

Catalyzing Climate Action through Public Private Partnerships (PPPs): Challenges and Opportunities

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Abstract

Private public partnerships (PPPs) are used routinely in a variety of sectors, such as health care, waste management, and infrastructure development. Only recently, as climate mitigation and adaptation rapidly rise in importance on urban agendas however, have PPPs begun to be considered within a climate context. This thesis investigates the significant, yet thus far mostly unexplored potential for PPPs as a vehicle to drive forward climate action. Through scoping studies of both academic and grey literature, as well as consultative interviews with practitioners, the thesis charts the emerging field of PPPs for climate action and presents opportunities for further development. Results may help cities and other public-sector actors more effectively collaborate with and integrate private partners into climate planning and ongoing initiatives, with the potential to better scale up impact and progress towards climate adaptation and mitigation goals.

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Abbreviations and Acronyms

BODT:	Build-Operate-Design-Transfer (PPP procurement mechanism)
BOT:	Build-Operate-Transfer (PPP procurement mechanism)
CC:	Climate Change
DBFM:	Design-Build-Finance-Maintain (PPP procurement mechanism)
DBO:	Design-Build-Operate (PPP procurement mechanism)
GHG:	Greenhouse gas
NURI:	Nordic Urban Resilience Institute
PPP:	Private Public Partnership
SDG:	Sustainable Development Goals

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1. Introduction

1.1. Rationale and Background Context

Climate change is both creating and exacerbating a number of significant environmental challenges for urban municipalities, ranging from rising sea levels and stormwater flooding to heat waves and heat island effects that stress city systems and impart human and economic costs (Funfgeld, 2010; Wamsler et al., 2013).

Cities, especially so in developed countries, are significant contributors of GHG emissions that fuel climate change (Center for Global Development, 2015), while also being vulnerable to those very climate change impacts. At the same time, they are critical incubators for innovation and solutions to these challenges, and local actions by cities and municipalities have a large role to play in meeting global climate mitigation and adaptation goals (Schroeder et al., 2013; Peterson & Hughes, 2017). With populations and economic activity increasingly concentrating in cities worldwide, this critical role will only continue to grow (Hughes & Peterson, 2018).

Urban climate action can span across a wide range of initiatives, such as constructing flood barriers, building retrofits, creating new sustainable transportation infrastructure, building green infrastructure for stormwater management, or modifying procurement and disposal streams to reduce waste and transition towards a circular economy. Such action also extends to efforts to change behavior, through campaigns to raise awareness about climate change and incentivize individual level actions that residents can take.

The scale and complexity of these climate initiatives often mean that available public resources, finance, and capacity are not enough to meet project needs (Berrone et al., 2019), and new governance methods are gaining prominence in order to tackle the complex, ‘wicked’ challenges brought on by climate change (Evans & Karvonen, 2013; Taylor & McAllister, 2015). These challenges are increasingly demanding collective capacity and new collaborations (Mees, 2017; MacDonald et al., 2019). Despite this need, public sector led climate initiatives generally focus solely on action within and by the public sector (Klein et al, 2018).

At an international level, the UN SDG 17 calls for developing effective partnerships for achieving the sustainable development goals (United Nations, 2018), and at a local level, many urban climate resilience projects are already funded through an assembled mix of local government funds, national grants, private sector funding, and/or philanthropic support. In addition, the resources, skills, capacity, and knowledge from other sectors also often feed into such projects. The private sector can have a significant, if often overlooked, role to play in such partnerships.

Effective public-private partnerships (PPPs) can be key delivery vehicles for implementing such projects (Kyvelou et al, 2011), with the potential to scale up the impact and accelerate

progress towards climate mitigation and adaptation goals in an era of intensifying climate challenges (Schroeder et al, 2013). PPP structures are already used routinely within the health care, waste management, infrastructure and construction sectors, but only very recently have they begun to be considered within a climate context (Newman & Perl, 2014). However, climate mitigation and adaptation are quickly being mainstreamed into urban and local agendas, making climate action and PPPs an emerging field of importance.

More research is thus needed in this area, including detailing what PPP models are already in use, the different ways in which cities can partner with the private sector to further climate goals, and what best practices exist. Such knowledge may help cities and other public actors more effectively collaborate with and integrate private actors into climate planning and initiatives, thus scaling up impact of and progress towards local and international climate goals.

1.2. Research Questions and Objectives

The **overall objective** of the project is twofold.

Firstly, **Objective A** is to identify how public-private partnerships are used for climate action today, with a focus on city contexts in developed countries. This delineation was chosen as developed countries are disproportionately responsible for global carbon emissions (Center for Global Development, 2015). As well, more case examples of PPP for climate action were expected to be found in developed country contexts.

Secondly, **Objective B** is to identify opportunities for future development regarding PPPs for climate action.

One primary research question (RQ1) together with **two supplemental research questions (RQ 2, 3)** were devised in order to address and accomplish the overall objectives.

Research Question 1 (RQ1): What is currently known about the use, best practice, and effectiveness of public-private partnerships for climate action in cities?

Research Question 2 (RQ2): What are principal challenges to effective use of PPPs for furthering climate action?

Research Question 3 (RQ3): What are principal opportunities for further development regarding PPPs for climate action?

Two methods were used to address the project's objectives and research questions:

- 1) Scoping studies of scientific and grey literature within the field
- 2) Consultative interviews with practitioners working with PPPs connected in some way to climate issues.

The scoping studies provide a broad theoretical foundation, building a knowledge base relevant to the research questions. RQ1 was used as the initial guiding scoping study question. RQ2 and RQ3 were later used as focus areas while performing the in-depth analysis. The consultative interviews then add nuance and real world perspective to the results. The **envisioned outcome** of the project is a thematic framework that maps key themes, challenges, and opportunities within the field.

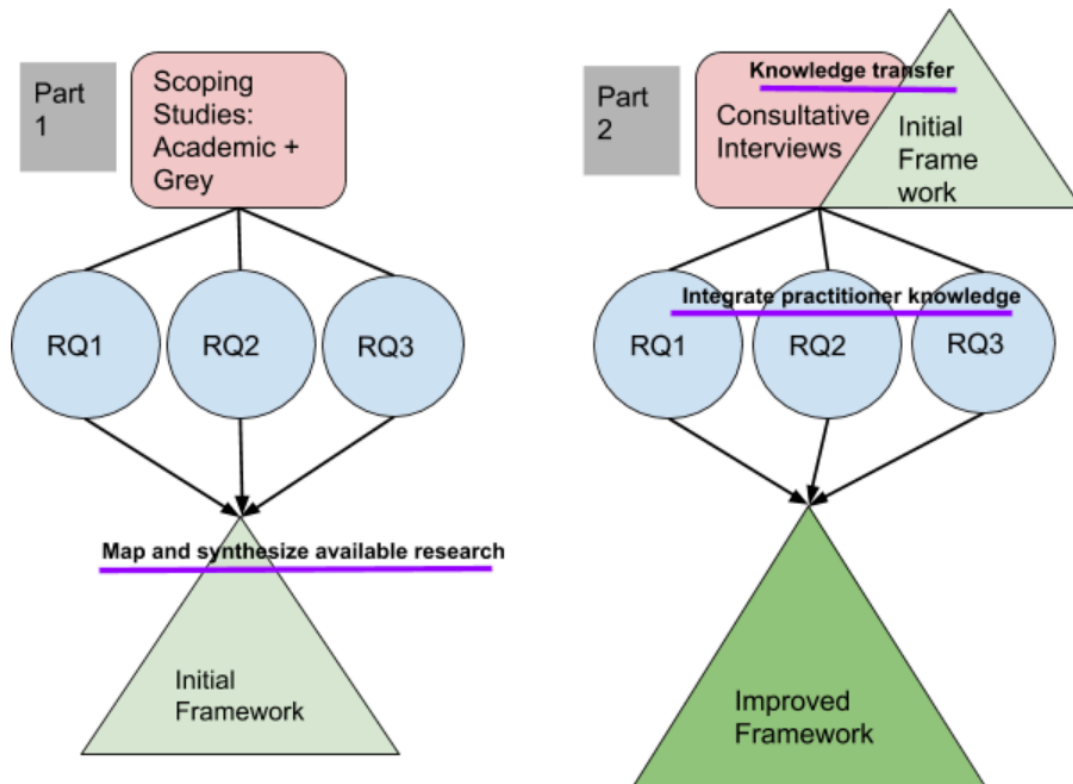


Figure 1. Thesis process conceptualization. Part 1 consists of the grey and academic scoping studies, results of which provide an initial framework answering the research questions. Part 2 consists of the consultative interviews, results of which are compared and contrasted with scoping study results, adding nuance to the findings and leading to an improved framework addressing the research questions.

2. Methodology

This section explains the study's design and implementation, including data collection and analysis across its two main stages.

2.1. Part 1: Scoping Studies

Scoping studies are particularly useful to map out the available literature within a specific field of interest, including characteristics such as the existing volume and type of research available, and can be thought of as an extended form of literature review providing a narrative account and synthesis of the literature (Arksey & O'Malley, 2005; Levac et al., 2010). They are particularly relevant within emerging disciplines where existing literature is dispersed, as they provide a clearer conceptual picture of available knowledge (Levac et al., 2010). As such, the use of scoping studies is a relevant tool in investigating the emerging, interdisciplinary field of private-public partnerships for climate action.

Arksey & O'Malley (2005) identify four common reasons why a scoping study can be undertaken: 1) to map existing research within a field of interest; 2) to determine the value and feasibility of performing a full systematic review; 3) to summarize and disseminate research findings within a particular area of interest; and 4) to identify gaps in the existing literature within a field of interest.

Two scoping studies, one based on available academic literature and the other on available grey literature, comprise the first part of the thesis. The grey literature scoping study was performed in order to supplement the academic study with knowledge and case examples from the field, as well as to contrast the available knowledge of PPPs and climate action 'from the field' with the available academic knowledge.

The main goals were to **map out the extent and nature of available research**, as well as to **summarize and disseminate research findings**. It was not a goal of the scoping studies to determine the value or feasibility of performing a systematic review, nor to identify gaps in the academic literature, which would require a much more authoritative depth of experience within the field.

The following sections walk through the five-step scoping study methodology proposed by Arksey & O'Malley (2005) and subsequently improved upon by Levac et al. (2010), and explain how these steps were followed within the project. Steps 1-3 were followed exactly, whereas steps 4-5 were merged into a singular step 4.

2.1.1 Step 1: Identifying the Research Question

A three-part research question was identified, as presented in Section 1.2.

Terms chosen within research questions influence literature searches undertaken in subsequent steps (Arksey & O'Malley, 2005; Levac et al., 2010). Arksey & O'Malley (2005) recommend maintaining a broad scope with terminology within the research questions. This provides a breadth of search results which can later be narrowed down. Meanwhile, Levac et al. (2010) recommend articulating a clear scope of inquiry through carefully defined research purposes and research questions to aid in narrowing down search results. Thus, a balance was sought between breadth and specificity in defining research questions and objectives.

2.1.2 Step 2: Identifying Relevant Articles

Secondly, a search strategy was developed to identify relevant articles. The process for each scoping study is presented below.

Database Selection

Academic Literature

Scopus (<https://www.scopus.com>), an electronic database owned by Elsevier, was selected for the scoping study. As the largest database of peer-reviewed literature, Scopus covers a wide, multi-disciplinary range of research areas (Beerens & Tehler, 2016). Articles were accessed through Lund University's journal subscriptions.

Grey Literature

The Google search engine was used, as it offers a comprehensive scope of results and an easily navigable and flexible advanced search function.

Search Query Identification

Academic Literature

A number of possible keywords and associated synonyms were considered when building the query.

“Public (AND) private (AND) partnership” formed the first half of the query. While synonyms and acronyms such as public private cooperation, collaboration, and PPPs do exist to describe the same concept, “Public private partnership” was the most prominent and term encountered during background readings conducted during the initial thesis conceptualization phase.

“Climate (OR) sustainability (OR) resilience” formed the second half of the search string. This was included in order to narrow the range of results to include a climate mitigation or adaptation dimension context, as related to public-private partnerships.

The initial number of results generated was (3,162). A review of the results revealed that many of the articles contained a strong focus on rural development. As the scoping study sought to focus on an urban, municipal context, the search query was modified to exclude the term “rural,” which then reduced the number of results to (2,467). Document type was limited to “articles,” in order to obtain only published academic articles, and the language or results was limited to “English”, which further reduced the number of results to (1,553).

At this point, another review of article titles was conducted, which revealed a significant number of articles in fields not of particular relevance to the study. These articles happened to include relevant keywords but had little to do with an urban, municipal context. As such, results were narrowed down by subject area (see Figure 4). While this subject area limitation ran the risk of missing relevant articles within the excluded subject areas, through filtering search results by subject area and then reviewing the first 50-100 titles within each subject area, it was determined that the selected subject areas would in fact provide more relevant results. Additionally, if any especially important articles were missed, either due to subject area or keyword exclusion, it was assumed these would be found through a snowballing process, described later in this section.

The final search string used is shown in Figure 2 below. This reduced the number of results to (1,104). All entries were then exported into an Excel spreadsheet for further management.

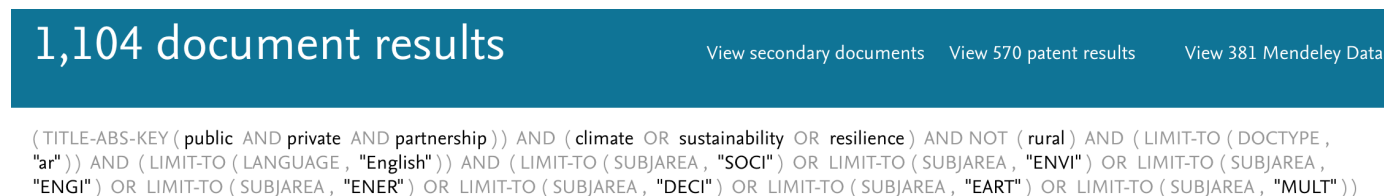


Fig 2. Final SCOPUS search query used, which generated (1,104) articles

Grey literature

A total of (6) search strings, based on the search string used in the academic literature scoping study were used, with variations on keywords in order to capture as broad a range of relevant results as possible (See Figure 5).

Search results were then limited to PDF format to exclude plain text webpages and identify published reports and other grey literature. As the Google search engine searches virtually the entire Web, the number of search results returned for each search string was in the millions.

Advanced Search

Find pages with... T

all these words:

this exact word or phrase:

any of these words:

none of these words:

numbers ranging from: to

Then narrow your results by...

language:

region:

last update:

site or domain:

terms appearing:

SafeSearch:

file type:

Figure 3. Example of a search query used within Google’s Advanced Search function

2.1.3 Step 3: Study Selection

Literature was weighed against the project’s research questions and excluded at different stages of the review. The sections below detail how this exclusion and narrowing down of took place within each scoping study.

Academic Literature

Clearly irrelevant articles were first removed, based on their titles, e.g. ‘*International regulation without international government: Improving IO performance through orchestration.*’

As initial irrelevant articles were being removed, inclusion criteria, described below, were developed together with increasing familiarity with the literature. These criteria were used in an iterative review process to refine the selection of articles that were included in the study. Articles needed to match all three of the criteria in order to be included.

Inclusion Criteria:

- 1) Article focuses on a municipal or regional urban context and scale
- 2) Article not exclusively focused on international development
- 3) Article relates PPPs to a clear sustainability or climate context

Some articles matched these criteria more or less strongly. For example, some articles (e.g. “Panacea or paradox? Cross-sector partnerships, climate change, and development”), had somewhat of an international development focus, but still addressed the use of PPPs in city contexts. A “rather include than exclude” attitude was adopted when applying the criteria. In this step, it was not important how closely the criteria were met, rather only that they were met.

Applying these criteria removed articles related to PPPs, but set in a different context, e.g. *‘Rethinking the continuum between public and private actors in electricity policy in the context of the UK Energy transition’* (relevant to PPPs and sustainability but set in an energy services context, and not set in an urban/municipal context).

These criteria were used to analyze articles titles, and reduced the number of articles from 1,104 to 417.

The remaining articles were more carefully examined based on abstracts and again weighed against the inclusion criteria, which reduced the number of articles from 417 to 155.

A second pass was made, this time through an overall scan of the introduction, methods, conclusion, and discussion sections of each article, which reduced the count from 155 to 90. The 90 articles were then split into two groups, based on relevance: Group 1 contained 22 articles deemed more relevant that most closely fit the inclusion criteria; and Group 2 contained 68 borderline cases deemed somewhat relevant which fit the inclusion criteria, albeit not as closely. These were retained in case more background literature was needed. Finally, 5 additional articles from Group 1 were additionally excluded due to lack of journal access, leaving 17 highly relevant articles.

Through a snowballing process comprised of reviewing references of highly relevant articles, an additional 14 highly relevant articles were found outside of the original scoping study process, leading to a total of 31 highly relevant articles which were used in the scoping study. This process helped capture important papers that were relevant to PPP and climate action (i.e. having to do with multi-stakeholder climate adaptation partnerships), but were likely missed due to different keywords. An additional 21 snowball articles were found and added to Group 2.

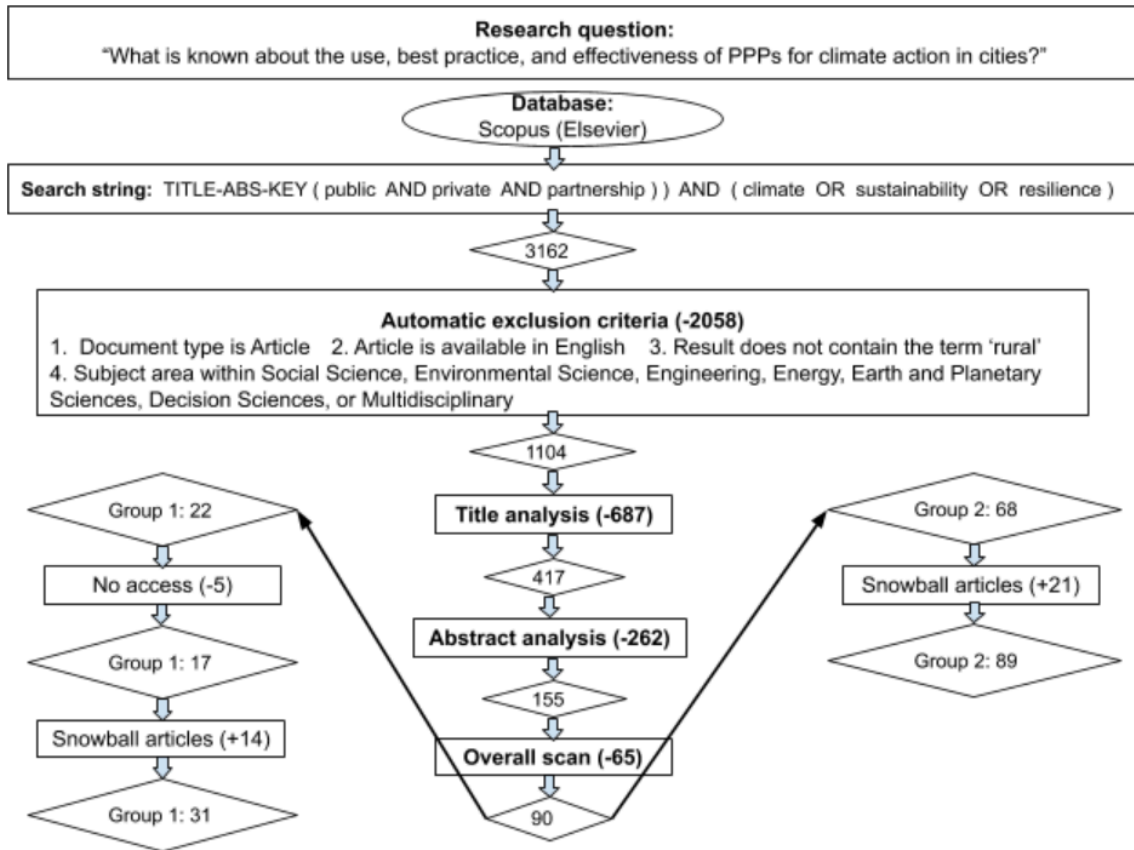


Figure 4: Overview of academic literature scoping study method

Grey literature

For each search string, the relevance of search results significantly declined by the 50th result. Thus, the first fifty results of each search string were reviewed. Any potentially relevant grey literature was opened, and analyzed based on the executive summary. Analysis was based upon the same inclusion criteria used previously. Searches returned results only in English; thus, it was not necessary to restrict the results to English manually in the search.

Inclusion Criteria:

- 1) Publication focuses on a municipal or regional urban context and scale
- 2) Publication not explicitly focused on international development
- 3) Publication relates PPPs to a clear sustainability or climate context

Very relevant publications were then saved and recorded. In total, 12 very relevant grey literature publications (Group 1) were found and included in the study. An additional 15 somewhat relevant publications (Group 2) were retained in case additional background information was needed.

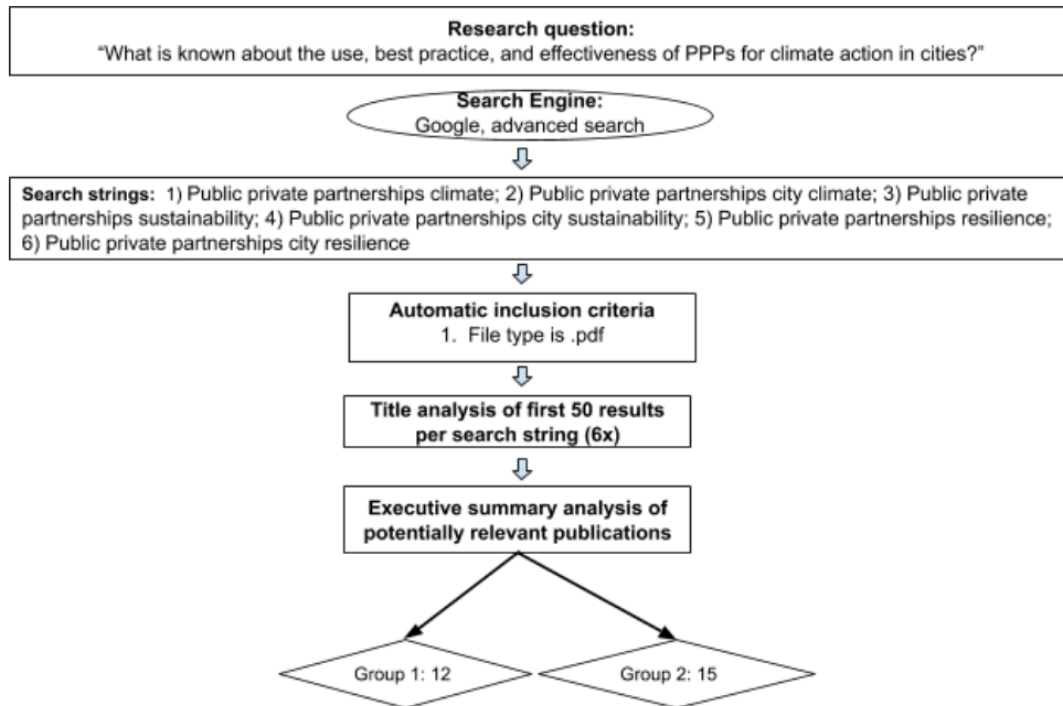


Figure 5. Overview of grey literature scoping study method

2.1.4 Step 4: Analysis

Levac et al.'s (2010:4) scoping study framework calls for a “charting” of the dataset in Step 4, followed by “collating, summarizing, and reporting results” in Step 5. These two processes were combined into a singular Step 4, made of three distinct parts: Overall Analysis, In-Depth Analysis, and Summary of Key Results. This was done in order to reduce potential for overlap between the stages and more clearly communicate results. The overall analysis examines broad trends and statistics in the literature, while the in-depth analysis, forming the focus of the scoping study, focuses on identifying and synthesizing key themes within the literature pertaining to the research questions. Finally, the Summary presents a concise overview of findings.

Overall Analysis

Academic literature

Only articles from Group 1 (highly relevant) were included in the overall analysis, as the purpose was to chart scholarship specifically pertaining to PPPs and climate action. Particular factors charted were:

- Subject area
- Publication year
- Location of publication
- Type of PPP focus

Information available on Scopus as well as the publisher's website, together with analysis of articles themselves was used in order to chart these factors. Microsoft Word and Excel were then used to produce graphs and tables for these statistics.

Grey literature

Like in the academic study, all publications from Group 1 were included in the overall analysis. The following factors were charted:

- Subject area
- Publication year
- Location of publication
- Type of organization
- Scale of organization
- Type of PPP focus

Relevant information was identified from either within publication's contents or on the website where it was linked, following the same method and parameters outlined previously.

In-depth analysis

With the research questions in mind, Group 1 articles from academic and grey literature were together analyzed in depth to map current knowledge within the use, design, best practice, and effectiveness of PPPs for climate action in cities, as well as identify principal challenges and obstacles to their effective use. These key findings were organized into key themes in the results section. These key themes were also later used to develop consultative interview scripts.

Summary of Key Results

Key results from the scoping study analysis are brought together and concisely presented.

2.2 Part 2: Consultative Interviews

In the project's second stage, four consultative semi-structured interviews were carried out with six practitioners involved in some capacity with PPPs within a sustainability and/or climate context. Respondents were selected through personal connections, through the connections of DRMCCA faculty members, and through suggested contacts from interview respondents. In two interviews, two interviewees were interviewed together. This was in both cases suggested by the interviewee pairs themselves, both of whom worked closely together.

All interviews were conducted either in person or over Skype and were audio recorded for later analysis. All lasted from between 50 minutes to 90 minutes. Key portions of the interviews were transcribed and are used in the Results section. Interview results are then also compared with the results of the scoping study to identify how they match, differ, or build upon the scoping study results, adding nuance and real-world experience to the results.

The consultative interviews asked about participants' own experience with public-private partnerships in a semi-structured format (Script provided in full in Appendix 4). The interviews serve to refine the results through bringing in practitioner knowledge and experience which might not be found within the literature (Levac et al., 2010). Additionally, they serve as a knowledge transfer mechanism, helping exchange information between real-world practitioners and the academic research spheres (Levac et al., 2010).

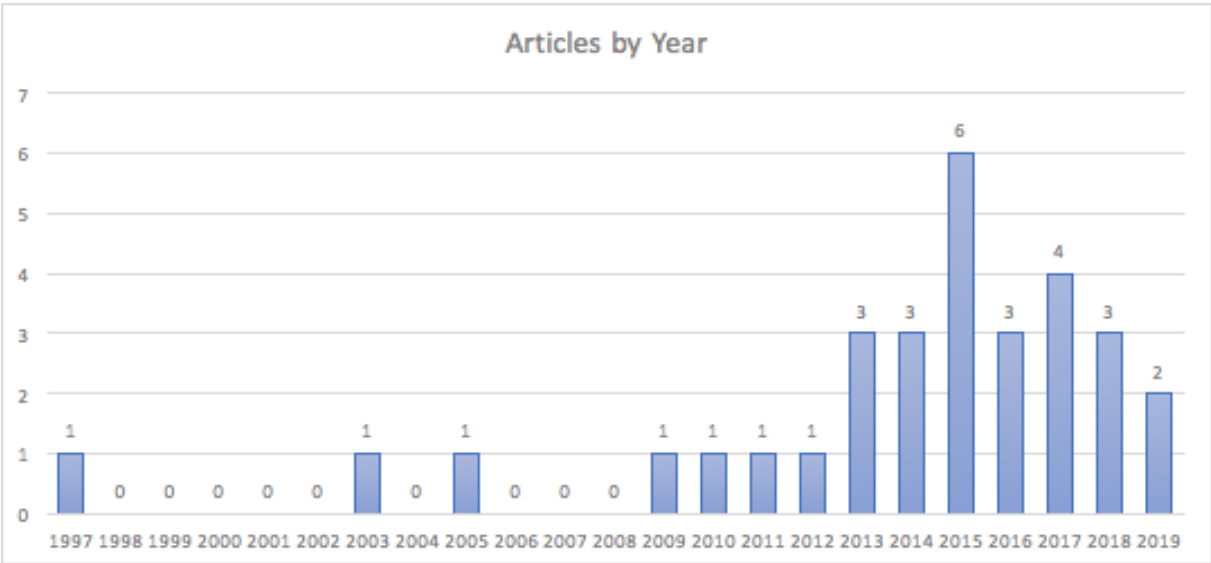
3. Scoping Study Results

This section presents the results of the scoping studies over three sections: Overall Analysis, In-depth Analysis, and Summary of Key Results.

3.1 Overall Analysis

Bibliographic trends and characteristics were charted by examining Group 1 articles and publications in both the academic and grey scoping studies. A summary of these results is presented here, with the full analysis available in Appendix 1.

Academic literature



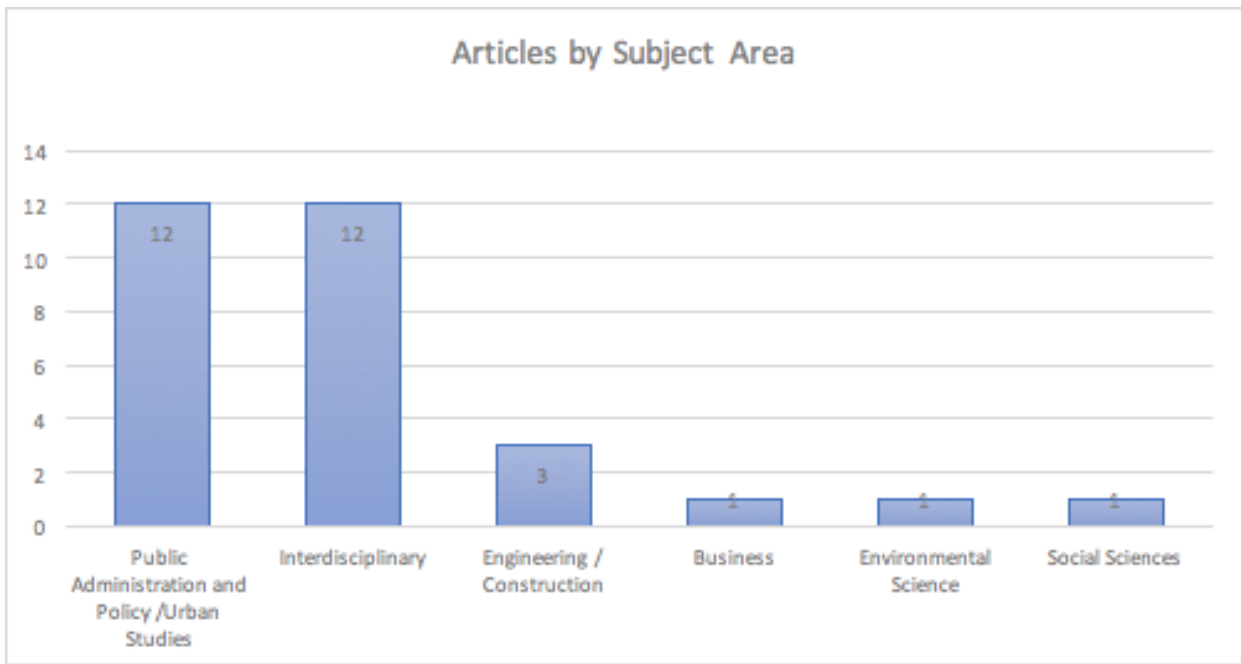
Graph 1. Articles by Year

- The earliest article found was published in 1997, and in the twenty-two year period since, the number of articles relating PPPs to climate action has increased, particularly from 2009 onwards, suggesting growing increase in and activity within the field.



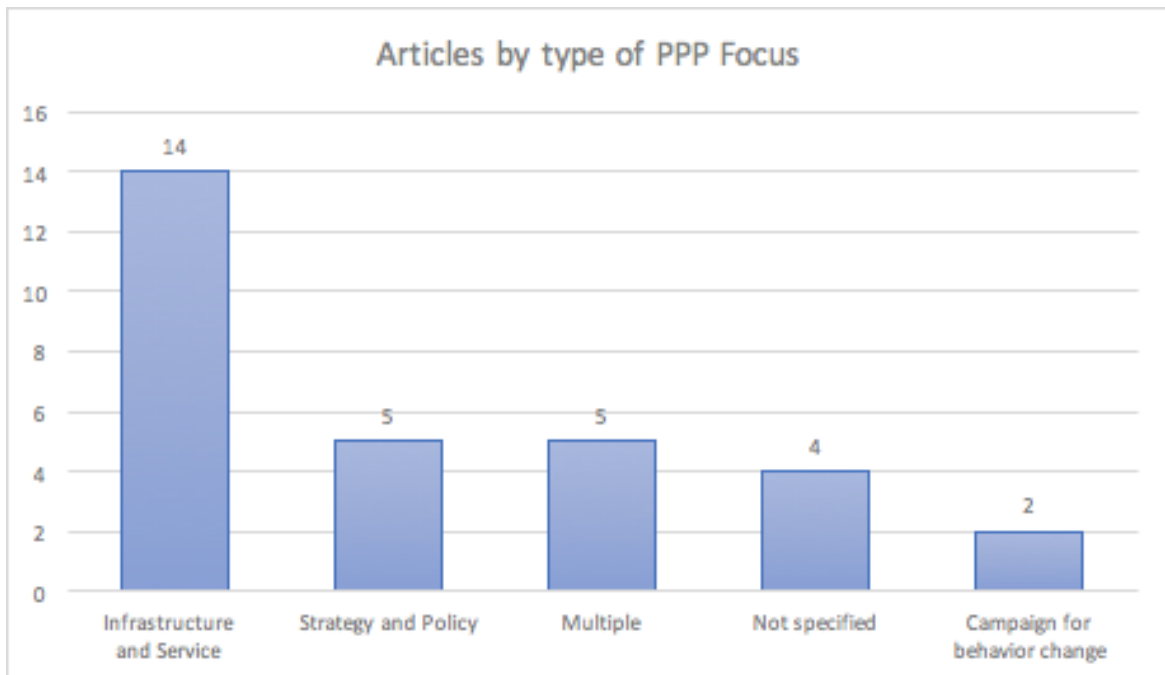
Graph 2. Articles by Publication Location

- The overwhelming majority of articles were published within Europe and North America, with the UK, the Netherlands, Canada, and Australia most represented.



Graph 3. Articles by Subject Area

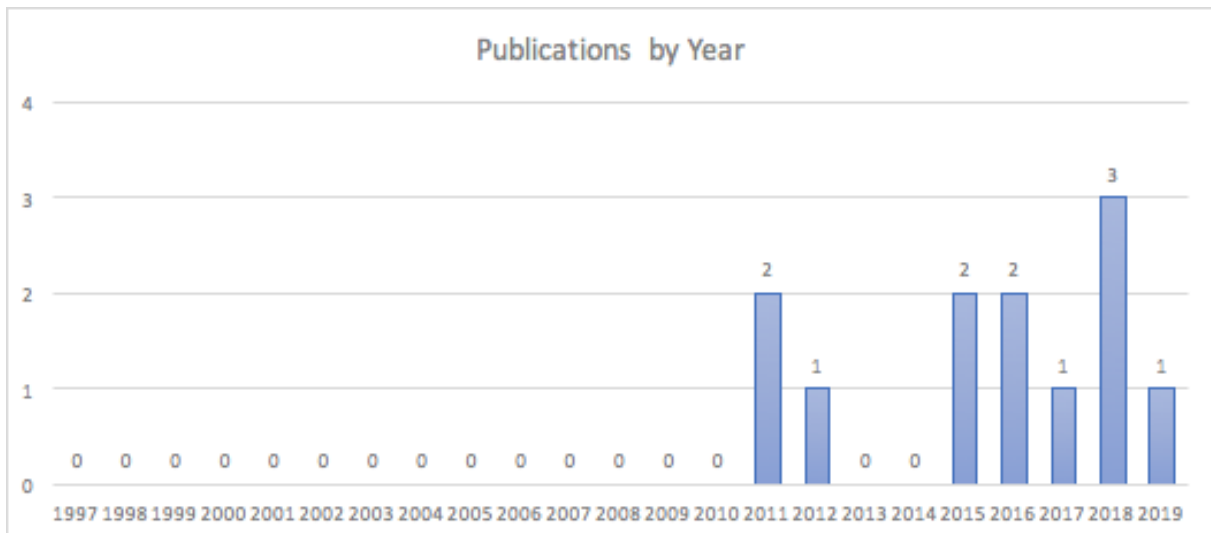
- Articles came primarily from two subject areas: Public Administration and Policy, a traditional subject area for general PPP literature, and an Interdisciplinary subject area, reflecting how widely the concept of PPPs for climate action spans across disciplines.



Graph 4. Articles by type of PPP Focus

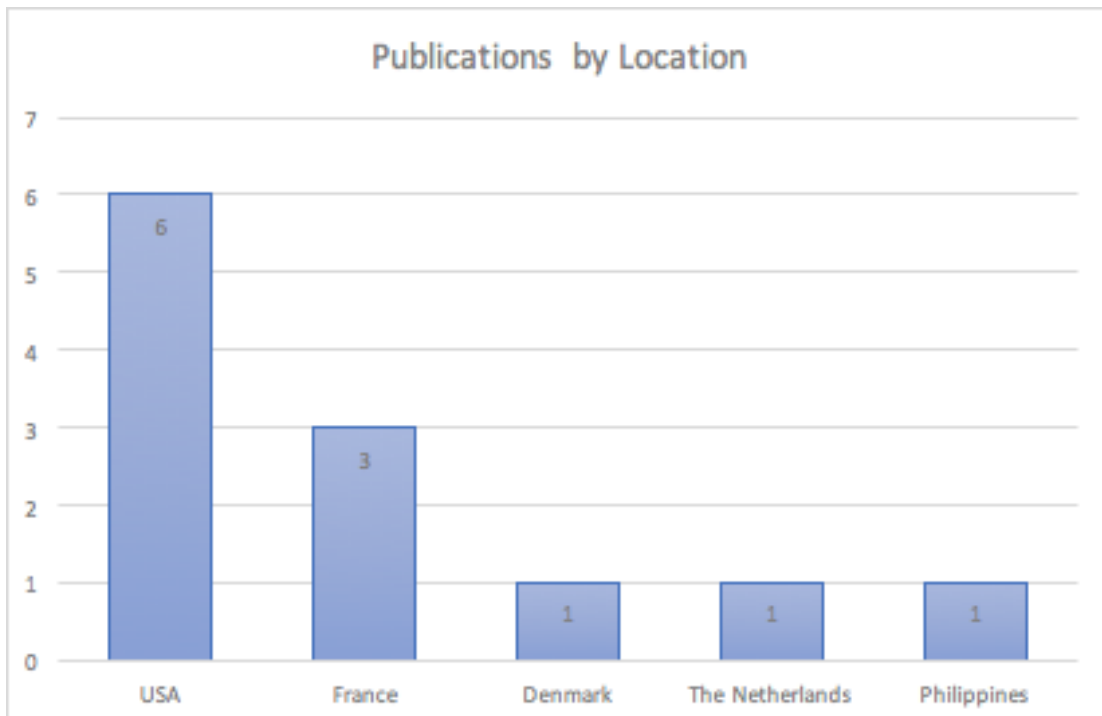
- Articles focused primarily on PPPs for infrastructure and service delivery. About a third as many articles focused on PPPs for climate strategy and policy, or on multiple uses of PPPs. A smaller number, meanwhile, focused on using PPPs for climate related behavior change.

Grey literature



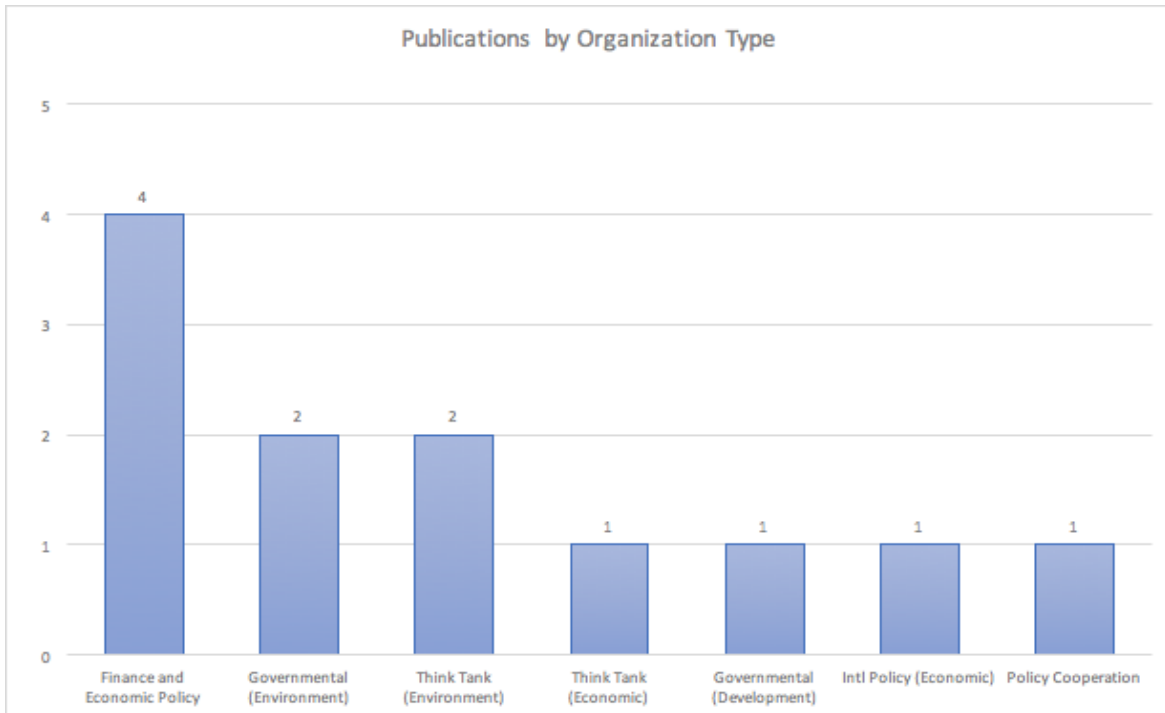
Graph 5, Publications by Year

- The earliest publication found was published in 2011. Over the eight years since, there has generally been an increase in the number and consistency in publications, suggesting a growing interest in the links between PPPs and climate action.



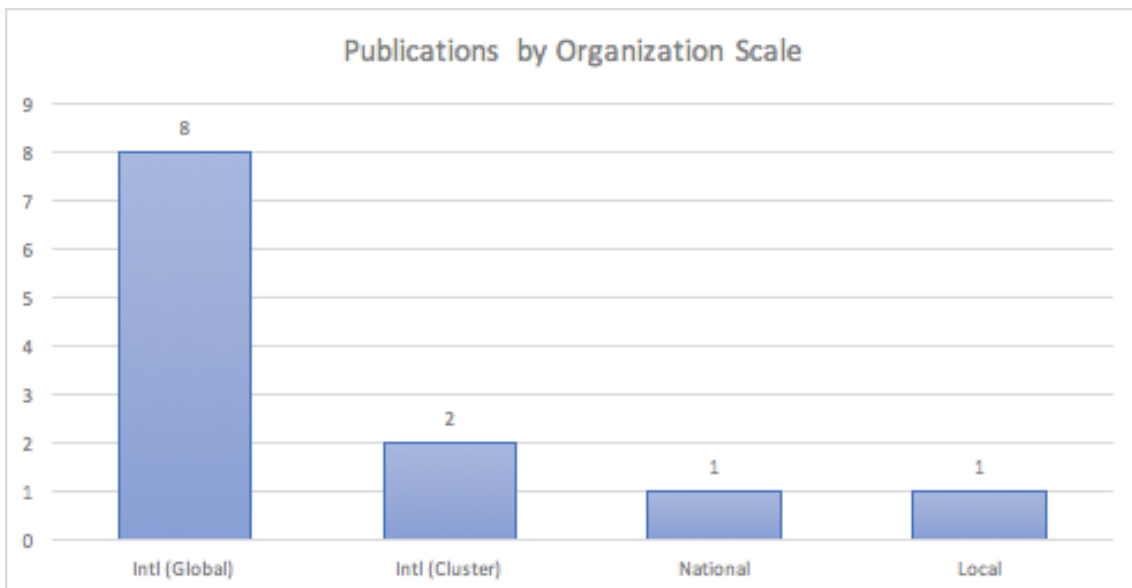
Graph 6. Publications by Location

- The majority of literature was published in the US; half as much was published in France. Denmark, the Netherlands, and the Philippines (notable as the only location outside Europe or North America), are the only other three represented countries.



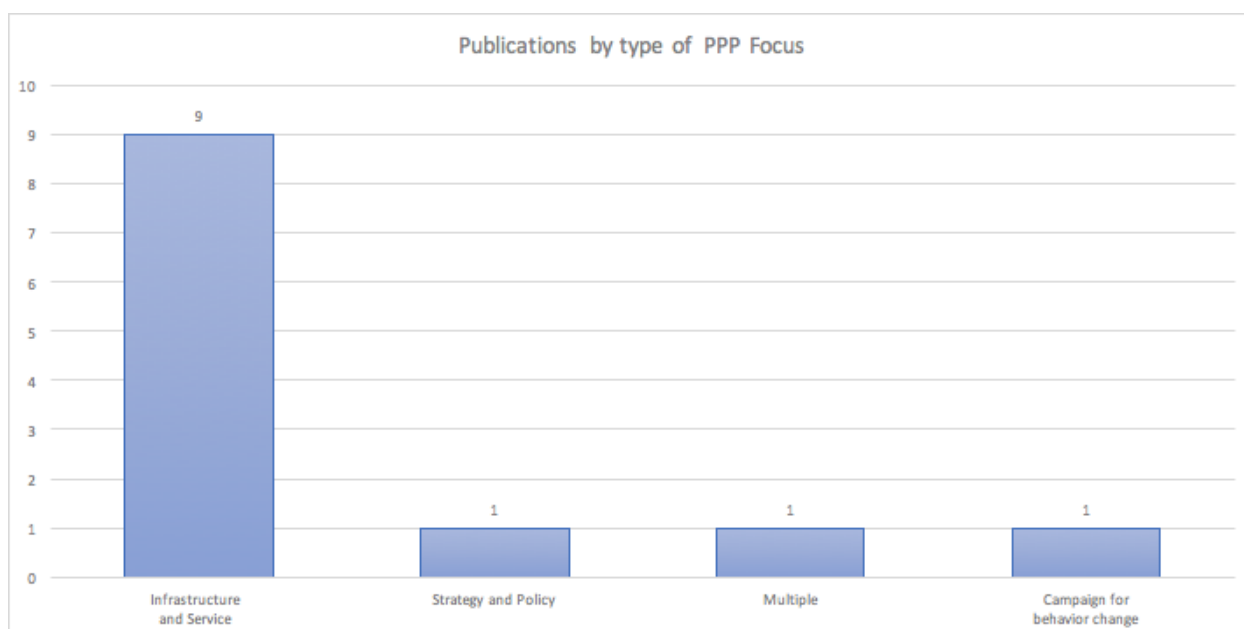
Graph 7. Publications by Organization Type

- A majority of the publications came from organizations involved in finance and economic policy. All other organization types were represented to a significantly lesser degree, through a broad range of organization types from which publications came were identified.



Graph 8. Publications by Organization Scale

- Publications came predominantly from international organizations working at global scales, while organizations at other scales were far less represented. This may hint at the fact that robust case examples of climate focused PPPs have not yet gained prominence on the ground at more local levels.



Graph 9. Publications by type of PPP Focus

- Even more so than in the academic literature, infrastructure and service delivery dominate as the type of PPP focused on.

3.2 In-depth Analysis

Articles from Group 1 within the academic and grey literature scoping studies were analyzed in detail and results from both scoping studies were combined within a singular in-depth results section. This was done in order to provide a more cohesive and unified picture of the available literature on PPPs within a climate context. While presented together due to space limitations and for greater cohesion, contrasts and comparisons between the grey and academic scoping studies are made throughout the analysis.

Four major themes emerged from the scoping studies in relation to the research questions:

- 1) Defining PPPs
- 2) Motivating the use of PPPs
- 3) Using PPPs for climate action
- 4) PPP effectiveness for climate action
 - a) Challenges for PPPs in furthering climate action
 - b) Success factors in driving forward climate action within PPP projects

3.2.1 - Defining PPPs

A wide range of PPP definitions was discovered, many of which span beyond the traditional focus on PPP as vehicles for infrastructure and service delivery. While the idea of PPPs and partnerships more broadly have become commonplace within environmental and climate policy (McAllister & Taylor, 2015), the lack of an apparent ‘standard’ definition results in varying interpretations of the concept, producing a terminological ambiguity in some ways reflective of the ambiguity within key disaster risk reduction concepts described by Hagelsteen & Becker (2014).

Eighteen (18) unique PPP definitions were identified. These were classified according to the stated **outcome** of the PPP in the definition. Other forms of classifications are of course possible, i.e. according to *form* (PPPs as a cooperation mechanism, as a contract mechanism, etc.) or according to the formality of the relationship. Outcome was chosen as a classifying factor as it was deemed to provide the clearest organizational structure.

The four classifications are presented below, followed by an explanation. Due to space limitations, the identified definitions are provided in Appendix 3.

Definitions focused on infrastructure and service outcomes

These definitions share a common identification of infrastructure and service as PPP outcomes, despite defining what PPPs themselves are rather differently — anything from a type of contract (Hueskes et al, 2017); to a form of cooperation (Patil & Laishram, 2016; Taylor & Harman, 2015); to the act of the private sector taking on a traditional role held by government (Kumaraswamy et al, 2015).

Definitions focused on policy as outcomes

These definitions share a common identification of policy as PPP outcomes, and both identify cooperation as the form PPPs take in order to achieve this objective. Taylor & McAllister (2015) emphasize policy design and implementation, while Forsyth (2010) emphasizes a broader outcome of achieving an aspect of policy.

Definitions focused on broader needs as outcomes

These definitions share a common broader definition of PPP outcomes, not necessarily specifying whether a PPP should produce infrastructure, policy, or some other particular outcome. Instead, they focus on the achievement of a collective goal, common problem, or public need as central to the idea behind a PPP. They all additionally share a focus on collaboration, cooperation, and ongoing relationships as key aspects.

Broader definitions relating to a continuum

While the previous definitions identify the pursuit of a broader common goal as PPP outcomes, these definitions, while also taking a broader view of PPPs, do not specify an outcome, focusing instead on the processes that occur within PPPs, and framing them within a conceptual continuum. Perl and Newman (2014) focus on the spectrum between full public provision and full privatization, while McAllister and Taylor (2015) situate PPPs on a continuum between coordination and collaboration, drawing a sharper distinction between these two terms used rather liberally (in comparison) by previous definitions (See Appendix 3).

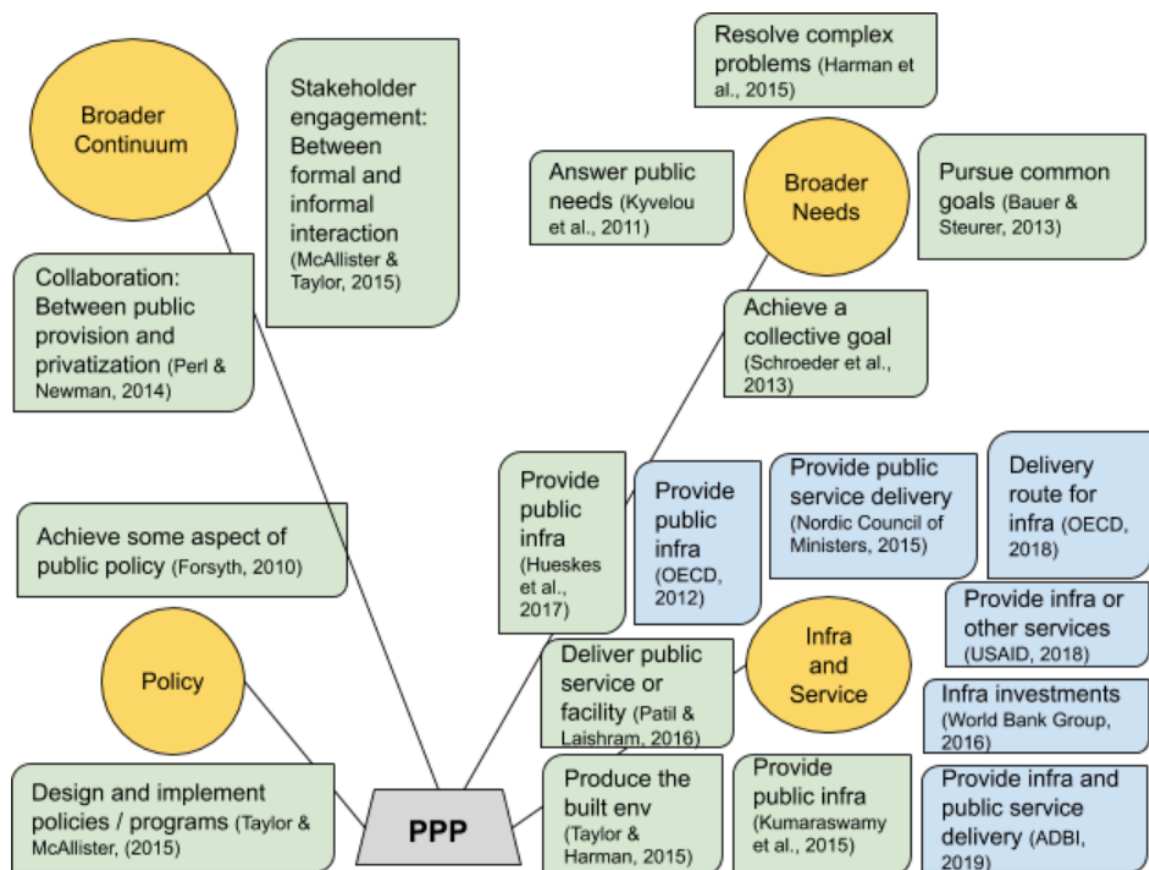


Figure 6. Overview of identified PPP definitions, classified based on specified outcome. Definitions from academic literature are colored green; those from grey literature are colored blue.

Key notes on defining PPPs

The literature analyzed presents a wide range of PPP definitions, highlighting the ambiguity surrounding the concept of PPPs for climate action. This was also exemplified in some grey literature publications analyzed, which, despite writing extensively about PPP benefits and case examples, did not provide a clear definition of what was meant by PPP.

Definitions relating to infrastructure and service outputs were clearly more prominent than definitions relating to other PPP outputs such as policy or broader needs, as well as PPP

definitions using the concept of a continuum. All six definitions identified within the grey literature on PPPs for climate action relate to PPPs providing infrastructure and service, reflecting their more traditional use. In contrast, definitions in the academic literature reflected a broader range of possible PPP outputs.

Though PPP outputs, forms, and actions vary greatly across identified definitions, a key component shared across many, though not all, identified definitions seems to be a focus on *shared action and collaboration across partners and/or sectors*.

The thesis does not attempt to prescriptively choose a definition to employ, which would limit possible analysis and counter the project's objective to scope and chart the field. Rather, all identified definitions are considered within the continued analysis.

3.2.2 - Motivating the use of PPPs

Mirroring the variety of PPP definitions, a wide scope of benefits to the use of PPPs for climate action was identified. These often overlap with benefits identified in the traditional (i.e. non-climate context focused PPP literature). This is perhaps not completely surprising, as climate adaptation and mitigation needs, much like the building of large public infrastructure, tend to be complex, expensive projects that exceed a locality's capacity, a key reason why PPPs are used (Klein et al., 2017).

The main benefits of using PPPs as vehicles for climate action are detailed below, in order of prominence within the literature. Rationales behind each proposed benefit and examples, where available, are also provided.

- Pooling of diverse expertise, capacity and skills from across sectors and organizations (Darlow & Newby, 1997; Koopenjan & Enserink, 2009; Schroeder et al. 2013; Taylor & Harman, 2015; Harman et al., 2015; McAllister & Taylor, 2015; Kumaraswamy et al., 2015; Netherlands Environmental Agency, 2015; Koopenjan, 2015)
 - Public sector gains private sector's superior managerial capabilities, speed, efficiency, and openness to risk (Berrone et al., 2019; Koopenjan & Enserink, 2009; World Bank Group, 2016)
 - Private sector gains public sector's local knowledge and authority (Roehrich et al., 2014; Koopenjan & Enserink, 2009)
 - Private sector can gain so-called procedural efficiencies from public sector's knowledge of planning, zoning, permitting and development processes, potentially streamlining the overall project (Taylor & Harman, 2015)
 - These resource poolings can create greater quality of service to be provided (Kyvelou et al., 2011) and allow bigger, more complex problems to be tackled (Van Huijstee et al., 2007)

- Mobilizes private finance / increases the amount of financing available for a project (Darlow and Newby, 1997; Berrone et al, 2019; Kumaraswamy et al., 2015; Harman et al. 2015; McAllister & Taylor, 2015; Toxopeus & Polzin, 2017; OECD, 2018))
 - Taylor and Harman (2015) and Roerich et al. (2014) note that the capital and financing needed for many climate adaptation related projects often exceeds what is available in public budgets
 - Public sector may gain the potential for increased payment flexibility in PPPs (for example through recurring smaller payments) and a lessened impact on public budgets (Berrone et al., 2019). Public sector may also be able to avoid taking on debt (C2ES, 2017; USAID, 2018)

- Greater sharing of risk; decreased financial risk for individual partners (Taylor & Harman, 2015; Harman & Taylor, 2015; World Bank Group, 2016; Asian Development Bank Group, 2019; OECD, 2012)
 - Taylor and Harman (2015) reported that private sector developers within a housing estate project reported being more willing to explore socially and environmentally innovative designs as a result of sharing risk with the public sector, as opposed to being on the free and open market on their own. This suggests a potential link between greater risk sharing and willingness to consider innovative environmental solutions.

- Emergence / potential to achieve something greater than the sum of parts (Darlow & Newby, 1997; Schroeder et al., 2013; Roerich et al., 2014; Koopenjan & Ensenrik, 2009)
 - Through combining the strengths of private actors, namely innovation, technical knowledge, and efficiency, and the missions of public actors — namely environmental goals, social justice, and public accountability — a strong enabling environment for high quality outcomes can be created (Roerich et al., 2014)

- Enables government to achieve policy implementation at larger scale and impact (LaFrance & Lehmann, 2005; Taylor & Harman, 2015; OECD, 2012; C2ES, 2017)
 - Business’ internal communications networks can spread relevant climate planning information, promote voluntary actions, and bring new partners onboard (C2ES, 2017).
 - Business often own significant amount of critical infrastructure upon which cities rely, making them important partners to bring to the table (C2ES, 2017)
 - Businesses, in addition to the public sector can be politically influential and help push forward projects and climate strategies (C2ES, 2017)

- Potential for increased creativity and innovative solutions (Schroeder et al., 2013; Newman & Perl, 2014; IFC, 2011)

- This comes in contrast to the tendency to associate the public sector with inefficiency and a lack of innovation, particularly when it comes to infrastructure and service delivery (Koopenjan & Enserink, 2009)
 - McAllister & Taylor (2015) propose this benefit arises in part as a result of overcoming institutional fragmentation and bring actors together in a shared space outside their usual arenas.
- Increased understanding and contact across sectors creates groundwork for future (perhaps larger) projects (Darlow & Newby, 1997; Roehrich et al., 2014)
 - Potential to boost reputation and public image as a good corporate citizen through involvement in the project (more strongly considered by the private sector) (La France & Lehmann, 2005; Elsig & Amalric, 2008; C2ES, 2017)
 - Better value for money and cost effectiveness is gained (Kumaraswamy et al., 2015; IFC 2011)
 - Significant potential for return (more strongly considered by the private sector) (LaFrance & Lehmann, 2005)

The first three most cited benefits, 1) Pooling of diverse, cross-sector expertise, capacity, and skills; 2) Mobilizing private finance and increasing amount of finance available; and 3) Greater sharing of risk / decreased financial risk appear to be central benefits, which are in various ways linked to the numerous additional benefits identified. Figure 7 below visually synthesizes the constellation of benefits identified in the literature.

In general, the academic literature presented a much wider range of benefits, both to public and private actors. In contrast, benefits identified within the grey literature focused almost exclusively on the benefits of increased speed, efficiency, and innovation that the private sector can bring to the public table. Only the Netherlands Environmental Assessment Agency (2015) and C2ES (2017) identified benefits that private actors stand to gain within a PPP, namely the public sector's local knowledge and regulatory capacity, as well as increased reputation within the community.

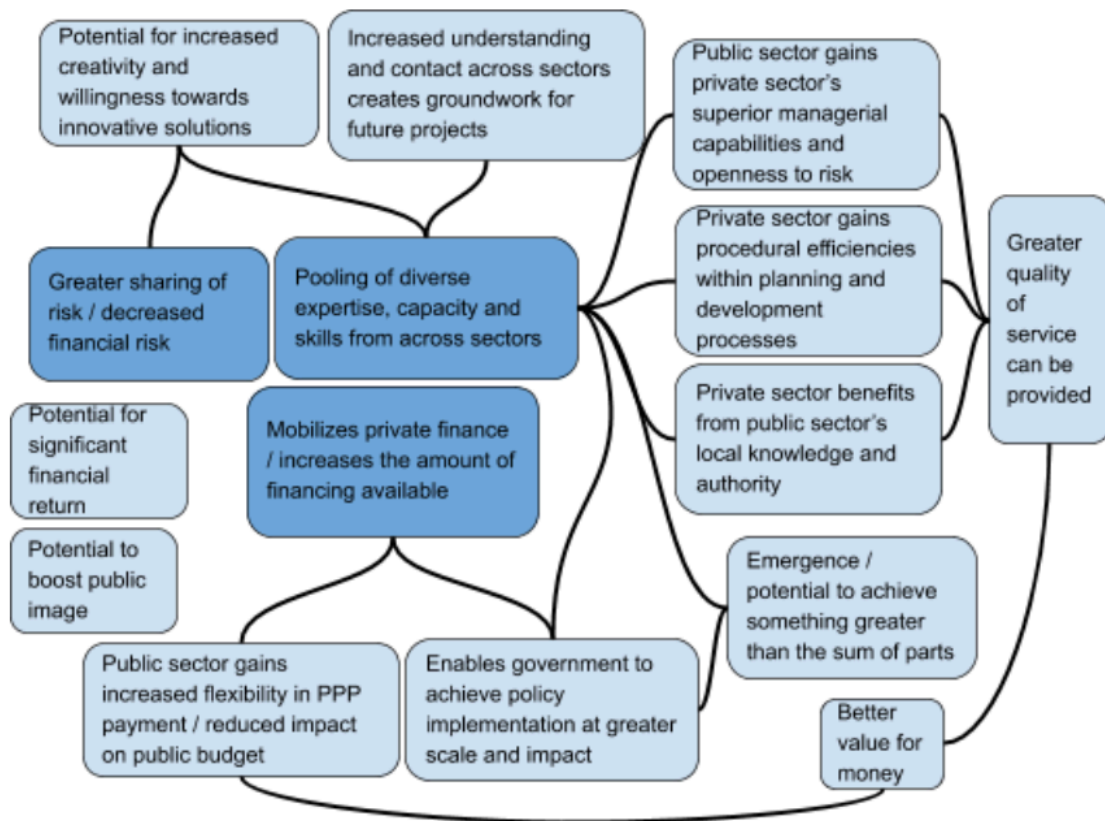


Figure 7. Overview of identified PPP benefits and interrelations

3.2.3 Using PPPs for climate action

As scoping study results have shown, PPPs are predominantly used for the provision of services and infrastructure. To conclude that the use of PPPs for climate action is limited to this however, would miss a wealth of additional avenues for PPP arrangements to further climate action. In fact, PPPs are already used to address climate and sustainability issues in a number of additional ways involving various actors, activities, outputs, and purposes (Von Malmberg, 2003; Bauer & Steurer, 2013).

The relatively recent uptake of climate adaptation and mitigation priorities on urban agendas in recent years means that the number of PPP projects within which climate action was an explicit objective, though growing, remain rather limited (Newman & Perl, 2014). This is especially true for less traditional, non-infrastructure related PPP projects. Nevertheless, through the analyzed literature, a typology was developed to classify the identified uses of PPP for climate action. Five different uses are identified below, and additional examples of each PPP category are presented in Appendix 2.

1) Through the Built Environment

1A) Building climate resilient physical infrastructure

Through their most traditional use, PPPs can further climate action through the actual building of physical infrastructure — bridges, roads, hospitals, office buildings, transportation networks, housing, etc. — to be climate adapted to evolving risks and/or contribute to climate mitigation. Often called climate resilient infrastructure, these types of infrastructure projects are increasingly being integrating into urban development agendas (OECD, 2018). This can also involve retrofitting existing infrastructure to enhance adaptation to climate risk or increase mitigation benefits, such as electrifying bus lanes or improving a building’s resource efficiency (OECD, 2018). Climate resilient infrastructure can also be green and blue infrastructure that provides direct adaptation benefits, such as urban trees and green roofs that reduce urban heat island effect, or green basins and bioretention spaces that help manage stormwater runoff and flooding (USAID, 2018; OECD, 2018).

Example: Volkswagen and CONANP finance green infrastructure

Between 2009-2013, for example, CONANP (Mexico’s National Park Service) partnered with Volkswagen Mexico as well as local and national environmental departments to jointly finance the planting and maintenance of 300,00 trees in Iztaccíhuatl-Popocatepetl National Park. As the trees have matured, improved rainwater infiltration has provided up to 4 million cubic meters of additional water into the region’s aquifer, increasing the resilience and water security of the region’s cities, in addition to the significant carbon capture services the trees provide (USAID, 2018).

1B) Creating ‘urban laboratories’ and/or pilot projects with a climate theme

Another route through which PPP arrangements can address climate mitigation and adaptation issues, still within the built environment, is through the creation of “urban laboratories.” Often involving the public and private sector together with research or academic partners, and generally smaller in scope than larger infrastructure projects, urban laboratories bring these stakeholders together to design, test, and implement projects that address local challenges and improve quality of life (Evans & Karvonen, 2013; GUST, n.d.). These social and technical innovations are tested within the built environment of cities and towns (Evans & Karvonen, 2013). Urban laboratories can be themed around sustainability and climate, allowing these partnerships to test, evaluate, and scale up innovative solutions that can drive forward climate mitigation and adaptation actions. Their collaborative and multi-stakeholder nature is especially conducive to bringing together the expertise and perspectives of various sectors (Evans & Karvonen, 2013).

Example: The NYC Off-hour Delivery Program

An example of this type of PPP comes from the New York City Off-hour Delivery Program (OHDP), a public, private and academia partnership that followed a study on the potential financial, environmental, and quality of life benefits of implementing an off hour delivery program in NYC neighborhoods. After funding the initial research, the New York Department of Transportation entered into partnership with academic and private sector partners to devise the logistics needed to implement an OHDP program to test. Here, private actors provided financing, valuable information on business procedures, shared their delivery data, and helped recruit other private actors to join the pilot program and voluntarily shift their deliveries to off hour periods (Holguín-Veras et al., 2018). Successes from the pilot program include significant cost reductions for participating private partners, increased driver satisfaction, reduced traffic congestion and risk, and a 50-60% reduction in total delivery vehicle emissions (Holguín-Veras et al., 2018).

2) Improving sustainability performance of municipal services

The provision of municipal services, much like infrastructure development, is another traditional use for PPPs. Infrastructure and service provision, in fact, most often appear paired together within the literature. PPPs within municipal service delivery tend to be based on a contracting, top-down relationships, wherein the city can stipulate climate friendly performance targets and incentives, as opposed to the collaborative structures, common goals, and resource pooling found in other types of PPP arrangements. Nevertheless, municipal services represent important leverage points for impactful climate action (Peterson & Hughes, 2017), and PPPs within municipal service delivery are a significant way way in which cities can can bolster progress towards climate goals.

Example: Municipal Waste Management in the Twin Cities, Minnesota

Waste management can account for up to 10% of a city's greenhouse emissions (Peterson & Hughes, 2017). Often, public services, including waste management, are not publicly managed, but rather delivered through a form of partnership with the private sector. A minority of US cities, in fact, have solely publicly managed waste collection services (Peterson & Hughes, 2017). Cities with privately operated waste service are split between an "open system" of waste collection wherein the city gives private operators a license to manage waste collection, and an "organized system," wherein the city maintains a relationship with a private operator based on a contract, which stipulates terms such as service expectations and performance criteria. Through modifying these contracts to set, for example, service standards requiring separation of organic waste from the normal wastestream or targets for waste vehicle greenhouse gas emissions, cities can shape the behavior of municipal service providers and achieve positive climate mitigation benefits (Peterson & Hughes, 2017).

Cities with open systems of municipal service, meanwhile, report increased difficulty in convincing their waste providers to adopt significant climate mitigating measures (Peterson & Hughes, 2017), highlighting the value of carefully considering the kinds of institutional arrangements pursued within PPPs for municipal service delivery. Pursuing organized systems for municipal service delivery allow cities more latitude to drive forward positive climate action (Peterson & Hughes, 2017). While no additional reviewed literature focused on public-private relationships for managing climate goals within other types of municipal service deliveries such as transport, energy, or water, these areas may also hold potential to use PPP structures to advance climate mitigation.

3) Climate Strategy and Policy Cooperation

Collaboration for strategy and policy development are another way through which PPPs can be used to further climate action. These strategic arrangements bring together the perspectives and resources of both public and private actors — as well as other possibly relevant actors across academia, civic/non profit organizations, and / or community representatives — to increase awareness, build capacity, share knowledge, and coordinate policy on climate adaptation and mitigation strategies. (Harman et al., 2015). Though the public sector generally retains final say on policy implementation, these arrangements bring together the public sector's often long term planning horizon with business' typically shorter to medium term risk management perspective, creating a synergy that benefits the overall climate resilience planning effort (Bovaird, 2004; C2ES, 2017). Such multi stakeholder collaborations are a key component used by, for example, cities within the 100 Resilient Cities program in creating local resilience strategies (100 Resilient Cities, n.d.).

Example: RACs and RCCPs in England and Canada

One example of PPP used for climate planning comes from a series of so-called Regional Adaptation Collaboratives (RACs) in Canada and Regional Climate Change Partnerships (RCCPs) in England, comprised of federal, regional, and municipal local actors, together with businesses, academia, and civil society organizations. Launched around 2008 with varying forms of joint financing, some of these are still in operation today. Through workshops and strategy sessions, both the Canadian RACs and English RCCPs created coastal management plans, floodplain regulations, and vulnerability assessments which led to the updating and re-formulation of existing regional and local climate adaptation and resilience plans (Bauer & Steurer, 2013; Natural Resources Canada, 2015).

4) Campaigns for behavioral change

The fourth and final way identified in which PPPs are used to further climate action at the city or regional level are through campaigns for behavioral change, wherein strong public

leadership on a climate mitigation or adaptation action, coupled with networking and partnering with private sector and other partners, galvanize momentum and action.

Example: The NYC Carbon Challenge

The Carbon Challenge, launched in 2007, was an integral component of NYC's efforts to reduce overall greenhouse gas emissions by 80% by 2050. It challenged participating universities, hospitals, hotels, commercial owners, and other private businesses to voluntarily reduce their building based emissions by 30% over ten years. A recent analysis shows that participating consortia of colleges, universities, retail owners and commercial participants have reduced annual emissions by a total of 580,000 metric tons of carbon dioxide equivalent — an estimated impact equivalent to removing 135,000 cars from the city's streets, with collective savings of over \$190 million USD annually, while at the same time spurring a significant reduction in polluting PM2.5 particulate matter as well as creating over a thousand new local construction jobs through energy efficient building upgrades (NYC Office of Sustainability, 2018). In part due to positive results from the Carbon Challenge that demonstrated the potential for climate action through partnership with private stakeholders, the City has sought to introduce new ways of working with the private sector, such as the NYC Retrofit Accelerator which provides decision support to help commercial building owners implement climate mitigating energy and water upgrades (NYC Office of Sustainability, 2018).

3.2.4. How Effective are PPPs for Climate Action?

Partnerships in themselves do not necessarily result in improved environmental or sustainability performance; available case studies show examples of both success and failure (Von Malmborg, 2003). Determining the effectiveness of PPPs for furthering climate action then, was a key component of RQ1. This question is broken down into two constituent parts: the main challenges identified that PPPs face in furthering climate action, and the main success factors identified that allow PPPs to effectively produce climate action. How well PPPs manage these challenges and capitalize on success factors determines how effective they are in furthering climate action.

Challenges for PPPs in furthering climate action

A number of challenges for PPPs in a climate context were identified in the literature. These can also be thought of as risk factors. Much like the previously identified benefits, some of the identified challenges overlap to a degree with identified challenges in the traditional (i.e. non-climate context focused PPP literature). The identified challenges are elaborated upon below, in order of prominence within the literature. Rationales behind each proposed benefit and examples, where available, are also provided.

Conflicts between public and private interests

The differing objectives and philosophies of the public and private sector present a major challenge for the use of climate-focused PPPs. Companies look to commercial pay offs and financial profitability as bottom lines, while public actors aim to achieve social benefit and further the public interest, which increasingly includes achieving high levels of sustainability and climate action in projects (von Malmborg, 2013; Roehrich et al., 2014). This short term financial focus may be fundamentally at odds with the long-term perspectives needed to push forward sustainability and climate positive outcomes (Koopenjan & Enserink, 2009). Acting on climate goals, for example, can require actions (or the lack of certain actions) that may reduce profitability, such as restricting carbon emissions, placing limits on resource use, or mandating stricter climate adaptation standards in construction, which may come into conflict with profit-focused business logic. As both sides typically share decision making power within a partnership, the potential for meaningful climate action within PPP projects may be greatly diminished if partners cannot see eye to eye (Koopenjan & Enserink, 2009; Forsyth, 2010; Newman & Perl, 2014; Patil & Laishram, 2016).

In a case study of Australian housing estates delivered via PPP, for example, Taylor and Harman (2015) note that while there was a willingness among private developers to pursue heightened energy efficiency and water use standards in the project due to the clear financial benefits provided, private actors saw less benefit and were more reluctant to pursue heightened engineering standards to address potential future climate risks due to the uncertainty and potential for reduced profitability.

Lack of clear financial benefit or business plan

The absence of a positive and profitable business model that appeals to private partners is a key reason PPP projects fail (Koopenjan, 2015). Here, an additional challenge can arise when the public sector attempts to appeal to the private sector's bottom line and bring them on board the project. Governments sometimes offer too much in the way of financial incentives, sometimes risking creating unintended monopolies, long term debt, and undermining the transparency of negotiations (Koopenjan, 2015). An often difficult, and sometimes impossible, balance between offering attractive financial opportunities for private partners and safeguarding public and environmental goals is thus required (Koopenjan & Enserink, 2009).

Lack of regulatory public-sector capacity to ensure meaningful climate action

PPPs differ from most other business relationships in that public actors must work closely in partnership with the private sector, while at the same time maintaining a regulatory role (Kumaraswamy et al., 2015). However, public actors' capacity for ensuring climate or sustainability goals are achieved within projects vary widely between cities and countries, and is often inadequate (Hughes & Peterson, 2018). Regulatory capacity is needed along various stages of a PPP project, as public actors may need:

- Relevant knowledge about existing or emerging sustainable technologies and construction techniques to choose the projects that best contribute to climate goals (Koopenjan, 2015). This may not always be straightforward, as mitigation and adaptation must be considered together across the lifespan of the project (Koopenjan, 2015). The risks are particularly high within larger infrastructure projects, where long contracts lock-in technologies and practices over the project's life span (Koopenjan, 2015)
- Sufficient resources to ensure climate related goals, quality standards, and targets are both initially set in the writing of the contract as well as continuously met as the PPP project progresses (Koopenjan & Enserink, 2009)
- Knowledge and political will to move away from predominantly economic regulation (i.e. focused on ensuring fair competition and project budgets) and incorporate climate considerations into the regulatory framework, which are typically overlooked and rarely integrated into most built environment PPP projects (Koopenjan & Enserink, 2009; Koopenjan, 2015)

As a result of this lack of regulatory capacity, even infrastructure projects intended to be, for example, low carbon climate resilient developments, may not fully deliver on their climate mitigation and adaptation potential.

Risk Aversion

Risk aversion hinders the potential for innovation and sustainable solutions to be developed (Koopenjan, 2015). Benefits identified in the literature focus largely on the risk taking and innovation the private sector brings to a public sector generally averse to risking public money in new ways. Koopenjan (2015) however, argues that the private sector, in its own ways, is also risk averse, through reluctant to embrace new methods of working that may, for example, offer better environmental performance but yet unproven financial returns.

Private parties may also be particularly wary of political risks to getting involved in public projects, including potential government turnover, uncertain long-term political appetite for projects, and the risk of shifting public budgets (Koopenjan, 2015).

Relational management challenges

These challenges relate to the ways in which relationships within the partnership are managed and the dynamics between partners. When poorly managed, they can significantly reduce a partnership's momentum and effectiveness.

- Partnerships often start with high levels of involvement, but initial enthusiasm diminishes over time, causing projects to lose momentum before achieving impact (Darlow & Newby, 1997; MacDonald et al., 2019).
 - Multi-stakeholder strategy coordination partnerships may be especially vulnerable, as they may lack the political status and financial resources of more

formalized partnerships (Harman et al., 2015)

- Power struggles may emerge if partners do not perceive each other to be on equal footing (Darlow and Newby 1997).
- Carefully written contracts can clarify partners' roles responsibilities, however at the same time, overly rigid specifications have been shown to constrain partners' desire to take risks and test new or innovative solutions, presenting a difficult balance for partners to strike (Roehrich et al., 2014).

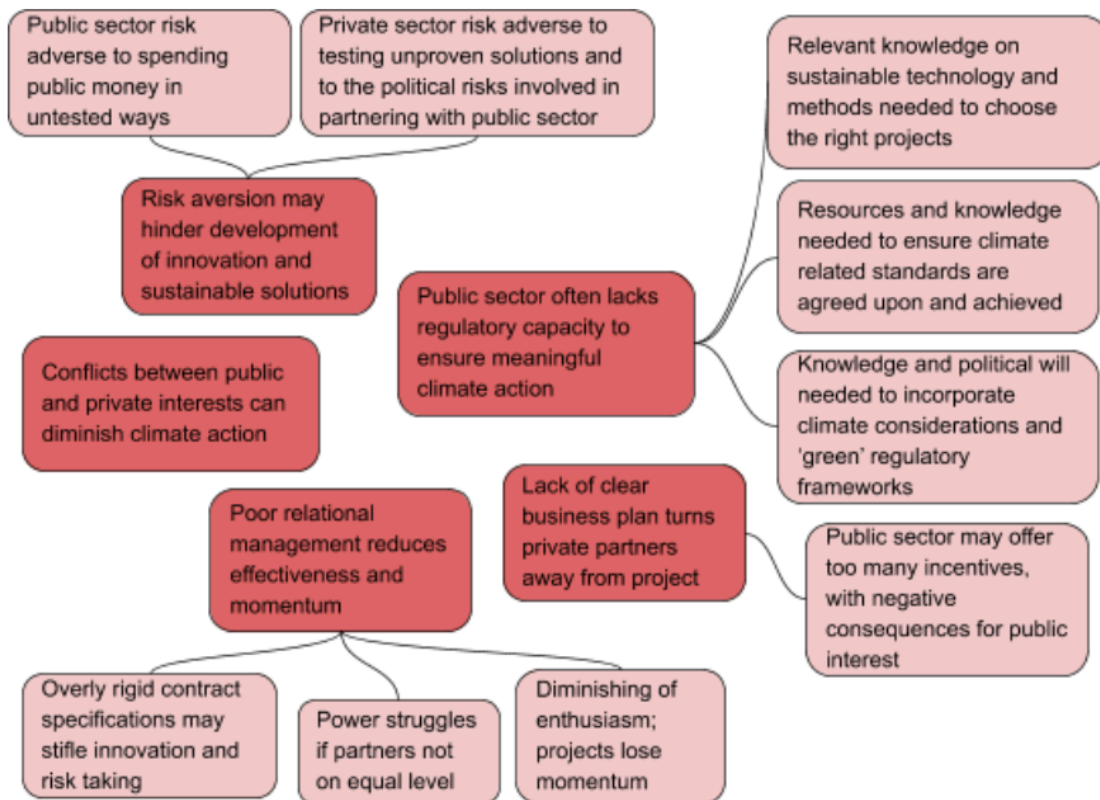


Figure 8. Overview of identified challenges to PPPs for climate action

Success factors in driving forward climate action within PPP projects

Identified success factors are elaborated upon below, in order of prominence within the literature. In some cases, success factors closely overlap with those previously identified within broader PPP literature, as research by Von Malmborg (2013) also found. Rationales behind each proposed benefit and examples, where available, are provided.

Effective relationship management

Considering how relationships are managed within partnerships are important ‘soft’ factors that help ensure partnerships maintain momentum and are able to achieve intended impact. A number of interrelated relationship management factors are frequently cited within the literature as key elements for PPP success.

- Goal alignment and interdependence
 - A shared vision of the problem and a recognition that one partner’s benefits and performance are linked to those of another, can build trust and goodwill, as well as create long term motivation among partners (Von Malmborg 2013; Marana et al., 2018).

- Trust
 - Often mentioned as a very significant factor for PPP success (McAllister & Taylor, 2015; Kumaraswamy et al., 2015; Hueskes et al., 2017)
 - Needed to build informal relationships which help effectively manage unexpected problems that arise, particularly those not explicitly covered within a contract (Roehrich et al., 2014; Kumaraswamy et al., 2015)

- Minimizing financial and time costs to engage in collaboration
 - Making opportunities to collaborate as convenient and accessible as possible helps keep partnerships alive (Forsyth, 2010)

- Deliberative capacity
 - A deliberative atmosphere that allows diverse perspective to be heard and different actors feel included, and that prioritizes mutual understanding can enhance trust and keep stakeholders engaged (Forsyth, 2010)

- Ensuring small successes, particularly at the start of partnership, keeps commitment among partners strong (Darlow & Newby, 1997).

- Regular exchange of relevant information from the start helps build trust and reduces duplication of effort, adding to the effectiveness of the partnership (Marana et al., 2018; Roehrich et al., 2014)

Public leadership

Public leadership is identified as a central factor in ensuring PPPs can drive forward climate action and deliver more than simply financial success (Hueskes et al., 2017). The private sector looks to government and public leadership for signals to direct their engagement with climate issues (World Bank Group, 2016; C2ES, 2017). Left alone, the private sector on its own is highly unlikely to achieve significant climate mitigation or adaptation actions (Newman & Perl, 2014). The public sector thus has a critical role to play in demonstrating

that climate issues are a high priority and a common interest, encouraging and enabling the private sector to pursue climate goals in PPPs (OECD, 2011; C2ES, 2017).

The previously mentioned NYC Carbon Challenge was successful in part due to the high level of public leadership that spearheaded the campaign. Advocacy and influence from the Mayor's Office inspired similarly high-level commitments by private partners to participate and take meaningful climate action. As different partners across diverse sectors joined in the highly publicized challenge, growing momentum helped overcome barriers to participation. The City also led through providing decision support and progress tracking tools to participating partners, reducing the time and resource barriers to participating. (NYC Office of Sustainability, 2018).

An example of strong public leadership driving forward climate action within an infrastructure PPP comes from the construction of the Canada Line train extension project in Vancouver, Canada. Despite being built through a binding contract with private sector partners, the project achieved the ambitious sustainability and climate mitigation targets originally set by its public management. This was in large part due to the public-sector project managers, who underlined the strict climate targets from the onset when defining the project and soliciting requests for proposals (Newman & Perl, 2014). While private partners did not initiate climate efforts, they actively contributed to them once within the project as a result (Newman & Perl, 2014).

Greening the contract and procurement process (Early project stages)

'Greening' PPP project frameworks, benchmarks, incentives, and accountability standards is a significant avenue through which PPPs can help stimulate private engagement in producing meaningful climate action (Koopenjan & Enserink, 2009; OECD, 2011). Like in the Canada Line example above, climate mitigation and adaptation criteria should be incorporated into a PPP project's initial procurement and tender evaluation processes from the outset, helping define climate goals as central project themes (Patil & Laishram, 2016).

Within infrastructure PPPs, the type of contract utilized should also be considered, as it may play a large role in determining the project's sustainable development potential. A Design-Build-Finance-Maintain (DBFM) project structure, for example, is thought to offer greater potential for positive climate impact than other forms like Build, Operate, Transfer (BOT) due to the ability to consider the project's entire lifecycle when mainstreaming climate considerations into the framework (Patil & Laishram, 2016; Hueskes et al., 2017).

A contract is central to any transactional relationship, particularly within infrastructure and service PPPs, and provides a formal framework which outlines duties and responsibilities, as well as common goals and strategies (Roehrich et al, 2008). Too often, however, contracts are overly focused on regulating economic success through price and coverage targets, to the exclusion of sustainability and climate considerations (Koopenjan & Enserink, 2009). A number of suggested ways to 'green' the contract and procurement processes for better

climate action and stimulate private actors to take climate mitigation or adaptation action were identified:

- Regarding initial project requirements
 - Public sector managers should be prepared and able to choose the proposal that leaves open alternatives for future climate actions rather than simply the cheapest proposal (Koopenjan, 2015)
 - Sustainability criteria should be implemented into the initial requirements stage (Hueskes et al., 2017)
 - Exclude companies that have breached environmental law
 - Require past experience with sustainability
 - Find balance between setting high criteria and excluding smaller companies and possibly overly limiting competition
- Regarding awarding of the contract
 - Apply sustainability focused award criteria (Hueskes et al., 2017)
 - Express clear preferences with regard to sustainability
 - Clearly formulate criteria that explicitly mention sustainability and how it will be measured
 - Consider the use of a minimum score required for each sustainability criteria, so that all bids are required to take some base level of climate action
 - Assign an impactful evaluation weight to meeting these standards, so that they cannot be ignored (at least 10-20% is recommended)
- Regarding incentives during the project
 - Create project incentives linked to mitigation and adaptation targets of importance (Koopenjan & Enserink, 2009)
 - Achieving resource conservation or reduction targets
 - Limiting wastewater and other waste streams
 - Certifying the use of sustainable materials and processes in construction and operation of infrastructure
 - Such incentives may be particularly useful for for long term contracts where technology ‘lock-in’ is a concern, as they can incentive private actors to continue investing and upgrading their use of low carbon and climate resilient technology and methods throughout the project (Koopenjan & Enserink, 2009; Koopenjan, 2015)
- Regarding defining project output specifications
 - Apply sustainability focused specifications
 - Define expected climate/ sustainability performance outputs as well as what indicators will be used to measure this performance
 - Basing the contract on these kinds of rigid performance standards and specifications as opposed to achieving a predetermined detailed design

encourages private actors to focus on developing and explaining their own sustainable solutions to meet project requirements (Koopenjan, 2015; Hueskes et al., 2017)

Just as importantly, the public sphere must have the necessary capacity to regulate the partnership and monitor the achievement of these aforementioned governance mechanisms across the project lifespan (McAllister & Taylor, 2015; Hueskes et al., 2017; Hughes & Peterson, 2018). Integrating climate related performance into at-present economically dominated regulation agendas and auditing frameworks will require the presence of strong public leadership (Koopenjan & Enserink, 2009). To this end, training programs and the establishment of PPP knowledge centers may be useful in increasing in house public sector expertise and regulatory capacity (Koopenjan & Enserink, 2009).

Redefining and measuring success (project end stages)

A key success factor for climate focused PPPs is moving away from the use of purely economic measures and instead considering alternative criteria to evaluate progress and define success (Koopenjan & Enserink, 2009). Economic impact assessments are commonly used to produce economic analysis of a project, but often exclude social or environmental performance, presenting an incomplete picture of project results (Berrone et al., 2019).

In response, Berrone et al. (2019) suggest a conceptual PPP evaluation model that can be used to evaluate project performance more holistically, based on the UN SDGs. Named EASIER, the model evaluates projects based on their:

- Engagement of community stakeholders
- Access to services for those most vulnerable, and effects on reducing inequality
- Capacity to be scaled up and replicated to expand impact
- Inclusiveness
- Economic impact through generation of local jobs and innovation
- Climate resilience and environment actions, like the inclusion of DRR strategies and CCA plans, sustainable material and energy use, and emission and waste reduction actions

While the model's climate resilience criteria presents a clear avenue to evaluate climate performance, it should be noted that the inclusion of social sustainability (i.e. reducing inequality), is also an important, if more indirect contributor to increasing climate resilience through reducing social vulnerability.

Some of these success criteria have been applied in case studies presented. The NYC OHD pilot program, for example, measured success in part through the potential to scale up the climate mitigating benefits of off hour deliveries. The project team calculated that at a global scale, switching ten percent of all freight deliveries off hours in all cities with a population greater than two million would eliminate 297.8 million tons of CO₂ and 19.7 thousand tons of

PM10, in addition to helping reduce traffic congestion in densifying urban areas (Holguín-Veras et al., 2018). Success was also marked through the US Federal Highway Administration and EPA developed a program to replicate OHD in other cities.

Similarly, the NYC Carbon challenge defined its success in part through its ability to engage with additional private sectors each year, expanding from working with universities to hospital, commercial property owners, and later, hotels (NYC Office of Sustainability, 2018).

Ensuring PPP projects are financially sustainable

In order to be successful, PPP projects must make financial sense to private actors considering investing time and resources (Toxopeus and Polzin, 2017). In addition to simply providing traditional monetary incentives however, the public sector may also take the lead in framing climate action in business terms, by communicating how taking climate related actions such as climate-proofing buildings, improving energy efficiency, or investing in green infrastructure can contribute to long term economic competitiveness and provide joint financial benefit (C2ES, 2017).

Just as cities and businesses jointly suffer the negative impacts of climate change, they may jointly benefit from the economic development opportunities that come from improving resilience. Upgrading or relocating infrastructure, implementing energy efficiency projects, building microgrids, and restoring natural ecosystems can improve resilience, create jobs, and require business solutions.

A key motivational factor identified in the green infrastructure PPP between Volkswagen Mexico and the Mexican National Park Service, for example, was that the region's water shortages posed a risk to the company's operations (USAID, 2018). Taking steps to mitigate water scarcity and improve climate resilience then, made clear financial sense for Volkswagen.

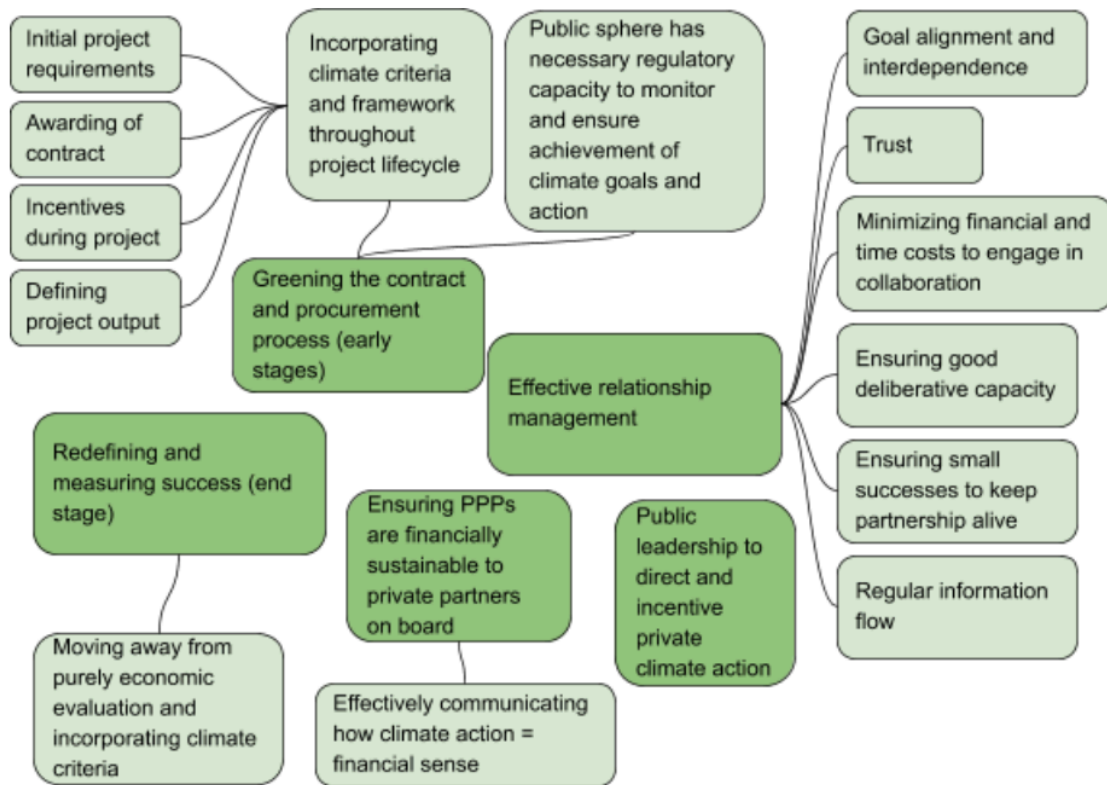


Figure 9. Overview of identified success factors for climate focused PPPs

3.3 Summary of key scoping study results

Overall, much more academic literature was found on the topic of PPPs for climate action than grey literature. The number of academic and grey publications has been increasing in recent years, indicating a growing interest in the topic as climate adaptation and mitigation considerations climb higher onto urban agendas. Within the academic and particularly within the grey literature, PPPs were predominantly conceptualized as vehicles for infrastructure and service delivery. Multiple examples of other non-infrastructure PPP uses were found within the recent academic literature, but only a few were found within the grey literature.

An exceptionally wide range of PPP definitions was identified within the literature, highlighting the ambiguity surrounding the concept. Similarly, a wide range of benefits to the use of PPPs for climate action were identified. The three most cited benefits related to:

- The pooling of diverse, cross-sector expertise, capacity, and skills
- Mobilizing private finance and increasing the amount of finance available
- Greater sharing of project risks and decreased financial risk

Though the literature focused on PPPs within an infrastructure and service context, multiple ways PPPs are used to further climate action exist and were identified:

- Building climate resilient physical infrastructure
- Creating “urban laboratories” and/or pilot projects with a climate theme

- Improving sustainability performance of municipal services
- Climate Strategy and Policy Cooperation
- Campaigns for behavioral change

PPPs in and of themselves do not result in improved sustainability performance or climate action (Von Malmberg 2003). PPPs face a number of challenges, the three most cited being:

- Conflicts between public and private interests that impede climate action
- Lack of regulatory public sector capacity to ensure meaningful climate action
- Relational management challenges that reduce effectiveness and momentum

The most cited success factors key to allowing PPPs to effectively produce climate action meanwhile, are:

- Effective relationship management through the development of key relational factors such as goal alignment, interdependence, trust, and deliberative capacity
- Public leadership that directs and incentives climate action
- Greening of the contract and procurement process to include climate related incentives, accountability standards, and frameworks
- Redefining and measuring success with climate, rather than solely financial, criteria

4. Consultative Interview Results

The four scoping study themes were used to design the interview questions, and used as a lens with which to analyze and distill interview results. A total of six respondents were interviewed over four interviews. Interviewees came from both the public and private sector, and worked primarily with PPPs for infrastructure and services as well as PPPs through urban laboratories and pilot projects (See Appendix 4).

4.1 Defining PPPs

Interviewees had varying definitions of what a PPP was. Each definition seemed to reflect the way in which they themselves worked with PPPs.

Interviewee 1 reflected on the fact that conversations about defining concepts like PPPs rarely happen in the field. When asked how he would define the concept, he emphasized the role the private sector takes on in providing infrastructure and services:

”PPP in general is where you involve private organisations...usually a company with a commercial interest...into something that the public usually does...”

Working at the city level, Interviewee 2 provided a broader definition, mentioning various kinds of PPP formats:

”It’s a working between the private and the public, either formally, through joint investments and contracts or informally...it could be working with joint policy, R&D projects, with IT companies, or innovation piloting programs.”

Interviewees 5 and 6 meanwhile, whose work revolves around ‘facilitating a neutral ground’ for public and private partners to jointly develop resilience solutions, highlighted working towards a common goal, while also hinting at the presence of differing objectives:

”It’s about creating a collaboration on an issue that both the public and the private are stakeholders in, even though the individual objectives of being engaged may not be the same....”

Interviewee 4, also working with the innovation sphere and with large consortiums of public, private, and academic partners also mentioned collaboration, highlighting problem scale as an important dimension of PPP:

“A collaboration that gets people to tackle challenges that can’t be solved on your own, where partners are interdependent on each other.”

4.2 Motivating PPP Use

Interviewees named a range of benefits that working with PPPs can provide.

For Interviewee 1, from the private sector, focused on what the private sector brought to the public table:

“[PPP arrangements] often help public organizations be more innovative. We can also help find external financing to make these projects with positive environmental goals possible...and the public usually enters these projects because they want to do more than they can themselves with limited staff resources”

Interviewee 2, from the public sector, emphasized the efficiency that PPP projects bring:

“When you find the right people, the most passionate people and work together, it brings this rapid execution and efficiency.”

Impact and the ability to address problems at larger scales was a key benefit emphasized by Interviewee 4:

“ The key factor is impact..we do partnerships for the possibility of impact and to be able to tackle these kind of challenges..often within the sustainability area..where we need to adapt new ways of working...because now the questions are bigger, it’s more complicated to solve issues and there are more common problems.”

In terms of what the private sector stands to gain, business and financial opportunities were frequently mentioned by respondents:

“They [the private sector] are interested in getting some of the public financing into their business...they usually have a very clear commercial objective” (Interviewee 1)

“The private sector always come to the table when there is a possibility of finding out what challenges the city has and what business opportunities there are to work on these” (Interviewee 6)

Innovation was a key benefit of PPPs mentioned by various respondents. While the scoping study literature largely mentioned innovation without describing how it arises or is created, interviewees described somewhat more concrete links.

As previously mentioned, Interviewee 1 focused on the innovation that the private sector brings to the table:

”Usually when you tell someone to be more innovative they say ‘we don’t have the money, and we’re a public organization’ ... Meanwhile the companies are always interested in becoming more innovative, it’s part of their business and competitiveness. Municipalities also interested in becoming more innovative, but usually need the private organisations to concretize their often fuzzy innovation plans.”

Interviewee 4, meanwhile, from a municipal perspective and working with a range of partners, focused more on the innovation that arises from bringing multiple partners together and their resulting interactions, explaining:

”Innovation happens when you create dense spots, it’s always about density of people, different ideas from a range of different partners.”

4.3 Challenges and risks

Interviewees identified a number of main challenges within their PPP experiences:

Navigating public-private conflicts

One prominent challenge mentioned was navigating conflicts between public and private interests. According to Interviewee 1:

“It’s very clear that companies are not understanding municipalities and public authorities, and public authorities are not really understanding the companies. Many of these people are schooled only within one or the other world...there are not that many people that jump between these sectors and have both perspectives. So we have to find some kind of common denominator...that can be tricky. And when it comes to sustainability...for a traditional company seldomly will the growth of the company and sustainability or climate go hand in hand.”

Risk aversion

Risk aversion — from both sides — was another prominent challenge within PPPs that interviewees described.

According to Interviewee 3, from a private sector perspective:

“Too many people on the public side don’t understand what innovation is or how it works in real life.”

This frustration towards bureaucratic public processes that stifle innovation was also pointed out by Interviewee 1, also from the private sector:

“The public sector is usually, according to the companies, the main barrier to run certain innovative projects.... The public legislation, policies, and guidelines that companies have to work within are usually not adapted to new innovation. When you bring these people together...the public sector often doesn’t know what’s going on in reality.”

Coming from a public perspective meanwhile, Interviewee 2 argued that risk aversion was a challenge, but pointed out how the private sector’s own risk aversion can slow progress:

“ Some of the companies say we are really open, but at the end of the day...it’s not part of their business logic to be open, they’re not open to the municipalities because they won’t earn as much money..and some are afraid of the risk of information sharing to competitors so they can be very locked up in many discussions...so I don’t think it’s fair to say it’s so one-sided...it’s complicated by business logics too.”

Technology lock in

Pointing to a challenge also identified within the literature, Interviewee 1 highlighted the risk of changing technologies and research relating to sustainable innovations. Solutions which seem to promote sustainability or climate mitigation may quickly be deemed maladaptive as new research emerges, he explained, an especially big risk when long term contracts lock in operations for a number of years:

“ Ethanol for example used to be a huge thing, to run the busses on ethanol. But to grow the substrates for ethanol, suddenly it started to be revealed that they were chopping down rainforest in Brazil...and suddenly we had a huge environmental catastrophe that we were contributing to.”

4.4 Success Factors

Public sector leadership

Leadership from the public sector emerged as a strong key success factor for PPPs to drive forward climate action. Multiple respondents emphasized the need for public actors to produce guiding visions that inform and motivate sustainability and climate action within PPP projects.

“The public sector is very important. It is not the companies that should drive Agenda 2030 and climate issues, of course they should adapt to it and help further it, but the responsibility is on the public to create and share a vision that will help enable the private sector companies take their responsibility...they have to be the visionaries.” (Interviewee 5)

“ They [the private sector] can add to sustainable development by different modes of transport, or employing different types of people or technologies or whatever it might be...but

I can't see how the private sector will lead here...they will adapt to the vision set by the public.” (Interviewee 6)

Interviewees also stated that public leadership could take the form of greening the PPP framework through regulatory changes that help produce stronger climate action.

”If you talk about sustainability and climate in the future, the government must be more bold...more aggressive, more ambitious, in setting these sustainability regulations and incentives...but it might hurt them in the next election of course.” (Interviewee 2)

In contrast to other interviewees who pointed out how government regulations sometimes hinder innovation and implementation of new sustainable solutions, Interviewee 2 was optimistic that such new regulation around sustainability and climate could instead catalyze innovation:

“I'm very optimistic about that [kind of sustainability regulation and initiatives], because that means the best companies will win. If you can be innovative within the regulations, then you can be a much better and more agile company and do and talk about sustainability and climate change in new ways.”

Overcoming public-private conflicts

Bridging the private public divide and overcoming conflicts was a key factor for success identified by interviewees, who tended to focus on their own methods of managing and overcoming these conflicts, something not found within the majority of the literature.

Interviewee 4 focused on the importance of accepting and managing these conflicts, rather than trying to prevent them:

”There will be conflicts, there has to be conflicts, otherwise, we don't gain new perspectives and knowledge...if I have a conflict, if I have something clashing, then I know that I have something new coming.”

Interviewee 4 additionally emphasized the need to seek and find compromise, suggesting partners should move away from seeking a completely win-win situation:

“You have to deal with it and be pragmatic, be transparent and talk about it and say, here is my limit, here is what we can do, and be prepared to find the positions between the yes and the no to find what could work, what is fair enough, what is good enough...and often you can do a lot more than you thought you could.”

Interviewee 3 meanwhile, stressed the need to find and include more people working ‘in the middle,’ with knowledge of both private and public worlds in PPP projects:

"We must find more kinds of [name of interviewee 2] and work with them...we need these ambassadors who really understand both sides, that's critical"

Trust

Almost all interview participants identified trust as a critical factor behind general PPP success. Respondents, in some cases, dove deeper than the literature did in terms of identifying how trust can be built, and reflecting upon the importance of the presence of trust before versus during a PPP project.

Interviewee 1 on the importance of trust:

"I have a feeling that the most important factor in whether or not to join a PPP...is kind of the personal contacts you have from before and the trust that exists there"

Generally, participants seemed to agree that trust building is a dynamic process that requires continuous effort. All pointed out how trust can be gained or lost at various stages within a PPP project. For example:

"Trust increases slowly with time if there are no mistakes, and when you see that others are working in the same direction together. So it's often built up along the way, but if you already know each other from before, maybe it takes less time to get started, there's already existing trust there compared to if you had to build it up." (Interviewee 1)

Along similar lines, Interviewee 6 emphasized that trust arises from an alignment of goals and direction:

"One key element [of building trust] is when you prove you understand the problem in a way the other partner understands, that you have some kind of shared values that go together around the problem."

In contrast to Interviewee 1 however, Interviewee 6 stated that trust needs to continue to be built, even if it exists prior to the start of a partnership:

"It needs to be built during the partnership...even if you already have trust among the partners, even if I already trust people from the beginning, that trust has to be proven again in the actual context of the project."

Interviewee 2 pointed out that trust can and should be produced both through formal measures, like the contract, as well as through informal interactions:

”I think it’s partly about the contract, that outlines responsibilities and produces some trust, and of course continuing to build it throughout the procurement and project lifespan as well.”

Interviewee 4 provided perhaps the most concrete example of how trust can be built, explaining:

“We work with values, throughout the partnership we bring in people and talk about what we think is important, through workshops, through storytelling, through visualizing goals and talking about how we see things...this is the ongoing trust building processes, who are you, what are your goals, and if you have a problem, let’s talk about it. You need to do this from the beginning, before you have a problem...then it’s much easier to deal with.”

Ensuring financial sustainability

Interviewee 6 noted that even if sustainability and climate action are key components within a PPP, ensuring financial sustainability is a prerequisite to making the PPP viable:

”Some companies might really want to contribute to sustainability and climate action ...but their logic is still that they need to be able to survive, so those financial and business models are needed from the very beginning.”

Advocacy

Interviewee 6 identified advocacy as an additional success factor not previously mentioned. This is in a way similar to public leadership, which the literature identifies as a key success factors. The interviewee’s conception of such an advocate role, however, extends beyond the public sector:

“ Something that I think is not very often mentioned is that you need to have some kind of advocacy around the project. You need to have someone - it could be a politician, an executive, someone with some status — that can talk about your project and give it life and energy.”

Measuring Success

As within the literature, finding different ways to define success was identified as important for climate focused PPPs.

Lamenting how success is often measured in purely political terms, Interviewee 2 called for finding new, more objective ways to measure project success:

“ That needs to be improved...we need to be able to measure success in a better way. If you ask politicians, they can find the calculations that make the project look good, and those against can find calculations that make the project look bad...but it’s different for the public

to understand if this was a successful PPP or not. For legitimacy of the future projects it's important that the public understands the success of these things"

Echoing those comments, interviewee 5 stressed the need to think about scalability as a success factor in order to realize increased impact.

"Often we talk to city officials suggesting something and they say, 'Oh that's already been done, but usually they're referring to a test project that's been done, like selling local food from urban agriculture at the station, but when it comes to real life, you can't scale it up and get past the regulations to get a permit to actually do that. So the innovation doesn't stop after the test...to succeed we need to scale up projects to really make an impact."

4.5 Summary of Key Interview Results

Interviewees provided a variety of definitions for PPP, spanning numerous forms, structures, and objectives, much like academic literature did, pointing to how PPP is often used as a broad umbrella term. The definitions provided by interviewees were visibly linked to the ways they worked with PPPs, and if they worked within the private or public sector (or somewhere in between). Overall, interviewees' definitions focused most on PPPs as vehicles with which to work towards broader common goals as opposed to traditional definitions of infrastructure and service delivery which was somewhat more common within academic literature and especially more so within grey literature.

Much like the scoping studies, interviewees named a range of benefits PPPs provide; these centered around innovation, efficiency, and the ability to tackle larger, complex problems. All the most cited benefits found in the literature were also mentioned by interviewees, representing general alignment with both academic and grey scoping study results.

Interviewees in general identified far fewer challenges compared to the literature. The challenges identified centered around trust, risk aversion, and other relational management factors. Many more success factors were named by interviewees, on the other hand. The most mentioned was public leadership for motivating climate actions within PPPs. At the same time, only one interviewee mentioned greening of PPP frameworks, which was a major factor frequently identified within the literature.

Interviewees were overall positive towards the use of PPPs and the potential for PPPs to drive forward innovative sustainable solutions. This is somewhat expected, as all interviewees work professionally with such projects.

A few novel themes were identified through the consultative interviews. Interviewee 4 described how projects use workshops, storytelling, and mutual goal setting techniques to establish trust, providing a concrete example of a trust building process that was not found in the academic or grey literature. In contrast to the framing of public-private interest conflicts as major challenges within the literature, Interviewee 4 framed them almost as opportunities to

gain new perspectives and find common ground, emphasizing the need to manage these natural and inevitable conflicts.

Interview results overall were more similar to the academic literature, as both presented a broader set of perspectives about the use, best practice, effectiveness, and challenges for climate action PPPs, as compared to the more traditional grey literature. While both interviews and grey literature captured perspectives linked to the real-world work of practitioners, the identified grey literature came almost exclusively from large organization working on a global scale with more traditional infrastructure and service related PPPs, while interviewees generally worked more locally or regionally, with a greater variety of PPP types. This may help explain the rather large contrasts between interview and grey literature results.

5. Discussion

Methodological Limitations

Leavac et al. (2010) note that it is unclear whether the lack of quality assessment of the literature affects the relevance of scoping study results. This was not an aim of the scoping studies conducted, but may be relevant for future research to pursue considering the emerging and dispersed nature of the field.

Small sample sizes in both the academic scoping study (thirty-one articles) and the grey scoping study (twelve publications), mean that it is difficult to authoritatively draw broad bibliographic conclusions in the overall analysis. At the same time, this indicates the emerging nature of the field of PPPs for climate action, particularly in real world practice.

The number of interviews was also limited, due to difficulty in reaching respondents. With a total six interviewees, results cannot be expected to be representative of how practitioners generally think, particularly considering the limited geographical diversity of respondents (all within the Skåne region in southern Sweden). Additionally, respondents worked primarily within PPPs for infrastructure and services as well as urban laboratories and pilot projects, meaning that views of respondents working with other relevant forms of PPP, such as policy building and behavioural change campaigns, were not included. However, results are still valuable in strengthening the project's connection to practical work and adding nuance to the findings.

Contrasts and tensions

A number of tensions were discovered between the scoping studies and interview results.

Public leadership was identified as a key success factor for PPP climate action within much of the academic and grey literature. The Canada Line PPP showed how ambitious climate goals were achieved because public leadership emphasized and included these goals from the project's outset, suggestion they were central, non-negotiable aspects of the project. Meanwhile, Interviewee 4 emphasized the need to seek compromise among partners and find acceptable tradeoffs. Some of the academic literature also suggested that tradeoffs and compromise are inevitable aspects of PPPs, with no partners likely to get everything they would like, particularly when climate ambitions and financial bottom lines come into conflict (Newman & Perl, 2014; Peterson & Hughes, 2017). This likely has in part to do with the particular kind of PPP project in question and the degree of mutual decision making present within the partnership. Projects with a high degree of mutual decision making seem likely to require greater compromise, as opposed to more top-down contracting PPPs, where non-negotiable climate standards and criteria can more easily be set. Nevertheless, how to navigate this apparent tension between the need for compromise (and the risk of watered down climate

action) and the need for uncompromising public leadership (and the risk of project failure), remains unanswered.

Among the PPP benefits commonly found in the literature is the innovation and risk tolerance the private sector brings to the generally conservative, risk-adverse public table. Interviewees differed in who they described as risk-adverse, however, painting a more nuanced picture of risk-aversion from both sides. Private sector interviewees pointed to the public sector's unwillingness to break out of conservative innovation-stifling regulations, while public sector interviewees also noted the private sector's risk aversion in being unwilling to break out of their rigid business logic.

A third tension arises from the fact that contracts are identified both as a success factor, as they clarify roles and responsibilities and provide clear frameworks for shared goals, and are simultaneously considered a risk, in that a dependence on a contractual relationship management approach via overly rigid contracts risks stifling innovation and reducing opportunities for trust through informal interaction to be built (Roehrich et al., 2014). The balance between contractual and informal relationship management appears to be an area worthy of further study.

Reflections on strength of results in an emerging field

PPPs for climate action represent an emerging field, evident in the relatively small number of case studies of climate focused PPP projects currently available in the literature and the fragmentation of relevant literature across a diversity of fields, disciplines, and journals (Mees et al., 2012; Harman et al., 2015). Klein et al. (2019) show that the more advanced a city is in its climate adaptation policy planning, the more likely it is to engage external actors and private sector partners in its climate initiatives. As climate adaptation and resilience have only relatively recently been more widely incorporated into urban agendas, this may help explain why these case examples are not yet abundant.

While quality assessment is not an aim of the project, it is nevertheless worth noting that most of the study's results were thus based on literature concerning small numbers of case studies, rather than more robust longitudinal studies or meta-analyses, which Schroeder et al. (2013) also point out are currently lacking. While individual case studies provide valuable narrative evidence that were used in the study, they make it difficult to prescribe clear ways forward or make concrete claims, highlighting the need for caution before generalizing these results, as well as the need for more systematic research — perhaps attempting to identify the specific effect of PPP structure on a project's achieved climate action — as the available body of PPP projects for climate action grows in the years to come.

Overlap between climate and traditional PPPs

Numerous benefits, challenges, and success factors for PPPs for climate action identified are also relevant to traditional PPPs, and overlap with those found in traditional PPP literature.

The boundaries of PPPs for climate action proved, in some ways, tricky to define. Trust is clearly a success factor relevant to all forms of PPPs, climate focused PPPs included. At the same time, trust takes on a more specific climate role when considering that trust is likely needed for public leadership to effectively drive forward climate action by other partners. Similarly, public leadership could be said to be applicable to PPPs generally, but takes on a climate dimension when considering it is needed in order to adopt and mainstream new climate relevant project evaluation frameworks, for example.

Additional considerations

Two additional recurring themes, albeit to a significantly smaller degree, were identified in the scoping studies:

- Critical debate on the appropriateness of private actors being increasingly involved in public affairs, and corresponding issues relating to transparency, accountability, representation, and democracy
- Integrating community and people into PPPs in order to better incorporate local knowledge, increase project legitimacy and effectiveness, and ensure local accountability

These were not identified frequently enough to justify creating new themes, and were not able to be classified within the main identified themes. They were not critical components for answering the posed research questions, and due to space limitations, they are not further analyzed. When possible, however, interviewees were asked about these considerations, and their responses, though limited, are provided in Appendix 6. Though not further examined here, these represent important considerations as PPP challenges and success factors. The fact that these considerations were not frequently identified in the scoping studies could even suggest they are under-appreciated and under-considered challenges and success factors. Whatever the case, they are promising as areas of further research, particularly as the use of climate focused PPPs continues to expand.

Reflections on the emerging field of PPPs for climate action

Results of the study showed PPPs are not a silver bullet for climate action. Nevertheless, they seem to hold immense potential to combine funding, knowledge, capacity, and resources across sectors and organizations and enable more impactful climate action. The importance of PPPs is highlighted at an international level with SDG 17, which calls, in part, for promoting effective and diverse partnerships. PPPs for climate action appear to be gaining increasing interest, attention, and use, and appear to be growing in prominence as a versatile tool in the climate toolbox of cities (and likely also for regions, national governments, and international organizations). This should be seen as a positive development, providing policy makers and governments another promising avenue for action.

PPPs for climate action do face a number of significant challenges, as well as ethical considerations, and particularly as their use continues to grow, it is important that these are

properly addressed and managed to ensure PPPs are employed within frameworks of good governance and deliver impactful climate action. The variety of ways that PPPs can be successfully used for climate action inspires optimism in the face of critical climate challenges. It is critical that continued research and knowledge is developed within this emerging field to maximize this potential. As the urgency of achieving climate mitigation and adaptation goals rises on urban agendas, coupled with rapidly increasing risks to environmental, economic, and human health, it becomes increasingly clear that new collaborations, combined resources and capacities, and novel forms of governance are needed to tackle wicked climate challenges. Moving forward, effectively used PPPs offer encouraging and significant potential for catalyzing needed climate action in response to these growing challenges.

6. Conclusion

The thesis aimed at determining the current state of PPPs for climate action (RQ1), what challenges exist for such projects (RQ2), and what opportunities exist for future development within the field (RQ3).

A particularly wide range of PPP definitions were found across scoping studies and interviews, with varying forms, structures, objectives and groups of actors, highlighting the overall ambiguity of PPP as a concept and the still emerging nature of the field.

Literature relating to PPPs for climate action focuses predominantly on PPPs as vehicles for infrastructure and service delivery. A broader use for PPPs, by contrast were reported by interviewees, and some academic literature examined climate action within PPPs beyond simply infrastructure and service contexts. A typology was created, which categorizes and delineates five ways PPP structures are used to promote climate action:

- Building climate resilient physical infrastructure
- Creating “urban laboratories” and/or pilot projects with a climate theme
- Improving sustainability performance of municipal services
- Climate strategy and policy cooperation
- Campaigns for behavioral change

Together with the range of definitions identified, this typology challenges and reconceptualizes¹ this dominant conception of PPPs as infrastructure and service delivery vehicles, showing instead that a range of uses exist through which PPPs can drive forward climate action.

Through analysis of a broad range of literature and supplemental consultative interviews, the thesis summarizes and distills the dispersed information within this emerging field, presenting smaller sets of manageable conclusions related to PPP’s principal benefits, challenges, and success factors.

¹ Underlined conceptual contributions based on MacInnis’ (2011) framework

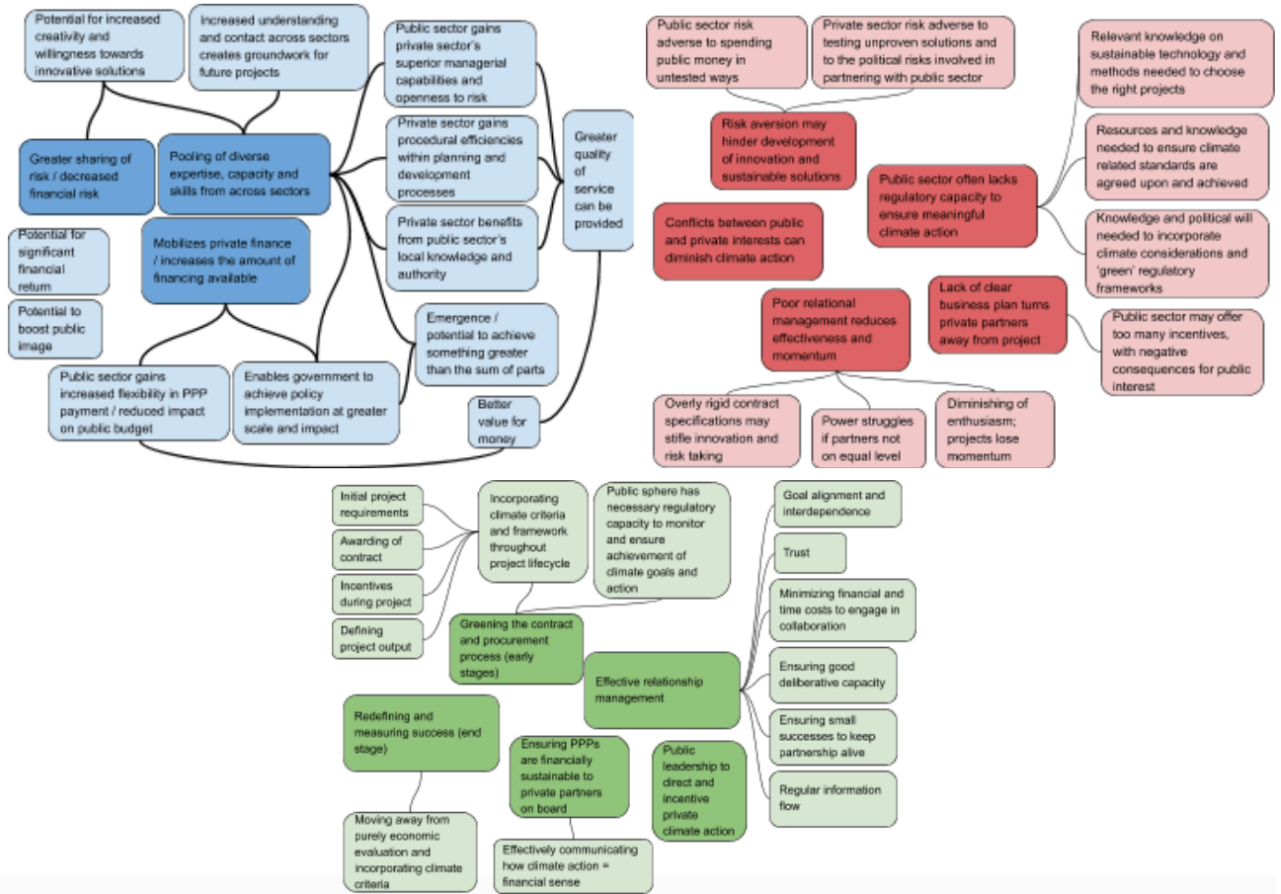


Figure 10. Side-by-side of identified PPP benefits, challenges, and success factor overviews

PPPs are associated with a wide range of benefits and have significant potential as vehicles through which to further climate action. They are, however, not a silver bullet; the presence of a PPP structure will not automatically result in better climate — or even financial — performance (von Malmborg, 2003). PPPs also face a broad range of challenges that hinder their success. The thesis underlines that how well PPPs manage these challenges and capitalize on available success factors determine how effective they can be in furthering climate action.

In doing so, the thesis answers RQ 1 and 2, and meets objective A, to identify how PPPs are currently used for climate action today within city contexts. This initial synthesis and charting of the emerging field of PPPs for climate action provides a better understanding of how they work, and what factors influence their success in achieving climate action. At the same time, additional knowledge is needed to maximize the potential for these structures to catalyze climate action and progress towards local, national, and international climate goals.

In addressing RQ 3 and meeting Objective B, the thesis concludes by proposing three opportunities for future development regarding PPPs for climate action, based on an overall analysis of project results.

- 1) Deeper mapping of the relationships between the range of identified benefits, challenges, and success factors on one hand, and the different types of PPPs for climate action on the other. Due to differing organizational structures, relationships, and objectives across the types, it seems likely that the most relevant benefits, challenges, and success factors will differ across PPP types. This was not addressed within the reviewed literature, and would help those involved in and managing PPP projects to better prioritize partnership resources to ensure success.
- 2) Further investigation of broader (i.e. policy based or national level) success factors for PPPs to drive forward climate action is also important. This study's analysis at the city government and individual partnership level generally excluded potential broader success factors, such as the development of nationally mandated infrastructure project climate criteria, which has thus far been underutilized (World Bank Group, 2016).
- 3) More thorough exploration of how trust is built within PPPs. Though frequently cited as a key success factor, scarce and inconclusive evidence was found identifying how or when it is developed. Considering the centrality of trust to the effective functioning of PPPs, including potential to drive forward climate action, the identification of concrete strategies, processes, and case studies for trust building within PPPs for climate action appear needed.

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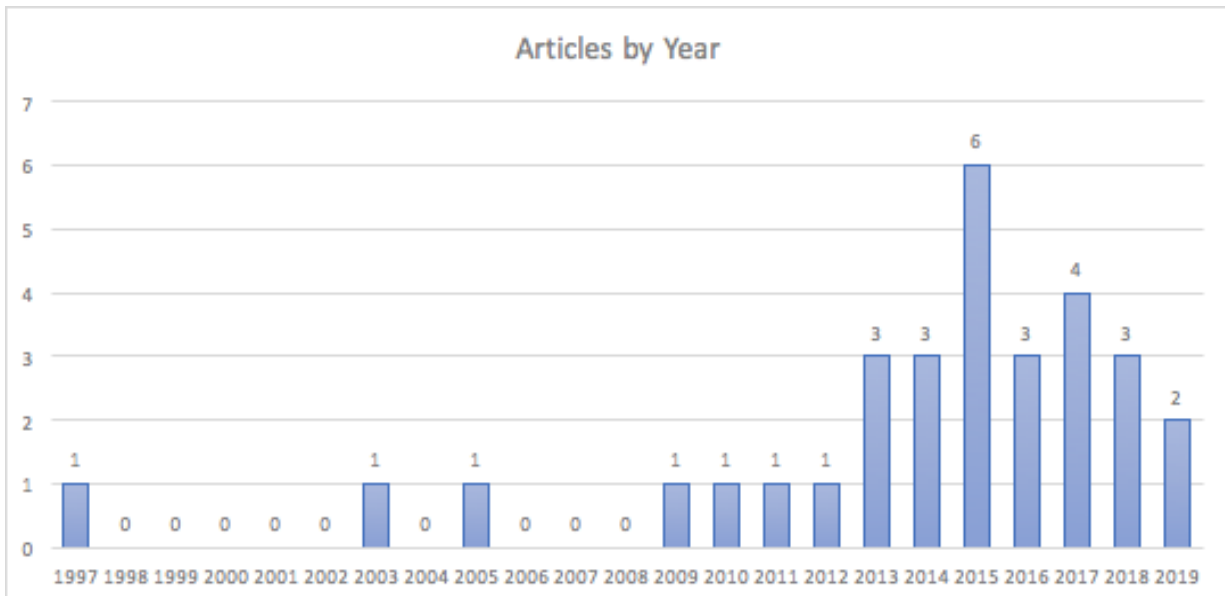
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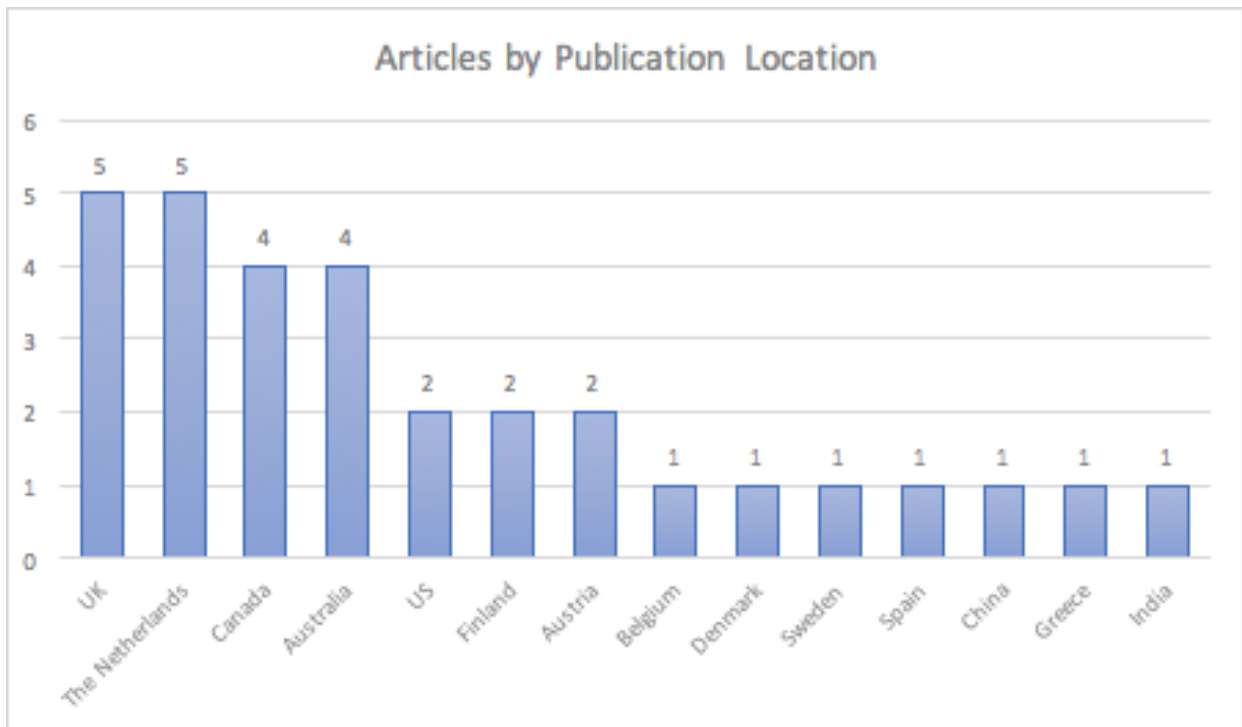
Appendices

Appendix 1: Complete Overall Analysis



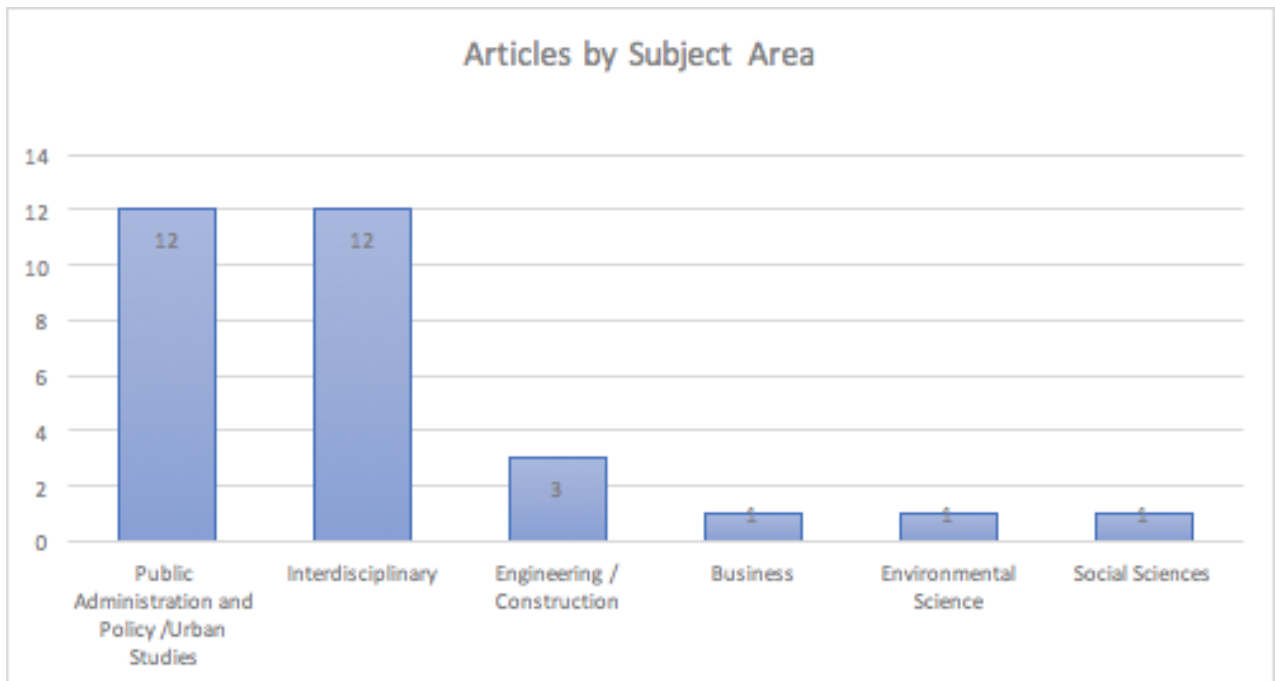
Graph 1. Articles by Year

Articles were charted according to their year of publication, as indicated in the Scopus database. The earliest article found was published in 1997; the most recent was published in 2019. Generally, over the twenty-two year period captured, the number of publications relating PPPs to climate action has increased, suggesting a growing interest in the links between PPPs and climate action. From 2009 onwards, publication of articles becomes both consistent and more frequent. The reduction in articles in 2019 is expected, as the scoping study was conducted in the summer of 2019, before the total number of publications could be captured.



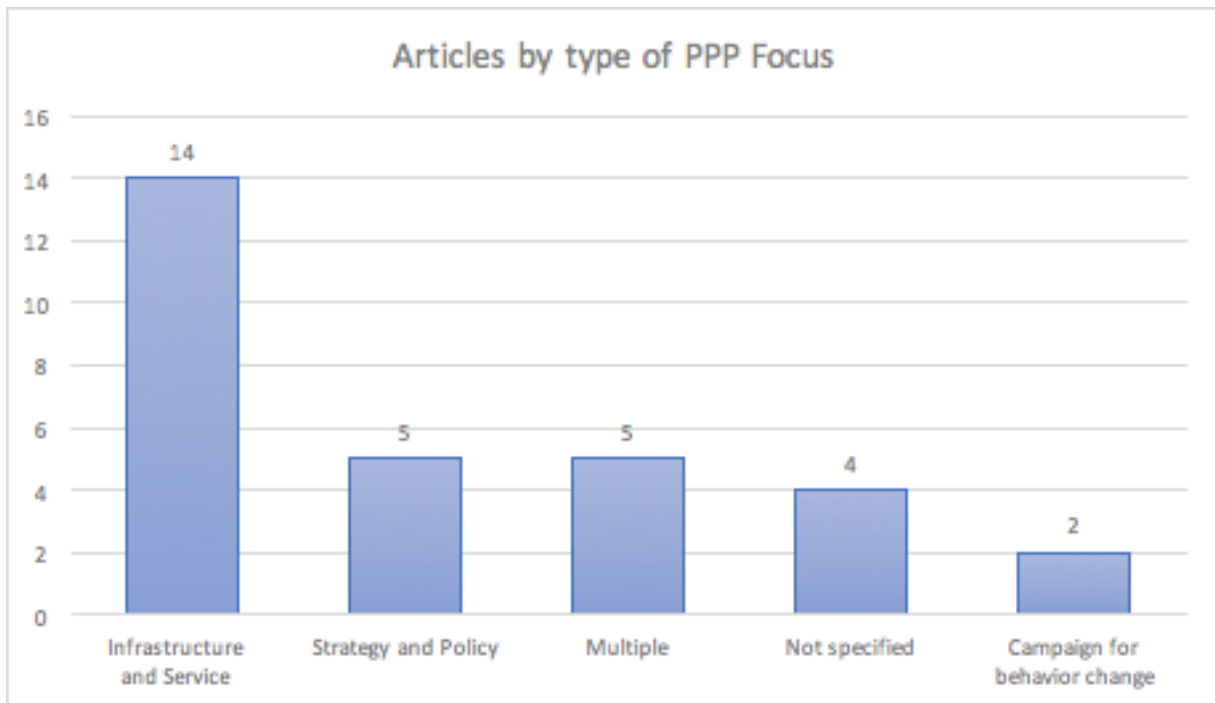
Graph 2. Articles by Publication Location

Regions of publication were identified through the location of the university affiliated with the lead author of each study. In those cases with two authors with different university affiliations, the lead author’s affiliation was chosen. Overall, a majority of articles were published from within Europe and North America. This is somewhat expected, as the project’s scoping study selection criteria favored articles with a city level perspective in Western countries, avoiding articles with an international sustainable development focus. The majority of articles came from the UK, the Netherlands, Canada, and Australia. Within Europe, the majority of publications came from the UK and the Netherlands. Within North America, Canada proved more prominent as a publishing location for articles than the US.



Graph 3. Articles by Subject Area

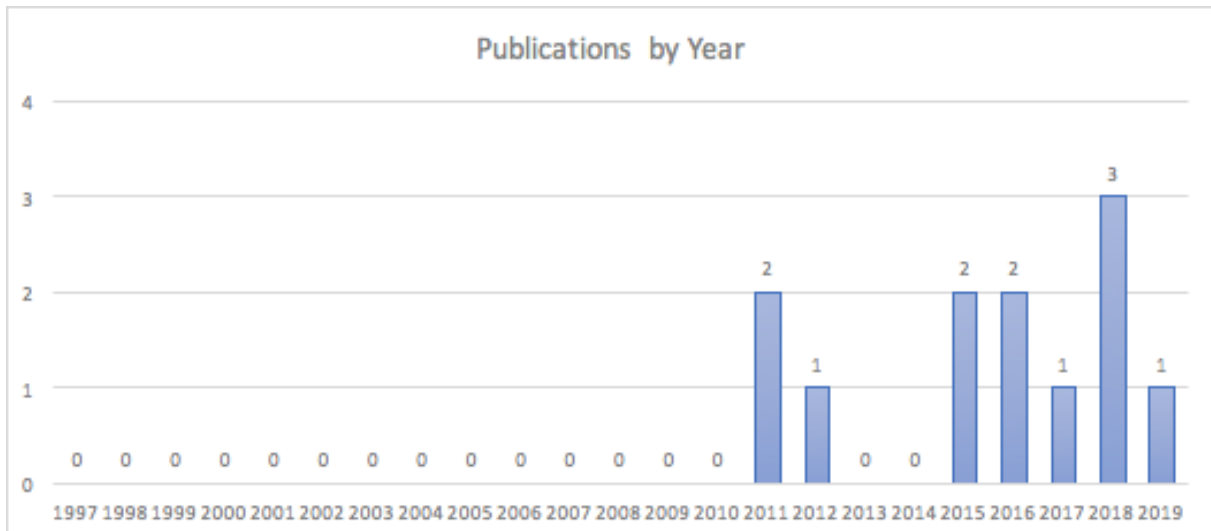
Articles were categorized based on their subject area, as indicated on Scopus and/or through analysis of the title and abstract. The six subject area categories reflect those used within Scopus. One article was excluded due to its status as a not yet published working paper. Public Administration and Policy was one of two key subject areas from which a majority of articles came. This is also a traditional subject area for more ‘classic’ or traditional PPP literature. The Interdisciplinary category, which includes Journal such as ‘Sustainability’ and ‘Wiley Interdisciplinary Reviews’ was also prominent subject area, reflecting how widely the concepts of PPPs and climate change span across disciplines. Engineering/Construction, another traditional subject area for more classic PPP literature, contributed far fewer articles, yet still more than the remaining subject areas of Business, Environmental Science, and Social Sciences.



Graph 4. Articles by type of PPP Focus

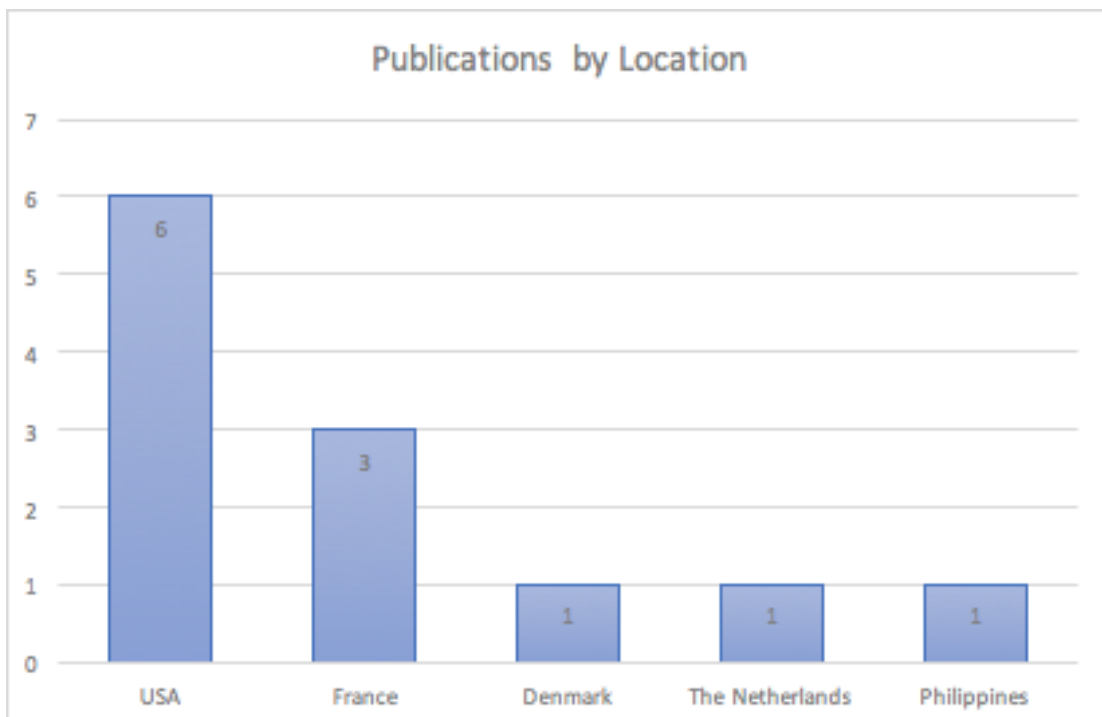
Finally, articles were classified according to the type of PPP focused on; this was determined after having fully analyzed each article. Much as in the more traditional PPP literature, infrastructure and service delivery clearly dominate as the kind of PPP most written about, even within this scoping study focusing on climate related PPPs. About a third as many articles focus on PPPs as a vehicle for climate strategy and policy. A similar number of articles recognize and elaborate upon two or more types of PPP. Only 2 articles focused on the use of PPPs to campaign and drive forward climate related behavioral change.

Grey Literature



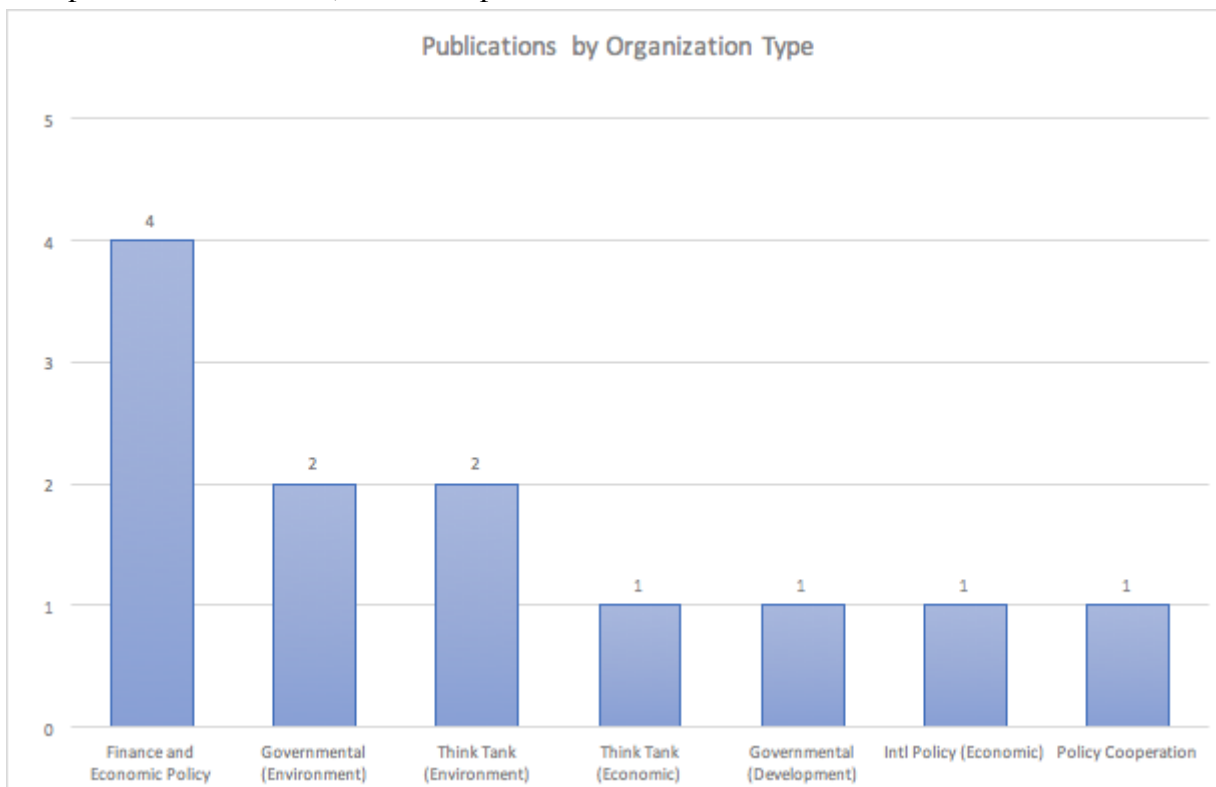
Graph 5, Publications by Year

The earliest publication found was published in 2011, significantly later than the 1997 article found in the academic literature. Meanwhile, the most recent was published this year, 2019. Generally, over the eight year period captured, the number of and consistency of publications relating PPPs to climate action within the grey literature seems to have increased, suggesting a growing interest in the links between PPPs and climate action and growing numbers of real world projects being written about. From 2015 onwards, publications seem to become more consistent and frequent (increasing each year). As the scoping study was conducted in summer of 2019, the total number of yearly publications was not yet captured.



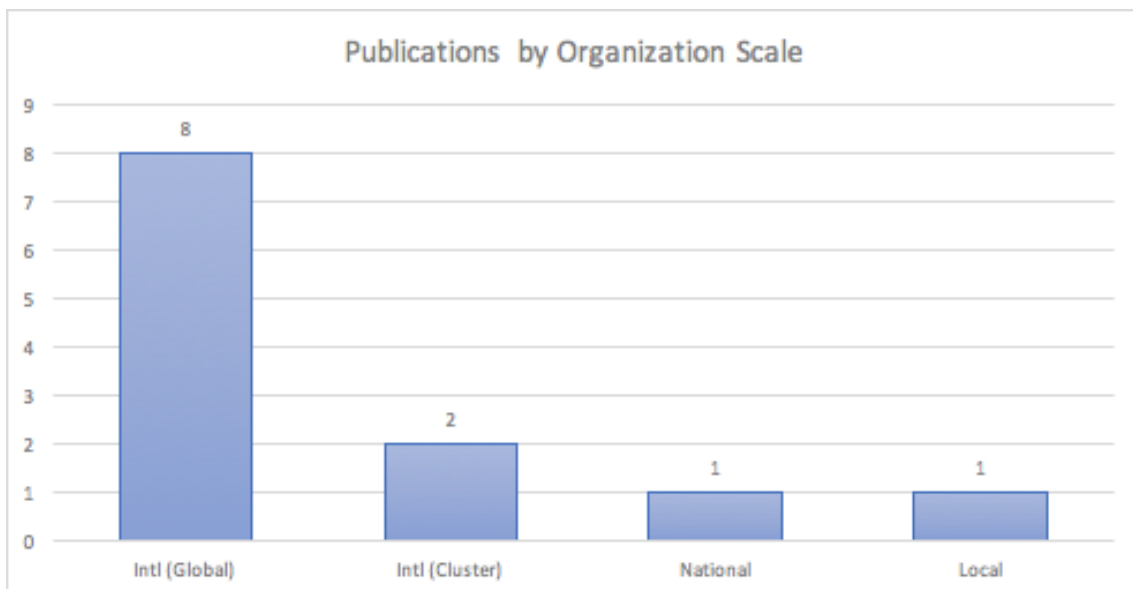
Graph 6. Publications by Location

Publications were charted according to the location of the authoring organization's headquarters. This does not necessarily reflect the location of the publication focus, but rather reflects where the organizations writing about PPPs in a climate context are situated. In contrast to the academic literature, a clear majority of the grey literature was published in the US, with half as many being published in France. The only three other represented countries are Denmark, the Netherlands, and the Philippines (notable as the only location outside Europe or North America), with one publication each.



Graph 7. Publication by Organization Type

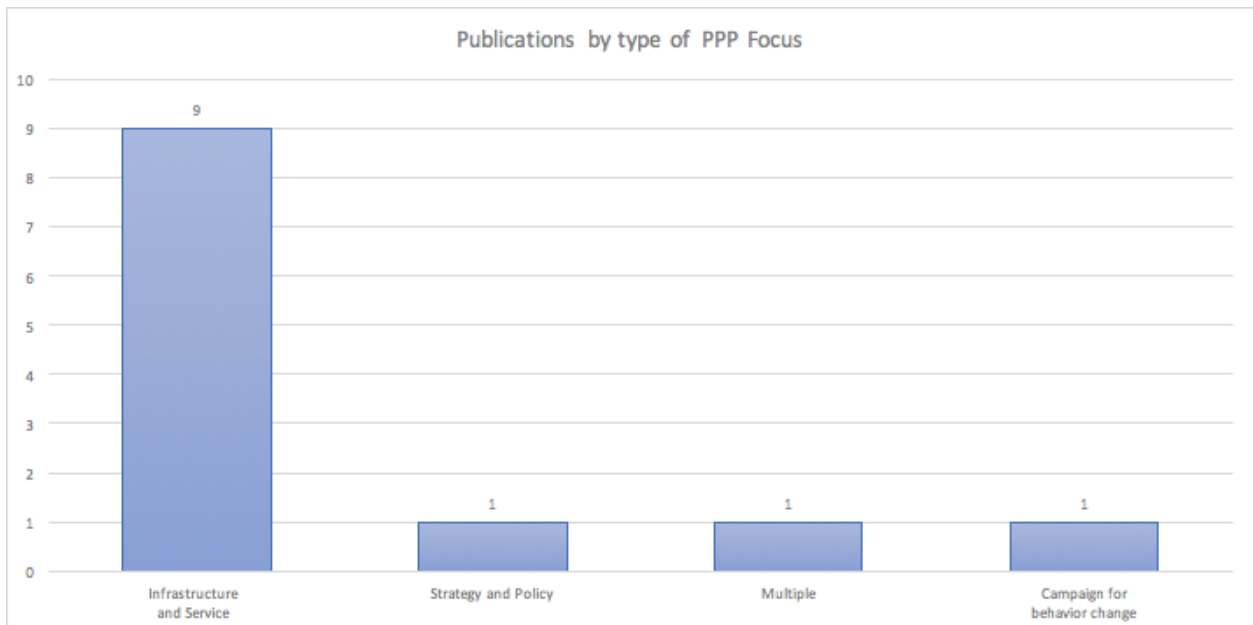
Publications were categorized by Organization Type, that is, the kind of work the publishing organization does. A majority of the publications (6) came from organizations involved in finance and economic policy. Publications from governmental environment organizations as well as environmental think tanks were represented to a lesser extent (2 publications each). Finally, one publication each from economic think tanks, governmental development agencies, economic international policy organizations, and organizations working on policy cooperation was identified, representing a rather broad variety of organizations.



Graph 8. Publications by Organization Scale

The scale and scope of each organization from which publications were found was charted. International organizations working at the global level were by far most represented, with eight out of twelve (66%) of scoping study publications. Two additional publications came from organizations working at a more regional or cluster-based international level. Ten out of twelve (83%) total scoping study publications thus come from organizations with an international scope.

This is somewhat in contrast to the intended focus at the local and regional level of the thesis project. At the same time, it may be reflective of the fact that PPPs with explicit climate goals, despite increasingly being called for in policy frameworks and international environmental and development agendas, have not yet gained prominence ‘on the ground’ at the local level.



Graph 9. Publications by type of PPP Focus

Finally, articles were classified according to the type of PPP focused on. Even more so than in the academic literature, infrastructure and service delivery clearly dominate within the identified grey literature as the most common type of climate written about. Only one grey literature publication each focused on PPPs for climate related strategy and policy, for campaigns for climate related behavior change, and on multiple PPP uses for climate action. While various types of climate focused PPPs and climate related uses for PPPs exist, it seems clear that the realm of infrastructure and service delivery is most commonly associated with the concept of PPP, even within a climate context.

Appendix 2: Additional PPP examples by type

1A: Building climate resilient physical infrastructure

Example: Malmö Stad and MKB renovate Augustenborg Eco-city

An additional example comes from a partnership between the City of Malmö and MKB, the city's publicly owned housing company. MKB, being publically owned, retains a public service component to its mission, somewhat blurring the line between public and private. Nevertheless, it functions as a commercially driven business. Through joint funding (in addition to some national and EU level funding) and a joint management contract, MKB and the city of Malmö worked together to renovate buildings within the Augustenborg neighborhood, at the same time performing energy efficiency and stormwater management upgrades (USAID, 2018). The results increased the housing area's rainwater capture capacity to 90% and significantly reduced the amount of runoff the housing area produces, in addition to reducing occupancy turnover and local unemployment rates, making the neighborhood an international eco-city model (USAID, 2018).

1B: Creating ‘urban laboratories’ and/or pilot projects with a climate theme

Example: Manchester's ‘Oxford Road Corridor’

The City of Manchester's ‘Oxford Road Corridor’ is one example of an urban laboratory site created collaboratively by private and public partners (including a cluster of Science Park companies and a local Hospital foundation), as well as local researchers, for a multi-pronged project to test innovative solutions to help the city reach its carbon emission reduction targets. Through joint financing and planning, environmental sensors were installed to monitor environmental variables before and after trees and green spaces were planted throughout the corridor, in order to measure their effects on preventing stormwater run-off, generating data which fed into subsequent policy for local climate adaptation strategies (Evans and Karvonen, 2013).

3: Climate Strategy and Policy Cooperation

Example: The Boston Green Ribbon Commission (GRC)

The GRC is another example of a PPP used for climate planning and strategy development. Comprised of city officials together with leaders across major business, health care, and education sectors, the Commission develops shared climate strategies — such as a recent

report outlining strategies across sectors to transition the city to carbon neutrality — that support the City’s overall Climate Action Plan and develop a stronger integrated regional vision for climate action (GRC, 2013; City of Boston, 2014).

4: Campaigns for Behavioral Change

Example: The NYC Water Challenge

As part of broader sustainability plans, including goals to reduce water consumption within the city by 5% by 2020, and recognizing that a substantial amount of water is consumed within non-residential buildings, the city developed a strategy to target and partner with private sector actors to promote more efficient water use and conservation. The New York City Water Challenge was established, seeking to raise awareness, support, and focus on partnering with a different private sector each year to reduce annual water consumption by 5%. Eleven hotels participated in the Challenge between 2013-2014, during which four hotels surpassed the goal and achieved 10% reductions in water use. The Challenge highlighted that through emphasizing long term cost savings and providing decision support to identify and promote recommended actions, business interest in conserving water and participating in such a sustainability campaign was high (Kenniff et al., 2016).

Appendix 3: Full classification of PPP definitions found

A slightly re-written version is provided below each original definition in order to emphasize three key components which differ between almost all definitions: 1) *Who is involved*, 2) *What do they do*, and 3) *For what purpose*.

Definitions focused on infrastructure and services outcomes

Kumaraswamy et al. (2015:119): “They...involve the private sector playing some roles traditionally played by governmental bodies in the provision of public infrastructure.”
Private sector plays some roles traditionally played by the government to provide public infrastructure.

Taylor and Harman (2015:927): “PPP’s are considered forms of organisational and financial cooperation between state and private actors involved in the joint production of the built environment that involves some sharing of risk between partners.”
State and private actors cooperate organizationally and financially as well as share risks to jointly produce the built environment.

Hueskes et al (2017:184): “Public–private partnerships (PPP’s) are long-term integrated contracts that are used for the provision of public infrastructure.”
Integrated contract to provide public infrastructure.

Patil and Laishram (2016:164): “PPP is a procurement approach where the public and private sector join forces to deliver a public service or facility.”
Public and private sectors join forces to deliver a public service or facility.

USAID (2018:29): “The PPP is a long-term contract made between a government and a private stakeholder wherein the private stakeholder provides infrastructure or other services traditionally delivered by the public sector.”
Private stakeholder, through a long term contract, provides infrastructure or other services traditionally delivered by the public sector.”

Asian Development Bank Institute (2019:2): “PPP’s aim to provide public infrastructure service delivery through a mutually beneficial partnership.”
Mutually beneficial partnerships that provide public infrastructure service delivery.

OECD (2018:30): “PPP’s are...long-term, fixed contracts and...a delivery route for infrastructure.”
Long term fixed contracts and a delivery route for infrastructure.

OECD (2012: 44): “PPP’s involve private sector participation in the development, financing, construction, operation, maintenance and transfer, deconstruction or re-designation of public infrastructure.”

Private sector participates in provision of public infrastructure.

Nordic Council of Ministers (2015:11): “PPPs...can be understood as interaction between public and private financial institutions for the delivery of climate finances. PPPs aim to provide public service delivery.”

PPPs aim to provide public service delivery

World Bank Group (2016:6): “PPPs’ are defined broadly in this report as investments with private sector involvement and equity (e.g. build-operate transfer) coupled with long-term government involvement. This excludes arrangements at the margins of the definition of PPPs, with privatization at one extreme and management contracts at the other.”

[Infrastructure] investments with private sector involvement and equity, coupled with long term-government involvement.

Definitions focused on policy as outcomes

Taylor and McAllister (2015:1) ”Cooperation amongst private, public and civil society actors in the design and implementation of policies or programs.”

Actors cooperate to design and implement policies and programs.

Forsyth (2010:683): “Collaboration between actors from different sectors of state, business, or society in order to achieve some aspect of public policy.”

Actors from different sectors collaborate to achieve some aspect of public policy

Definitions focused on broader needs as outcomes

Schroeder et al (2013: 761): “...Somewhat formalized, stable, and ongoing relationships among smaller and larger numbers of actors with the purpose of mobilizing resources (financial, technical, human, knowledge, etc) to achieve a collective goal—in this case urban climate change mitigation and adaptation.”

Smaller or larger number of actors maintain ongoing relationships and mobilize resources to achieve a collective goal.

Bauer and Steurer (2013:122): “...Self-organizing, non-hierarchical alliances in which actors from one or multiple levels of government, the business domain and/or civil society pursue common goals by sharing resources, skills and risks.”

Diverse actors share resources, skills, and risk to pursue common goals.

Kyvelou et al. (2011:98): “...Forms of cooperation between public authorities and the world of business in order to answer to public needs in the most effective possible way

Public authorities and businesses cooperate to answer to public needs in the most effective possible way.

Harman et al (2015:74) : “A coalition of interests from two or more spheres of society to resolve complex and often intractable problems which crosses traditional organisational boundaries and which present challenges agencies cannot tackle on their own.”

Different spheres of society form a coalition of interests to resolve complex and inter-organizational problems.

Broader definitions relating to a continuum

Perl and Newman (2014: 219): “Rather than assigning a label to a specific kind of public private partnership, it is more useful to conceptualize P3s as a spectrum of collaboration between the public and private sectors. Outside of this spectrum on one end would be found traditional public provision of goods and services; at the other end, there would be privatization.”

Public and private actors collaborate on a spectrum between traditional public provision and privatization.

McAllister and Taylor (2015:87): “... informal and formal interactions between stakeholders as they seek to not only share knowledge but also build trust that is required to ensure the interactions are effective. For all such partnerships, there is a continuum between coordination and collaboration”

Stakeholders engage through informal and formal interactions as they share knowledge and build trust to ensure effectiveness.

Here, coordination is defined as “interactions related to some formalised way of working” and involve the use of predetermined rules to facilitate decision making. This is more straightforward and can be sufficient for achieving limited objectives. Collaboration by contrast, is said to be a more involved process with greater transaction costs, but wherein objectives between stakeholders are harmonized and aligned (McAllister and Taylor, 2015: 87).

Though not providing a full standing definition, Taylor and McAllister (2015) suggest that PPP cooperation can also be conceptualized along a spectrum of formality, that is, from informal to formal relationships. Informal relationships may be voluntary, self-organizing, and more fluid (an occasional multi-sector working group to discuss policy, for example), while more formal relationships may be unwritten by legally binding contracts and numerous stipulations (within a large infrastructure project, for instance).

One additional definition was found without an identified outcome, and was not categorized:

C2ES (2017:14): “Public-private partnerships (PPPs) vary in form and typically involve a long-term arrangement formalized through a contract.”

Appendix 4: Interview list and script

Interviewee List

Interviewee 1: Henrik Toremark, Project manager at SWECO International (technical and architecture consultancy) with a focus on sustainable urban development. PPP experience: Sustainable development projects, often with a climate or sustainability theme. Different PPP types including infrastructure and service, pilot projects, and planning cooperations.

Interviewee 2: Henrik Lundblad, Business strategist, Skurups Kommun. PPP experience: infrastructure and service related PPPs within a municipal context, as well as joint planning PPPs.

Interviewee 3: Peter, Eyerman, Business manager and director of Smart Little Village (innovation and sustainable development program focused on small municipalities). PPP experience: Pilot projects, planning and strategy cooperation from a private sector perspective.

These two respondents were interviewed together.

Interviewee 4: Katarina Scott, Business and project manager at Future by Lund (urban innovation hub, with a focus on urban sustainability, part of Lunds Kommun). PPP experience: pilot projects and urban labs, with a sustainability and climate focus, from a municipal perspective.

Interviewee 5: Sylvia Olsson, Co-founder one of Nordic Urban Resilience Institute (NURI) / Resilient Regions Association (Facilitators of partnerships and cooperation projects related to urban resilience). PPP experience: planning and strategy cooperation as well as pilot projects, from a neutral, facilitation based perspective bringing together public and private actors

Interviewee 6: Magnus Qvant, Co-founder two of Nordic Urban Resilience Institute (NURI) / Resilient Regions Association. PPP experience: PPP experience: planning and strategy cooperation as well as pilot projects, from a neutral, facilitation based perspective bringing together public and private actors

These two respondents were interviewed together.

Interview Script

1) Defining PPPs: How would you define a PPP in a sentence or two? What kinds / types of PPPs have you worked with?

2) Why use PPPs: What is the most compelling reason/reasons from your perspective? Are there other meaningful benefits they bring?

2.1) Innovation as a theme within PPP arrangements

2.2) For policy cooperation cooperation focused PPPs: Where do policy innovations / resilience solutions happen? Through collaboration in projects? Through defusing knowledge to decision makers outside the partnership?

3) Negatives to engaging in PPPs: Are there reasons to avoid PPP arrangements from your perspective? What kinds of negative experiences or aspects have you encountered within PPP projects?

3.1) Navigating conflicts between public and private interests as a theme within PPP Arrangements

4) What would you say is or are the major factors for success within a PPP project?

4.1) Does trust play a role within PPP arrangements?

4.2) If so, how do build trust within PPP arrangements?

5) Deciding whether or not to enter into a PPP: What are the important criteria from your perspective? How do you decide if you should enter into partnership for a specific project and with a specific organisation/company/entity?

6) Have you be involved in PPP projects focused in some way on advancing sustainability/climate goals, if so which ones?

7) How do you measure success in your PPP projects?

7) A couple additional ethical considerations:

7.1) The involvement of private actors in the delivery of public goods; is that an ethical concern?

7.2) The involvement/engagement of the public and local community stakeholders within PPP projects; what's the role of this within projects?

Appendix 5: Scoping Study database management examples

Academic literature scoping study database management (Group 1)

20	Drive	Sustainable Development Goals." "https://www.mdpi.com/2071-1050/11/8/2339." © 2019 Mees, H. "Local governments in the driving seat? A comparative analysis of public and private responsibilities for adaptation to climate change in European and North-American cities." "https://www.tandfonline.com/doi/full/10.1080/1523908X.2016.1223540." © 2017	2019 Sustainability Journal of Environmental Policy and Planning	Spain		Infra and Service
21	Drive	Forsyth, T. "Panacea or paradox? Cross-sector partnerships, climate change, and development." "https://onlinelibrary.wiley.com/doi/full/10.1002/wcc.68." © 2010	2017 Policy and Planning Wiley Interdisciplinary Reviews: Climate Change	The Netherlands		Conceptual / Not specified
22	Drive	Toxopeus, H., Polzin, F., "Characterizing nature-based solutions from a business model and financing perspective." "https://naturation.eu/sites/default/files/news/files/naturation_characterizing_nature-based_solutions_from_a_business_model_and_financing_perspective.pdf." © 2017	2010 Change n/a, working paper from Naturation at	UK		Strategy and Policy
23	Drive	Mees, H., Driessen, P., Runhaar, H., "Exploring the Scope of Public and Private Responsibilities for Climate Adaptation." "https://www.tandfonline.com/doi/full/10.1080/1523908X.2012.707407." © 2012	2017 Utrecht University Journal of Environmental Policy and Planning	The Netherlands		Infra and Service
24	Drive	Bauer, A., Steurer, R., "Innovation in climate adaptation policy: are regional partnerships catalysts or talking shops?" "https://www.tandfonline.com/doi/full/10.1080/09644016.2014.924196." © 2014	2012 Environmental Politics	Austria		Conceptual / Not specified
25	Drive	Koopenjan, J., Enserink, B., "Public-Private Partnerships in Urban Infrastructures: Reconciling Private Sector Participation and Sustainability." "https://onlinelibrary.wiley.com/doi/full/10.1111/j.1540-6210.2008.01974.x" © 2009	2014 Environmental Politics	Austria		Strategy and Policy
26	Drive	Harman, B., Taylor, B., Lane, M., "Urban partnerships and climate adaptation: challenges and opportunities." "https://www.sciencedirect.com/science/article/pii/S1877343514001110." © 2015	2009 Review Current Opinion in Environmental Sustainability	The Netherlands		Infra and Service
27	Drive	Taylor, B., McAllister, R., "Editorial overview: Sustainability governance and transformation: Partnerships and sustainability governance: progress, prospects and pitfalls." "https://www.sciencedirect.com/science/article/pii/S1877343514001195." © 2015	2015 Sustainability Current Opinion in Environmental Sustainability	Australia		Infra and Service
28	Drive	McAllister, R., Taylor, B., "Partnerships for sustainability governance: a synthesis of key themes." "https://www.sciencedirect.com/science/article/pii/S1877343515000020." © 2015	2015 Sustainability Current Opinion in Environmental Sustainability	Australia		Strategy and Policy
29	Drive	Koopenjan, J., "Public-Private Partnerships for green infrastructures. Tensions and challenges." "https://www.sciencedirect.com/science/article/pii/S1877343514000530." © 2015	2015 Sustainability Current Opinion in Environmental Sustainability	Australia		Infra and Service
30	Drive	Klein, J., "Local authorities and the engagement of private actors in climate change adaptation." "https://journals.sagepub.com/doi/10.1177/0263774X16680819." © 2016	2015 Sustainability Environment and Planning	The Netherlands		Infra and Service
31	Drive		2016 Planning	Finland		Multiple

Academic literature scoping study database management (Group 2)

7		Marana P., Labaka L., Sarrigi J.M., "A framework for public-private-people partnerships in the city resilience-building process". "https://www.scopus.com/inward/record.uri?eid=2-s2.0-85038819206&doi=10.1016%2fj.ssci.2017.12.011&partnerID=40&md5=49ced6bd2db9daa7026c1c53d808c629", "Citizens living in cities where public entities are committed to the development of city resilience are increasingly aware that the entire responsibility for preventing, responding to and recovering from crises cannot fully fall on public entities and private companies. In fact, citizens are more and more required to prepare for, respond to and recover from crises. To that end, there is an emerging need to involve not only public entities and private companies but also citizens in the process of building a city's resilience in order to understand the different perspectives on the same reality. This research paper is based on a systematic literature review to develop a framework that defines and describes the successful characteristics of public-private-people partnerships (4Ps) in the city resilience-building process. The framework revolves around two criteria for classification: the dimension of the characteristics (stakeholder relationship, information flow and conflict resolution), and the attributes of the partnership. A preliminary list of relationships among the characteristics found in the literature is also presented. The aim throughout is to define which characteristics need to be developed in order to better ensure successful cooperation among the three main stakeholders: public entities, private companies and citizens. © 2017 The Authors"				Used (Scoping)
8		van den Hurk M., Hueskes M., Beyond the financial logic: Realizing valuable outcomes in public-private partnerships in Flanders and Ontario, https://journals.sagepub.com/doi/pdf/10.1177/0263774X16682237?casa_token=f7meklEbvaAAAAA:Sec0N135WYahXoE1sZSjV6K6RMfB5B-oMJaBopfxr0QkwB9iRiRrSRYsef2xYCSicN9cTv3YmB-SQ. © 2017				Used (Snowball)
9		McQuaid, R., Scherrer, W. "Changing reasons for public-private partnerships (PPPs)." "https://www.tandfonline.com/doi/full/10.1080/09540960903492331." © 2009				Used (Snowball)

Grey literature scoping study database management

	A	B	C	D	E	F
1		Publication Year	Publication Location	Type of Organization	Scale of Organization	PPP Focus Area
1	Private-sector partnerships and green investment banks can be used to effectively finance low-carbon infrastructure to fight climate change https://www.asiapathways-adbi.org/wp-content/uploads/2019/05/adbi-podcast-175-ppp-green-investment-finance-low-carbon-infrastructure-climate-change.pdf					Infrastructure and Service Delivery
2	The Netherlands Environmental Assessment Agency (PBL) (March 2015) Study on Public Private Partnerships for Contribution to Inclusive Green Growth http://www.aidenvironment.org/media/uploads/documents/Final_Report_PPPs_and_IGG_1.pdf	2019	Philippines	Think Tank (Economic)	International cluster	Infrastructure and Service Delivery
3	OECD, Private sector Engagement in Adaptation to Climate Change (2011) https://www.oecd-ilibrary.org/docserver/5kg221jkf1g7-en.pdf?expires=1566318989&id=id&accname=guest&checksum=6595F689B75E920A15DD2E67F41D2D38	2015	The Netherlands	Governmental (Environment)	National	Infrastructure and Service Delivery
4	USAID (2018) Engaging the Private Sector in Green Infrastructure Development and Financing: A Pathway Towards Building Urban Resilience https://www.climate-links.org/sites/default/files/asset/document/181107_Engaging%20the%20Private%20Sector%20in%20GI.PDF	2011	France	International Policy (Economic)	International global	Multiple
5	World Bank Group (2016) Engaging Private Sector in	2018	USA	Governmental (Development)	International global	Infrastructure and Service Delivery

Appendix 6: Interview responses to additional ethical considerations

Regarding the critical debate on private actors increasingly involved in public affairs

That public actors, often through PPP arrangements are increasingly involved in decision making and public affairs is identified within the literature as an area of concern, particularly as this relates to issues around transparency, accountability, and democracy. Interviewees that responded to the question were generally positive about private public partnerships, and the potential for the private sector to bring in added efficiency where possible and appropriate. As Interviewee 1 said:

”Public authorities are outsourcing certain services that they traditionally were doing themselves, because companies are making it more effective. I’m pretty sure that companies are better placed to carry out at least certain services for public authorities. Cities and the public sector can’t possibly have every expertise in the world, so as long as they maintain the responsibility and the capacity to procure in a good and sustainable way...I don’t see the public services provided by private organisations are necessarily worse than when the public sector is doing it.”

Interviewee 2, from the public sector, agreed, referring back to the efficiency benefits PPP structures provide, while also pointing out that these projects should to occur within a framework of appropriate public oversight, regulation, and transparency, citing recent changes in whistleblower laws as an example:

“Previously we had a whistleblowing and reporting law that was applicable to the public sector, but not the private sector...so it was difficult, because the private operators, if they were operating a public service, didn’t want to tell anyone about the problems they had...now that law has been partly changed...but the whistleblower aspect for example, is important in society and for transparency.”

Regarding public and community participation

Not much discussion was captured regarding the involvement of local and community stakeholders within the PPP projects interviews had worked with. Only Interviewee 4 explicitly responded to the issue, recognizing the importance of community involvement but highlighting the practical difficulties involved:

”That is important...the local community has credibility, and they can stay within the project when we have to go. But it’s hard, because we are so few. We are looking into it but it’s a resource issue. What we are trying is to work through other organisations who are already within the community, one level up so to say.”