work of others outside their project team. For example, CA policy advisors need to know what issues are discovered during the design and realisation of water retention measures. Similarly, asset managers need to know how the designed measures need to be maintained. These personal interactions help in recognising and solving issues early on and provides feedback to the involved persons.

In conclusion, the integration strategies mainly depend on better exchange of information between disciplines and implementation phases. This is because cooperation and learning from other disciplines and implementation phases is possible when there is clarity within the organisation about the intersections of the ambitions and planned activities.

Table 5: A summary of the found factors which facilitate integration

#	Facilitating factors	Sources
1	Working towards an overarching goal	[VER-2,3; NIJ-1,2; TWE-1,2,4; HVZ-1,2,3]
2	Availability of formal plans and tools which give insight in ambitions and planned activities	[VER-3; NIJ-3; TWE-1,2,3,4; HVZ-1,3]
3	Easy flow of information between disciplines (1) and implementation phases (2) via personal interactions	1: [VER-1,2; HVZ-3] 2: [VER-3; NIJ-2,3; TWE-4; HVZ-3]

3.4 How interventions can help municipalities integrate the separate trajectories

The previous sections showed the importance of collaboration between sectors and implementation phases to the integration of the CA and ET trajectories. Based on these insights, four recommendations are designed in this study (see Figure 4). Therefore, the following section elaborates what these recommendations are and how they help the integration of the ET and CA.

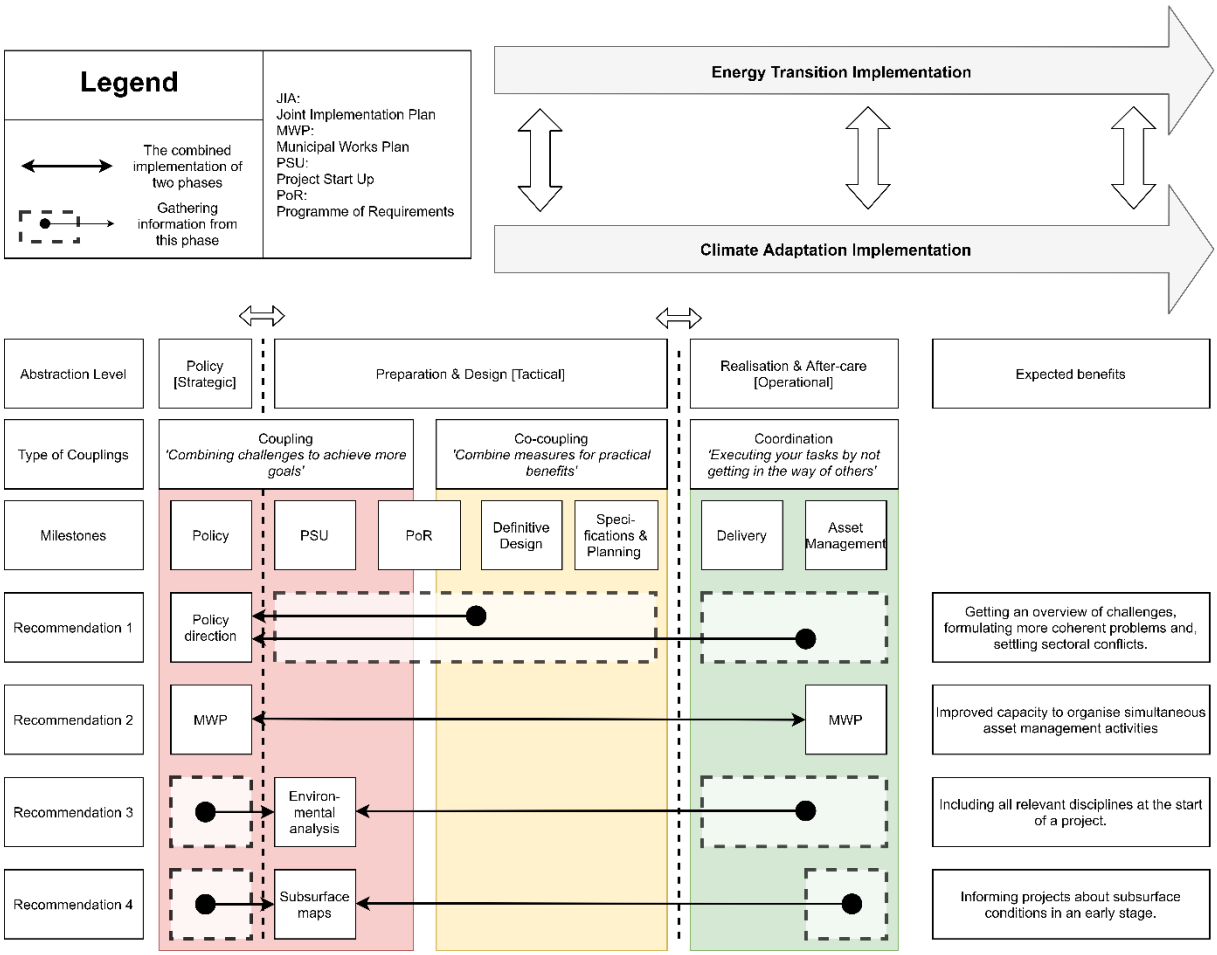

Figure 3: The recommendations with their respective implementation phase and information requirements

1. *Develop a comprehensive policy direction*

Symptomatic of sectoral processes is that each sector has its own goals and implementation trajectories. Consequently, disciplines of one sector do not know what their colleagues in other sectors are doing. Another issue is cooperating disciplines can have competing sectoral interests. Developing a comprehensive policy direction provides the organisation with an overarching goal where each sector can contribute to. One prerequisite for this is that the organisation should gather information from all three abstraction levels to create an overview of existing challenges. The benefits of developing a policy direction are that problems can be (re)defined with more coherence and conflicting sectoral interests can be settled sooner.

2. *Develop a Municipal Works Plan (MWP)*

Currently, the management of infrastructure assets is fragmented among external parties, like utility companies, and internal municipal departments. Ideally, if a municipality replaces one aging infrastructure asset, then it should also replace other aging assets to prevent excessive construction works. However, municipalities lack a comprehensive overview of their own maintenance and replacement activities and have therefore a limited capability to organise this process. A potential solution is to organise all municipal asset management activities from a new policy instrument: the Municipal Works Plan (MWP). This plan consists out of two elements: (1) a long-term financial planning and, (2) a short-term implementation agenda. The purpose of the long-term financial planning is to converge the functional lifespans of assets to enable simultaneous replacement. The short-term

implementation agenda checks whether planned activities can be combined with each other. A second purpose of the short-term agenda is that its information can used to collaborate with external parties. Ultimately, the goal of the MWP is to optimise asset management in a way which costs fewer resources and creates less construction nuisance to residents.

3. *Conduct an environmental analysis during the project formulation*

Projects which are initiated from sectoral goals can exclude otherwise contributing disciplines, and this problem is not solved by simply involving more disciplines at the start. This is because involving more disciplines slows the process [NIJ-1; TWE-1,4] and wastes the time of people who do not end up in the project team [VAL-2]. A better method of defining the scope of the project is to conduct an environmental analysis during the formulation of a project description. Key to this analysis is that the potential project owner, other managers, and someone who knows the project area provide the necessary input. Other managers contribute to the analysis because they know general developments within their domains. The inclusion of a function like a city district coordinator ("stadsdeelregisseur") contributes to this analysis by adding knowledge about the area and its residents to the analysis. The main benefit of conducting an environmental analysis before the formation of the project team is that all relevant disciplines are present at the start of a project.

4. *Develop digital maps about the subsurface*

The implementation of the ET and CA are not only demanding space on the surface but also space in the subsurface: roots, cables and pipes compete for space. This is especially problematic since little high-quality data exists on how much underground space is actually available [VER-4]. The data about the subsurface that is available, is dispersed over several disciplines: policy advisors [VER-4], civil engineers [HVZ-2] and asset managers [VAL-3] have each specific knowledge about the (im)possibilities of the subsurface. Developing digital maps about the subsurface requires the cooperation of all these disciplines and makes data about the subsurface more accessible to the organisation. While the whole organisation benefits from increased access to the data, projects will benefit the most. This is because data about the subsurface informs decision-making about the strategy, scope and measures of a project.

4 Discussion

The goal of this paper is to show that the coordination between implementation phases is a crucial factor to the integration of different themes. More specifically, this study argues that this type of coordination is just as important to integration as the inclusion of disciplines from other sectors. This contrasts with previous research where the focus lies on ways in which these different sectors can collaborate better. Therefore, the following section will first elaborate on the interpretation of the results and elaborate how that relates to the literature. Subsequently, the discussion reflects on the limitations of the research methodology and proposes a new direction for future research.

4.1 Interpretation of results

Factors

This study searched among others for factors which positively or negatively influence integration. Many factors were found during the processing of the data but there is a group of factors which were

mentioned several times by interviewees. A reoccurring theme is that a lack of information about two aspects prevents interviewees from collaborating with each other.

First, interviewees indicated that they cannot collaborate when they do not know the ambitions and ongoing activities of others. While this point may seem obvious, civil servants working in one sector or implementation phase do not always know what long-term ambitions and activities others outside their domain or implementation phase have. Consequently, existing developments like ongoing projects or the formulation of new policies cannot address threats and opportunities coming from other municipal goals. For example, when a CA project team is uninformed about potential ET ambitions, then it will miss opportunities such as negotiating an increase in electrical power capacity with a utility company in their project area.

Second, interviewees also show that they cannot collaborate when they do not know what other civil servants expect from them and what they can expect from others. For example, potential opportunities to include ET-goals in a CA project might not be pursued, if the project team does not have explicit permission to deviate from standard procedures. The reverse is also true: interviewees can cross organisational boundaries when rules, ratified policies and tools provide clarity about organisational expectations. Thus, if there is little clarity on the mutual expectations of cooperation, then the safest way of working is to stop crossing established organisational boundaries. This is especially a problem for the implementation because policy advisors, designers and asset managers depend on each other's work and knowledge. Therefore, measures which integrate the ET and CA trajectories need to bridge the organisational boundaries between implementation phases.

Methods of integration

The initial expectation was that methods which integrate aspects of the ET and CA only happen in the early phases of the implementation. In fact, most integration methods are found during the phases concerning the formulation of the goals and the designing of the solutions. However, several managers (like [NIJ-1], [TWE-2], [TWE-3] and [VAL-2]) remarked that the delivery and asset management phases also contribute to the integration of the ET and CA. The most common example that the interviewees give, is that these two phases are necessary to simultaneously replace aging infrastructure. However, what these interviewees also indicated is that measures in later phases requires extensive preparations in earlier phases. Case in point, if a project team wants to simultaneously replace infrastructure, then it needs to collaborate with utility companies from the start of a project to synchronise design activities [TWE-3]. Similarly, integration methods of earlier phases need information from later phases. For example, the SIA/DIA strategy of the municipality of Enschede can integrate goals at a strategic level, but it needs information from the tactical and operational levels such as information about CA-related problems [TWE-4]. Thus, while every implementation phase can contribute to the integration of the ET and CA, each phase is also dependent on the preparation and information of other phases.

4.2 Contributions to the literature

The main thesis of this study is that integration requires the coordination between sectors *and* implementation phases. The former part of the thesis is already widely established within the literature: Underdal (1980), Candel & Biesbroek (2016), and Domorenok et al. (2021) for example elaborate respectively that sectoral perspectives, (sub)systems and boundaries need to be overcome to achieve integral outcomes. The only consulted research where fragmentation is not primarily caused by distinct (policy) sectors is the study of Demirkesen & Ozorhon (2017): fragmented decision-making at construction sites is integrated by the coordination of among others separate specialists, processes and materials rather than fixed policy domains.

The latter part of the thesis is not explored by the consulted literature. Therefore, this study addresses the knowledge gap in the existing literature by exploring the interdependencies of integration between implementation phases. The contribution to the literature lies in the inclusion of a broader range of perspectives on integration than only the views of a single implementation phase. Consequently, new insights in the factors which influence integration and integration methods are found, and new interventions were designed. As a result, this study adds to the existing body of literature by showing that integration requires the coordination of fragmented decision-making between implementation phases.

4.3 Limitations

The main limitation of this study is that a less-structured approach is used for the data collection and processing. There are two aspects which stand out in this regard: the sampling method and the operationalisation of the factors and methods to integrate. The sampling technique that was used is snowball sampling. In this research, it means that interviewees refer to direct colleagues as potential new interviewees. Since this is a non-random sampling method, the risks exist that less-known perspectives within the target population are overlooked. This is a threat to the research quality because the research loses internal and external reliability. While a random sampling method prevents such sampling biases, it is not feasible to use such a sampling method. This is because the target group of civil servants directly working on the studied cases is relatively small and difficult to locate. This study coped with this threat by first describing the phases of the implementation process to get an overview of relevant activities. Based on this overview, the requirement has been set to include for each case at least one expert of the policy level and one expert of the design and preparation level. This minimum requirement leaves room to include unanticipated interviewees who are not substantively involved in a specific phase but do have unique information. Thus, the threat to the internal and external validity is mitigated by demarcating the implementation process and including a wide range of expertise.

Another threat to the research quality is the less-structured data collection and processing. More specifically, the factors which influence integration and the methods to integrate are collected and processed without a clearly demarcated operationalisation. The underlying problem is that there was limited a priori knowledge on what potential factors and methods could be found. The risk of defining a strict operationalisation of the potential factors and methods is that data could be excluded before the actual processing. Therefore, a looser operationalisation includes more data but at the expense of the reliability of the findings. This lack of structure is mitigated by using work definitions for the factors and methods. Moreover, the “exogenous variables” and the “action arena” of Ostrom's (2009) framework was used to code the factors which influence integration. The use of this existing framework creates a structure in which factors can be classified, compared and, when they are comparable, counted. Therefore, a relative lack of structure limits the reliability of the data collection and processing, but this has been mitigated as much as possible.

4.4 Research recommendations

The main limitation of this study is that the data collection and processing is relatively dependent on the context. Similar problems exist in the existing research since that the methodologies and findings are hardly transferable between studies. Consequently, the reliability and generalisability of the findings might be limited. Therefore, future research could focus on developing a general framework to operationalise and analyse the aspects of integration.

5 Conclusion

Achieving the climate action goals to be climate resilient and carbon neutral in 2050 depends on the ability of municipalities to change the built environment effectively and efficiently. Therefore, municipalities need to integrate the separated ET and CA trajectories. By studying how two Dutch municipalities try to integrate these trajectories, this research found several factors which influence integration and several methods in which aspects of the ET and CA are integrated. Ultimately, this study shows that this integration requires not only intersectoral cooperation but also the coordination among implementation phases.

Earlier studies put much effort in exploring and solving a lack of coordination between the fragmented decision-making of sectors. While this is an important aspect of integration, this one-sided focus also created a knowledge gap about the role of implementation phases in integral decision-making. This study addresses this knowledge gap by studying three cases in which Dutch municipalities try to integrate the ET and CA trajectories. Although there was a relative lack of structural data processing methods, this study found that the coordination among implementation phases is crucial to the implementation of integral ET and CA goals.

Currently, municipalities cannot realise an integral implementation of the ET and CA trajectories because professionals from different sectors and implementation phases rarely interact on a structural basis. By contrast, the participants of the three cases found methods to integrate aspects of the ET, CA and other themes in each implementation phase. They realised these methods by: (1) working towards an overarching goal; (2) providing insight in their ambitions and planned activities and (3) informally interacting with professionals from different disciplines and implementation phases. As a result, more sectors can be involved in the process. On top of that, each implementation phase contributes to integral solutions in later phases while also providing valuable feedback to previous phases. Therefore, an improved collaboration between sectors and implementation phases leads to the integration of the trajectories of the ET and CA. Thus, by showing the importance of collaboration between sectors and implementation phases, this study helps municipalities to contribute to a more sustainable and climate-resilient built environment.

5.1 Recommendations

Several recommendations are suggested based on the findings of this study. First, it is important that future research develops a framework which is applicable in more contexts. This is necessary because it allows for more generalisable results with a higher degree of reliability. Second, it is important for practitioners to come up with new ways to improve coordination over implementation phases. In this context, this study suggests practitioners to investigate the usefulness of the earlier mentioned interventions, namely:

- to develop an integral policy course;
- to create a long- and short-term asset management strategy;
- to analyse the project environment before the start of the project;
- to make practical maps of the subsurface with existing data.

Author contributions

R.D.R. designed the methodology, collected and processed the data, wrote the manuscript and was responsible for the visualisation and project administration. K.V., A.D. and R.C. have been extensively

involved in the reviewing and supervision of this research. All authors were involved in the conceptualisation of this study.

Disclosure statement

This research was conducted in collaboration with the municipality of Hengelo. The municipality of Hengelo provided R.D.R. with an internship during this research which facilitated conducting interviews and gathering documents. The interest of the municipality lies in gaining practical knowledge on implementing their CA and ET efforts more effectively and efficiently.

Acknowledgement

R.D.R.: I would like to thank my supervisors from the University of Twente Professor André Dorée and Doctor Karina Vink, and my supervisor from the municipality of Hengelo Remko Cremers, MSc. During this research, they helped to supervise the execution, and reviewed and commented on various drafts.

Special thanks go to Lisa Morsman, MSc., for guiding me through the municipality of Hengelo and providing feedback on the proposed recommendations. Lastly, I want to thank the municipality of Hengelo for providing me with an internship because that allowed me to understand the context of municipal planning practises better.

6 References

Candel, J. J. L., & Biesbroek, R. (2016). Toward a processual understanding of policy integration. *Policy Sciences*, *49*(3), 211–231. https://doi.org/10.1007/s11077-016-9248-y

CRED. (2022). *2021 Disasters in numbers: Extreme events defining our lives* (EM-DAT, p. 8). CRED. https://cred.be/sites/default/files/2021_EMDAT_report.pdf

Demirkesen, S., & Ozorhon, B. (2017). Impact of integration management on construction project management performance. *International Journal of Project Management*, *35*(8), 1639–1654. https://doi.org/10.1016/j.ijproman.2017.09.008

Domorenok, E., Graziano, P., & Polverari, L. (2021). Introduction: Policy integration and institutional capacity: theoretical, conceptual and empirical challenges. *Policy and Society*, *40*(1), 1–18. https://doi.org/10.1080/14494035.2021.1902058

DPRA. (2021, September 21). *1. Bestuurlijke inleiding*. Deltaprogramma 2022. https://dp2022.deltaprogramma.nl/1-bestuurlijke-inleiding.html

Duguma, L. A., Minang, P. A., & van Noordwijk, M. (2014). Climate Change Mitigation and Adaptation in the Land Use Sector: From Complementarity to Synergy. *Environmental Management*, *54*(3), 420–432. https://doi.org/10.1007/s00267-014-0331-x

Falkemark, G. (1999). *Politik, lobbyism och manipulation: Svensk trafikpolitik i verkligheten*. Nya Doxa.

Geerlings, H., & Stead, D. (2003). The integration of land use planning, transport and environment in European policy and research. *Transport Policy*, *10*(3), 187–196. https://doi.org/10.1016/S0967-070X(03)00020-9

Gemeente Enschede. (n.d.). *Bij herinrichting van de openbare ruimte*. Groenblauw Enschede. https://groenblauwenschede.ireporting.nl/hoofdrapport-wek/hoe-gaan-we-er-komen/klimaatbestendig-inrichten/bij-herinrichting-van-de-openbare-ruimte

Gemeente Hengelo. (2019). *Hart van Zuid: Klaar voor de tweede helft*.

Grafakos, S., Trigg, K., Landauer, M., Chelleri, L., & Dhakal, S. (2019). Analytical framework to evaluate the level of integration of climate adaptation and mitigation in cities. *Climatic Change*, *154*(1–2), 87–106. https://doi.org/10.1007/s10584-019-02394-w

Hengelo's Weekblad. (2020, October 28). *Concept-Ontwikkelkaart Hart van Zuid*. https://www.hengelosweekblad.nl/nieuws/algemeen/69012/concept-ontwikkelkaart-hart-van-zuid

Kapousouz, A. (2019). *SYNERGIES BETWEEN CLIMATE ADAPTATION OBJECTIVES AND OTHER GOALS: HOW THEY CAN BE ACHIEVED IN URBAN DEVELOPMENT PROJECTS*. University of Twente. https://essay.utwente.nl/79823/1/Kapousouz%20Athina_Master%20thesis%20with%20corrections.pdf

May, P. J., Sapotichne, J., & Workman, S. (2006). Policy Coherence and Policy Domains. *Policy Studies Journal*, *34*(3), 381–403. https://doi.org/10.1111/j.1541-0072.2006.00178.x

NASA. (n.d.). *Climate Change Adaptation and Mitigation*. Climate Change: Vital Signs of the Planet. https://climate.nasa.gov/solutions/adaptation-mitigation

Nilsson, M., & Persson, A. (2003). Framework for analysing environmental policy integration. *Journal of Environmental Policy & Planning*, *5*(4), 333–359. https://doi.org/10.1080/1523908032000171648

Ohemeng, F. L. K., & Ayee, J. R. A. (2016). The 'New Approach' to Public Sector Reforms in Ghana: A Case of Politics as Usual or a Genuine Attempt at Reform? *Development Policy Review*, *34*(2), 277–300. https://doi.org/10.1111/dpr.12150

Ostrom, E. (2009). *Understanding Institutional Diversity*. Princeton University Press. https://doi.org/10.2307/j.ctt7s7wm

Projectbureau Hart van Zuid. (2002). *Hart van Zuid Hengelo: Van Masterplan naar uitvoering*.

Rijksoverheid. (2019, June 28). *Klimaatakkoord maakt halvering CO2-uitstoot haalbaar en betaalbaar—Nieuwsbericht—Rijksoverheid.nl* [Press release]. Ministerie van Algemene Zaken. http://www.rijksoverheid.nl/actueel/nieuws/2019/06/28/klimaatakkoord-maakt-halvering-co2-uitstoot-haalbaar-en-betaalbaar

Underdal, A. (1980). Integrated marine policy: What? Why? How? *Marine Policy*, *4*(3), 159–169. https://doi.org/10.1016/0308-597X(80)90051-2

Uyterlinde, M., Fokkema, M., & Can, E. (2020). *Werken aan opgaven in de wijk: Gebiedsgerichte organisatiemodellen in vier gemeenten*. Platform 31.

Uyterlinde, M., van Hal, A., Coen, M., & Can, E. (2022). *Samen naar een duurzame en leefbare wijk: Lessen van drie jaar experimenteren in kwetsbare wijken*. Platform31 & Nyenrode Business Universiteit.

van Buuren, A., Buijs, J.-M., & Teisman, G. (2010). Program management and the creative art of coopetition: Dealing with potential tensions and synergies between spatial development projects. *International Journal of Project Management*, *28*(7), 672–682. https://doi.org/10.1016/j.ijproman.2009.12.002

van Straalen, F. M. (2012). *THE CONCEPT OF INTEGRATION IN SPATIAL PLANNING : AN EXPLORATION*. 2622–2633. https://edepot.wur.nl/218001

Yin, R. K. (2018). *Case study research and applications: Design and methods* (Sixth edition). SAGE Publications.

7 Appendice – References to interviews

Table 6 shows the references to the interviews which have been conducted during this research. The function of the interviewees is given to show their area of expertise. Note that the description of the function is generalised in some cases to prevent the traceability of interviewees.

Table 6: List of references to the conducted interviews

#	Code	Date	Municipality	Function	Content
1	VER-1	28-02-2022	Hengelo	Project manager	Exploration of working in projects
2	VER-2	28-02-2022	Hengelo	Project manager	Exploration of working in projects
3	VER-3	24-03-2022	Hengelo	Two policy advisors who handle the public space and sewer management	Exploration of combining challenges from a CA perspective
4	NIJ-1	10-05-2022	Hengelo	Process manager ET	Case de Nijverheid
5	TWE-1	18-05-2022	Enschede	Policy advisor CA	Case Twekkelerveld
6	TWE-2	18-05-2022	Enschede	Project manager ET	Case Twekkelerveld
7	TWE-3	20-05-2022	Enschede	Asset manager	Case Twekkelerveld
8	NIJ-2	24-05-2022	Hengelo	Process manager ET	Case de Nijverheid
9	HVZ-1	25-05-2022	Hengelo	Programme manager	Case Hart van Zuid
10	NIJ-3	02-06-2022	Hengelo	City district coordinator (“Stadsdeelregisseur”)	Case de Nijverheid
11	HVZ-2	09-06-2022	Hengelo	Project manager	Case Hart van Zuid
12	TWE-4	14-06-2022	Hengelo	Hydraulic engineer	Case Twekkelerveld

13	HVZ-3	22-06-2022	Hengelo	Process manager	Case Hart van Zuid
14	VAL-1	19-07-2022	Hengelo	Concern manager	Validation recommendations
15	VAL-2	21-07-2022	Hengelo	Team manager	Validation recommendations
16	HVZ-4	26-07-2022	Hengelo	Programme secretary	Case Hart van Zuid
17	VAL-3	28-07-2022	Hengelo	Team manager	Validation recommendations
18	VAL-4	02-08-2022	Enschede	Municipal project owner	Validation recommendations
19	VER-4	08-08-2022	Hengelo	Policy advisor who handles the soil	Exploration for underground solutions