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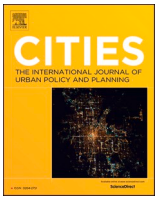

Private funding contributions for public infrastructure: Explaining implementation efforts in Brainport Eindhoven

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ABSTRACT

Public infrastructure development often benefits private actors in existing urban areas, yet capturing this value for funding purposes remains uncommon. It is therefore relevant to investigate how private sector funding contributions can be implemented. This article presents the results of a qualitative case study in the Brainport region, where two recent infrastructure funding agreements include significant contributions from the regional business community. Combining concepts from game theory and institutionalism, this article examines how the path-dependent practice of public funding discourages private beneficiaries from contributing collectively, while the free-rider problem discourages them individually. We apply process tracing to unravel the mechanisms by which these barriers were overcome. The case suggests that beneficiaries can rationally decide to contribute collectively, but only if this decision contributes to a goal that is highly desirable and urgent to them, and no more beneficial options are available. While the case also indicates that the free-rider problem can be overcome through normative pressure, the evidence suggests that this requires the existence of a homogeneous, tight-knit group of beneficiaries in which private funding contributions match pre-existing norms. These results help explain why few governments succeed in implementing private sector funding contributions, and provide starting points for changing this.

1. Introduction

The interest in value capture (VC) in urban policy, planning and development has increased rapidly worldwide, in response to a growing demand for urban infrastructure in combination with insufficient financial resources for public funding (Sorensen, 2023; Wolf-Powers, 2023). The basic idea behind VC is that new public infrastructure projects create value in their surroundings, which can be captured to fund these projects. As such, VC represents a promising strategy to continue funding urban infrastructure in the face of budgetary constraints (Mouton et al., 2023).

Although the concept has been around for a long time, the scholarly focus on VC has increased significantly recently. Many studies have demonstrated its potential by investigating the financial value created by public infrastructure (see for recent examples, He et al., 2023; Peng & Knaap, 2023). Other studies examined, among others, the way VC is currently being applied globally (Halleux et al., 2023; OECD, 2022). These studies show that capturing value arising from the development of new real estate is common, for example through developer contributions or strategic land management.

Less common are contributions from private beneficiaries. By private beneficiaries, we mean owners or users of real estate – often private actors - who are already located in an area and benefit from the development of new infrastructure. Unlike developers, these beneficiaries contribute far less frequently to specific infrastructure projects (OECD, 2022). At the same time, the revenue potential of this form of value capture is high. Urban development is increasingly taking place in existing urban areas (Broitman & Koomen, 2015). This means that the benefits of new infrastructure increasingly accrue to beneficiaries who are only contributing to a limited extent. Therefore, increasing the contributions of private beneficiaries can go a long way towards addressing the problems associated with infrastructure funding.

An important motive to investigate value capture instruments worldwide is the intention of authorities to implement them in other countries (Alterman, 2023). Hence, a growing body of research investigates the implementation of value capture (see Halleux et al., 2022 for a broad overview). Studies for example focus on the fact that a value capture strategy cannot simply be copied from one country to another,

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but has to be adjusted to the local conditions (Dye & England, 2010; Medda, 2012; Muñoz Gielen et al., 2017). Others focus on implementation obstacles, from which resistance from actors adversely affected by the VC implementation – above all the beneficiary – emerged as one of the biggest (Halleux et al., 2022; Van Zoest & Daamen, 2024). Unfortunately, however, few studies have thoroughly addressed the practical ways to overcome such obstacles, or identified ways to address problems in the implementation process of value capture more broadly (Aveline-Dubach & Blandeau, 2019; Fischer, 2019; Nascimento Neto et al., 2024).

Resistance against a new VC instrument is likely to be particularly strong when it involves a novel contribution from private beneficiaries. Contributing negatively affects them financially, and because they are already present in an area, it is harder for them to adjust their behaviour accordingly, as a developer can do by changing its plan or by developing elsewhere. In addition, property rights are strongly protected in many countries. This gives beneficiaries the ability to legally challenge a compulsory contribution. So far, however, little attention has been paid in the literature to the behaviour of the beneficiary in the VC implementation process. More insight is needed into the motivations of private beneficiaries to either resist or support the implementation of new funding contributions.

This article aims to provide insight into how funding contributions from private beneficiaries can be implemented in urban practice and what conditions need to be in place for this to happen. For our empirical study, we took a deep dive into the case of Brainport Eindhoven in the Netherlands. We selected this case because it is one of the few recent examples of private contributions being implemented. Formerly an industrial village, the Brainport region is now one of the most important technology nodes in Europe and is currently attracting global interest due to the growth of ASML, the world leader in semiconductor equipment. In this region, two infrastructure packages have recently been funded with significant voluntary contributions from the regional business community, even though infrastructure funding in the Netherlands is usually provided solely by the government and developers. We applied process tracing including extensive participant observation to uncover the causal mechanisms that made this deviant practice possible, and to identify the conditions that proved crucial for these mechanisms to work.

In the next section, we will first elaborate on the barriers to implement contributions from private beneficiaries by using concepts from game theory and institutional theory. Section 3 introduces the Brainport Eindhoven case. We then set forth the process tracing methodology and apply it to explain how the two funding agreements in this case came about. To conclude, we discuss the implications for a wider application of value capture innovations.

2. Barriers to implementing private funding contributions

In countries where it is uncommon for private beneficiaries to contribute directly to infrastructure projects, both informal and formal institutions are reinforcing this status quo. The introduction of obligatory contributions may conflict with norms that dismiss any obligation to do so. In addition, the right to keep increases in the value of one's property is legally protected in many countries (Alterman, 2010). This provides strong opportunities for private beneficiaries to formally challenge a compulsory contribution. Due to the legal and social nature of such barriers, making private sector contributions (more) commonplace thus requires a form of institutional change (Van Zoest & Daamen, 2024).

To understand how private funding contributions can be implemented, we need a more thorough understanding of the barriers that prevent beneficiaries from contributing and the processes through which these barriers can be overcome. This calls for a dual focus, linking macro-level institutional structures with micro-level individual choices. To this end, we combine insights from the three main strands of new institutionalism (NI).

Our point of departure is rational choice institutionalism (RCI), with its emphasis on strategic interactions between rational utility maximisers. Similar to scholars such as Ostrom, 2005, 2007b and Scharpf (2018), we use game theory to explain specific actions of individuals and groups and the factors driving them. Following Ostrom, we assume actors to be boundedly rational, fallible but adaptive individuals, which we consider most fitting for the type of uncertain and complex decision-making processes we are trying to explain.

To capture the full complexity, we combine this rational choice perspective with insights from the two other main strands of new institutionalism: historical institutionalism (HI) and sociological institutionalism (SI). In line with the former, we take into account that actors' preferences and strategies are often shaped by historical legacies, which can lead to path dependent practices, while the latter highlights the role of culture and norms in shaping institutions and actors' behaviour.

A growing number of scholars advocate bridging the different strands of NI (Hall, 2010; Katznelson & Weingast, 2005; Lowndes, 1996; Schmidt, 2020). Integrative frameworks are increasingly used to explain complex institutional dynamics - such as incremental policy shifts or urban institutional evolution – that are difficult to capture through a single paradigm alone (Koning, 2016; Lowndes & Roberts, 2013; Mahoney & Thelen, 2010; Peters, 2019).

This eclectic approach also meets with criticism, in part because the strands rest on different ontological and epistemological premises. For instance, formal models based on RCI typically assume a homogenous logic of strategic action and exogenously given preferences and identities, which can be difficult to reconcile with SI's emphasis on culturally specific norms and socially constructed rationality (Hall & Taylor, 1996).

To avoid such incompatibilities, we adopt an exploratory, pattern-focused use of game theory, rather than employing it to mathematically model and predict exact behaviour. In doing so, we avoid rigid assumptions - such as perfectly rational or history-ignoring actors – and instead treat game models as analytical lenses that illuminate one facet of a complex reality, to be supplemented by context-specific and historically informed analysis (see also Lara, 2015; Scharpf, 2000).

Based on game theory, we identified two key barriers that keep private beneficiaries from contributing to urban infrastructure, embodied in a game of chicken and the free-rider problem.

2.1. A game of chicken between the public and the private sector

Although most of the literature on collective action problems focuses primarily on the prisoner's dilemma, we must first turn our attention to a barrier that must be overcome beforehand, embodied by a game of chicken. The beneficiaries of an infrastructure project must be collectively inclined to contribute, whether they are one beneficiary, a few, or a large group. This can be difficult in a context where private beneficiaries have reason to expect others – primarily the government – to pay instead.

In game-theoretical terms this barrier can be characterised as a game of chicken, also known as hawk-dove. This is a non-cooperative game in which two players want to avoid the worst possible outcome in which neither player yields, but both prefer the other to cave in (Scharpf, 2018). Translated to infrastructure funding, both the government and the beneficiaries prefer the other to pay. Game theory postulates that in such a game it is not at all obvious what the outcome will be (Taylor, 1987, p. 36).

However, this uncertainty regarding the outcome changes when we consider the institutional environment of the actors involved. In most countries, infrastructure funding is primarily the responsibility of the government. This is often supplemented by contributions from beneficiaries such as developers and users of public transport (Zhao & Levinson, 2012). Private beneficiaries contribute far less frequently (OECD,

2022).

In countries where there is a custom that private beneficiaries do not have to contribute, it is to be expected that they will be reluctant to change that. Simply put: why pay if you can expect others to do so? Such a custom thus creates a path-dependency (Pierson, 2000) that can be difficult to breach.

The incentive to contribute changes when the optimal outcome can only be achieved if both parties cooperate, which is embodied in the assurance game (Taylor, 1987). In theory, a government can achieve this by declaring that it will not pay for a particular infrastructure project, or will only pay part of it, thereby necessitating a contribution from its beneficiaries. If the benefits of the infrastructure project are large enough, such a strategy makes it economically rational for the beneficiaries to contribute collectively.

However, studies show that people consider not only the material payoff in their decisions, but also social factors such as the perception of fairness of a given option (Fehr & Schmidt, 1999; Loewenstein et al., 1989; Rabin, 1993). It is therefore relevant to examine both the material and the normative motivations of private beneficiaries when faced with the choice of contributing to public infrastructure.

2.2. A free-rider problem among private beneficiaries

Once the beneficiaries are collectively inclined to contribute, the next barrier looms, this time among the beneficiaries individually: the free-rider problem. Investments in urban infrastructure often have not one but many beneficiaries. For example, all real property owners along a newly built railway line. This creates a collective action problem embodied in game theory by the prisoner's dilemma.

A group of actors can become 'privileged', meaning that at least one of its members is willing to bear the full costs on its own (Olson, 1965). However, this will only be the case if the benefits for this individual or coalition exceed the associated costs, even if the costs are solely borne by the individual or coalition (Cornes & Sandler, 1996, p. 325). Moreover, this individual or coalition must not deem it too unfair that other beneficiaries do not contribute.

Because of these barriers, it has long been argued that collective action problems beyond small groups cannot be solved voluntarily, but require formal rules (e.g., Hardin, 1968; Olson, 1965). However, the work of Elinor Ostrom and others (e.g., Ostrom, 1990, 2005) demonstrates that collective action problems can also be solved through informal enforcement mechanisms. In groups, norms can emerge that make it rational for individuals to cooperate even when there is an economic incentive to freeride. Yet, studies show that the emergence of such norms may require the presence of various conditions, such as a stable and homogeneous group of actors with many repeated interactions, as well as a strong collective will to solve the problem at hand (Foster, 2011; Ostrom, 2007a; Sampson, 2004). It is therefore important to also consider the influence of informal institutions and the conditions under which they emerge.

3. Research design and methods

To explain how the two funding agreements with the private sector contributions in the Brainport region came about, we applied a theory-building type of process tracing. Process tracing (PT) involves analysing a case backwards through time, from the outcome of interest to possible antecedent causes (Bennett & George, 1997, p. 17). It is generally used to uncover middle-range theories formulated as causal mechanisms that work within a bounded context (Beach & Pedersen, 2013). PT is well suited to study institutional change and public policy (Skarbek, 2020). It is often used to identify and understand the emergence of specific policy pathways (Collier, 2011; Hall, 2006), and is particularly useful for explaining processes that are path-dependent or rooted in strategic interactions (Kay & Baker, 2015).

The theory-building type of PT aims to identify causal mechanisms inductively and construct new theory by observing a specific case (Beach & Pedersen, 2013; George & Bennett, 2005). It is mainly utilised when we know that a correlation exists between X and Y, but we are in the dark regarding the potential mechanisms linking the two (Beach & Pedersen, 2013).

Causal mechanisms are often conceptualised as links between inputs and outcomes (Falleti & Lynch, 2009, p. 1146). As there is little consensus in the literature on what exactly causal mechanisms are, many different definitions are being used (see Mahoney, 2001). In this paper, we follow Falleti and Lynch's (2009) definition: "portable concepts that explain how and why a hypothesized cause, in a given context, contributes to a particular outcome" (p. 1143).

We adopt a probabilistic understanding of causality, recognising that social phenomena emerge from complex interactions between many factors rather than strict determinism. Although we are interested in mechanisms as concepts that are portable between cases, we presume that the outcomes of processes cannot be determined a priori by knowing the type of mechanism. Rather, we expect that the outcomes within each case are largely shaped by the (social) context in which they occur (Cecchini et al., 2020; Falleti & Lynch, 2009; Trampusch & Palier, 2016).

We consider the contextual sensitivity of mechanisms in two ways. First, with our probabilistic, theory-building type of PT, we aim to contribute to the construction of middle-range theories that are bound within specific contexts, rather than finding law-like generalisations (Beach & Pedersen, 2013). Second, we identify causal conditions, which are explanatory factors that must be present for a given mechanism to operate. For example, a causal condition can be an event or development, or an attribute of a group of actors (Mahoney, 2012).

The data collection consisted of a triangulation of participant observation, semi-structured interviews, and document analysis. Participant observation is often used when tracing social processes, to fully understand the social dimension of action (Cecchini et al., 2020). In this research, it provided insight into the social context in which activities occur, including the norms within a community, the relationships between actors and the influence of specific individuals.

The observation consisted of three parts. First, from November 2021 till June 2024, one of the researchers was embedded within all relevant meetings of a program management team from the Municipality of Eindhoven. Eindhoven has a leading role when it comes to infrastructure projects in the Brainport region. The municipal team is responsible, among other things, for establishing the business case of large-scale infrastructure projects and lobbying the national government. Secondly, from January till May 2023, the researcher observed a series of meetings of a team of government actors responsible, among others, for working out the private funding part of the Brainport Deal. Finally, in the same period, the researcher observed a series of workshops that were organised with delegates of companies and semi-public organisations to brainstorm potential ways to collect the private funding contributions of the Brainport Deal.

Additional data was collected through 18 semi-structured interviews with government officials from the municipality of Eindhoven and the province of Noord-Brabant, representatives of companies that may potentially contribute, and consultants. A first round of interviews was conducted between October and November 2022, with the aim of tracing the process up to that point and understanding the motivations and goals of the actors involved. A second round of interviews was executed with company representatives in March 2024. This round was used to triangulate the findings of the participatory observation and to deepen the understanding of the companies' motivations. A final interview was conducted in January 2025, shortly after the first companies had formally agreed to contribute, with a consultant who had played a key role in the process that led to this breakthrough. The data was complemented by a document analysis.

4. The case of Brainport Eindhoven

4.1. The Brainport region

The Brainport region comprises approximately 785 thousand inhabitants living in 21 municipalities, of which Eindhoven is the largest. Cooperation between these 21 municipalities is coordinated by the *Metropoolregio Eindhoven (MRE),* a regional governmental agency with primarily informal powers. The region is widely characterised in the literature as having a cooperative culture, provided with a climate of trust, reciprocity and solidarity between the public and private sectors, strong organisational capacity with many informal networks, and a strong shared narrative and long-term agenda (Fernandez Maldonado & Romein, 2010; Horlings, 2014; Horsten, 2016; Schaap & van Ostaaijen, 2015).

According to most scholars, this cooperative culture is the result of the region's history. In the twentieth century, it experienced explosive industrial growth around the development of the large Dutch multinational Philips, which invested heavily in urban amenities such as housing, and the growth of the DAF truck factory (Horlings, 2010). In the early 1990s, the bankruptcy of DAF and a large restructuring of Philips hit the regional economy hard. Under the motto 'never again!', the municipality of Eindhoven and its business community started to cooperate strongly (Horlings & Beckers, 2009). This response gave rise to a strong triple helix alliance between companies, government and knowledge institutions, aimed at "transforming a traditional industrial region into a top-technology and design region" (Fernandez Maldonado & Romein, 2010, p. 91).

This regional triple helix was further institutionalised with the establishment of the Brainport Foundation, which sets long-term strategies and policies for the region. This foundation is governed by equal representation from all three groups of actors and is linked to an executive body called Brainport Development (Romme, 2022).

Currently, the company ASML and its supply line have a major impact on the region. As a result of its global dominance in the semiconductor industry, ASML is growing at an extraordinary rate. Although highly appreciated from an economic perspective - ASML was recently described by the BBC as "Europe's most valuable tech firm" (O'Grady & Kenyon, 2023) – ASML clearly leaves its mark on the living environment, notably infrastructure and the housing market (Romme, 2022).

4.2. Infrastructure funding in the Netherlands

Most funding for large infrastructure projects in the Netherlands comes from the national government. To allocate funds, the national government has a detailed policy procedure called MIRT. In this procedure, the authorities involved work towards an annual point in time when all available national funds are allocated across the country. Over the past 10 years, the national government has released far less funding than in the previous decades (Heurkens et al., 2020). This has been changing again since 2020, in response to growing problems in the housing market.

Regions have to go through a number of steps to qualify for national funding, from a broad study to specific investment plans (Ministry of Infrastructure and Water Management, 2018). Commonly, this process involves arranging for co-funding to be provided in the region. This co-funding usually comes from local authorities, possibly supplemented by funds derived from real estate development. Private beneficiaries do not normally contribute. Moreover, authorities lack formal regulations to enforce such contributions.[1]

[1] Formally, Dutch law contains an instrument to tax infrastructure beneficiaries called the *Baatbelasting* (beneficiary tax), but due to legal disputes the instrument is rarely used (OECD, 2022) and has not been considered by actors involved for usage in the Brainport Deal.

4.3. Two funding agreements in the Brainport region

This paper aims to explain the processes that led to two funding agreements, the characteristics of which are shown in Table 1. Both funding agreements involve private sector contributions to transport infrastructure on a scale that is unique both in the Brainport region and in the Netherlands as a whole.

The 'Run Package' (*Maatregelenpakket De Run*) consists of several projects amounting to 50 million euros, aimed at improving the accessibility of *De Run*, one of the larger business parks in the region. This business park is home to ASML's headquarters as well as many other companies. The funding package involves physical infrastructure, such as a bicycle lane, as well as digital and social measures, such as a Mobility-as-a-Service app and an agreement with several employers to promote sustainable modes of transport. ASML paid 12.5 million euros of the total investment sum. While companies have contributed to other public facilities in the Brainport region before, this was the first time a company has contributed such amounts to a specific funding package of urban infrastructure that is not required for a specific urban area development.

The 'Brainport Deal' comprises five large projects and two additional projects worth a total investment sum of approximately 1.6 billion euros, elaborated in Table 2. Together, they are aimed to facilitate the development of 62,000 homes and 72,000 jobs in the Brainport region. The projects have diverse characteristics and beneficiaries. Project A for example involves the construction of housing in the city centre of Eindhoven, while project D improves the accessibility of the De Run business park in the municipality of Veldhoven, and project E is considered important for the national infrastructure network. The exact benefits of the individual projects are difficult to determine and are the subject of debate.

The various governments involved agreed in November 2022 that of the total of 1.6 billion euros, two-thirds will be paid by the national government and one-third regionally. This distribution is further specified by project, as shown in Table 2. Importantly, it was agreed that one-third of the regional share will be paid by the province Noord-Brabant (NB), one-third by the 21 regional municipalities and one-third by the business community. This sets the private sector funding contribution to public infrastructure in the Brainport Deal at €188.9 million.

5. Process tracing the implementation of private funding contributions

5.1. The run package

The process leading to the first funding agreement was set in motion with a 'cry for help' of ASML to various levels of government, as two stakeholders explained in interviews. ASML's extraordinary growth was putting severe pressure on the accessibility of the business park *De Run* in the municipality of Veldhoven, where the company's headquarters are located. An improvement in the local infrastructure was needed, and ASML was fed up with the limited progress to date. For them, this concerned more than just an infrastructure project; they made it clear

Table 1
Characteristics of the Run Package and the Brainport Deal.

Funding agreement	Investment	Division of costs
Run Package	€50 million	- 25 % National government - 25 % Province of NB - 25 % ASML - 12,5 % Municipality of Eindhoven - 12,5 % Municipality of Veldhoven
Brainport Deal	€1.6 billion	- 64 % National government - 12 % Province of NB - 12 % Municipalities of MRE - 12 % Private sector

Table 2
Detailed characteristics of the Brainport Deal, all costs in million euros (Ministerie van IenW, 2022; MRE, 2024).

Project		Costs	Share of nat. gov.	Share of region	Share of private sector
A	Acceleration housing development Internationale Knoop XL Eindhoven	137	98	39	0
B	Short term measurements package mobility transition	185	46,25	138,75	43,1
C	Multi-modal public transport node Eindhoven	727	469	258	96,8
D	High quality public transport line HOV4	270	132	138	49
E	Road network	TBD	TBD	TBD	0
	Rail step 1	125	125	0	0
	A58 road improvement	126	126	0	0
	Total funding	1.570	996,25	573,75	188,9

that if their growth could not be facilitated, they might have to move elsewhere.

The mayor of Veldhoven reacted promptly by arranging a meeting with what we call the 'Run Coalition', consisting of delegates from the national government, the province of North Brabant, the municipalities of Veldhoven and Eindhoven, and ASML. Multiple interviewees indicated that ASML's pressure on the authorities, combined with their economic importance to the region and the country, created movement among those involved.

Together, the organisations involved in the Run coalition have put together a package of infrastructural measures to improve the accessibility of De Run. Many of the measures were already part of long-term plans in a wider infrastructure program for the region but were brought forward and combined into an integrated package. A conscious decision was made not to make the package too large in order to make this new way of working with more private sector involvement manageable, a policy advisor explained in an interview.

Next, the Run Coalition agreed on a funding strategy in which the costs were split into four equal parts, with the two municipalities sharing one part. In the decision to use this rather pragmatic cost distribution, two conditions were decisive: time pressure and the distribution of the infrastructure's benefits. The time pressure came not only from the urgency of ASML but also from the desire to apply for national government funding, which is only being allocated once a year.

Although the proposed infrastructure measures would also benefit other companies, they would benefit ASML the most. Moreover, these benefits were more important to ASML than to other companies, as ASML's growth depended on them. Their head of real estate explained in an interview that, for this reason, contributing to the Run Package became a rational business decision for them:

> We have no problem with contributing. Our expectation is that because we contribute, it [the infrastructure projects] can be developed faster. If that effect is there, then it is actually a positive business case for us as well.

This willingness to contribute, together with the time pressure and the fact that ASML had sufficient financial resources and was comfortable being the only private sector contributor, meant that no other companies were considered.

5.2. The Brainport Deal

The process leading to the Brainport Deal began when the public authorities completed a major infrastructure study for the region in 2020, which resulted in a consensus on the infrastructure required up to 2040. Although little time was spent on the financial aspects, it was recognised that the availability of public funding was limited. Consequently, the final report of the study briefly mentioned the possibility of co-funding by beneficiaries, which had recently been the subject of a national study (BMC, 2020, p. 21). At that time, however, there were no suitable instruments for collecting contributions from private beneficiaries.

The next step for the authorities was to secure funding. This coincided with the national elections, which took place in early 2021. Historically, the formation of a new government is the most likely time for large amounts of public funding to be released at the national level. The stalled housing market was one of the main election issues at the time, further increasing the prospect of more public funding.

The municipality of Eindhoven, which together with the province played a leading role in securing the funding, clearly anticipated this one-off opportunity for significant national funding, as the participant observation within the municipality showed. However, they did not want to wait for the new government to announce its plans, which would have meant competing with all the other regions for the available money. Instead, they proactively began to work on a distinctive bid.

Central to this proposition was the figure of 1.3 billion euros, which was the estimated cost of the projects of the national government's procedural infrastructure (MIRT) study. The regional authorities first agreed among themselves on a cost-sharing principle of 2/3rd national government and 1/3rd regional actors, resulting in a request of €1 billion to the national government. Such ratios vary from project to project, but multiple interviewees explained that they considered this ratio to be conventional.

This request for €1 billion became a key part of a larger *Brainport Proposition,* through which the region lobbied the national government to continue to invest in innovation, talent, and the living environment in their region. The proposition was sent on behalf of the triple helix organisation Foundation Brainport *(Stichting Brainport*) to, among others, the person in charge of exploring options for the formation of the new government (Jorritsma, 2021). It included written support from the provincial delegates as well as the CEOs of the largest companies and the local employers' association.

Next, the regional actors had to agree on how to share the costs of their 1/3rd share. The idea of making companies pay for part of this share slowly but surely emerged for a number of reasons. There was a growing sentiment among regional politicians that companies should contribute to the amenities from which they also benefit (see, for example, Wijdeven, 2022). Moreover, several interviewees pointed out that this idea was in line with the history of public-private cooperation in the region, as well as the more recent precedent of the Run Package. Finally, as one of the officials interviewed explained, the inclusion of private sector contributions also served the strategic objective of differentiating from other regions in the competition for national funding.

At the same time, there also appeared to be a willingness among a number of companies to contribute. For ASML, it was soon quite conceivable that they would contribute again. Their growth accelerated even more after the Run Package was agreed, adding to their accessibility problems. The HOV4 public transport line, part of the Brainport Deal, would significantly alleviate these problems. It would also help them to become less car-dependent and allow them to use land currently earmarked for car parking to expand their business. For them, therefore, paying a contribution that could accelerate this specific infrastructure development could again be seen as a rational business decision.

When consulted, more companies revealed willingness to make a (limited) contribution. Our interviews revealed that the collaborative norms, that had historically grown in the region, contributed significantly to this. When asked about the motivations of companies, many interviewees spoke about the collaborative nature in the Brainport region. In an interview in 2022 for example, an advisor of the regional employers' association stated the following:

> It matters what the amount is, but there is a feeling that Brainport is a concept that gives momentum and strength to the whole region. And that means that extra steps must be taken, to strengthen Brainport. We want to contribute to that. That is the signal I picked up.

By the time the new national government released the anticipated infrastructure funding at the end of 2021, the Brainport region had already finalised its strategy to get its share. In the first round of negotiations, it formalised a €1.6 billion funding agreement that included 1/9th in contributions from the private sector (Ministerie van IenW, 2022). At the time of signing this agreement, the authorities did not yet have formal commitments from individual companies to contribute.

The triple-helix organisation Brainport Development, together with ASML, took a leading role in securing the private contributions. In 2023, Brainport Development organised a series of workshops with delegates from various large companies (including campus and semi-public organisations) to brainstorm on how the private sector could raise the total private sector contribution of 188,9 million euros, most of which were included in the participant observation.

In the absence of formal rules to enforce contributions, multiple individuals have been trying to persuade each other to contribute. A clear example of this social mechanism was visible during one of the observed inter-company brainstorming sessions. A representative of one of the companies, itself fairly new to the region, asked why private organisations should contribute to public transport, arguing that this is a purely government task. One of the other attendees answered at length that the major challenges in the region could only be tackled properly if all companies contribute, referring to previous examples where companies contributed jointly to collective goals, and concluded by saying "and that's Brainport!"

Interviews with company representatives confirmed the use of social pressure. For example, one of them reflected on the willingness of companies to contribute to public goods in the region:

> Perhaps the louder you shout it from the tower, the more difficult it is for people to say no. … If you shout loud enough that we are national champions working together, that we should be able to manage this [referring to contributing financially to infrastructure]. You actually throw in a moral obligation.

Simultaneously, several stakeholders were working to set up a governance structure to collect the funding contributions. In early 2024, Brainport Development announced the creation of four private sector funds, including a transport fund.[2] This fund, to be managed by Brainport Development, is initially intended to collect the private sector share of the Brainport Deal, but it is also set up to be used for future infrastructure projects. In a statement released in 2024, Brainport Development confirmed that ASML is the driving force behind these four funds, while so-called "fore-runner companies" are also participating in them. Specifically for the Transport Fund, it was noted that the high-tech manufacturing industry will take the lead (Brainport Development, 2024a).

However, the inter-company brainstorms revealed a hesitation on the part of companies other than ASML to contribute, a sentiment that was reaffirmed in interviews with company representatives in early 2024. While they generally shared the view that it is good for companies to contribute to regional challenges, a financial contribution to urban infrastructure was seen by several as a rather far-reaching step. Two arguments for this doubt were repeatedly mentioned. Firstly, several representatives stated that their company would benefit less from the specific projects than ASML, and therefore had less urgency to see them realised. And secondly, it was considered unfair that they had to contribute whereas the government usually does so, and still does so in other cities.

Despite this hesitation, a new fund called the Brainport Partner Fund was announced in December 2024, this time with formal commitments from multiple companies. It replaced the four previously announced funds and focuses on the same four social objectives. It aims to raise €219 million over 12 years, of which €189 million (89 %) is earmarked for the private sector contribution to the Brainport deal. In order to collect contributions, the fund organisation enters into voluntary partnership agreements with individual companies for a period of three years, with the intention of renewal. The annual contribution is €5000 + the number of employees in the region times €200 for companies in sectors that are expected to benefit significantly from Brainport's growth, or times €100 for other sectors. So far, 12 companies have agreed to contribute, most of them associated with the high-tech sector (Brainport Development, 2024b; Brainport Partnerfonds, 2024).

6. Analysis and discussion

The Brainport case reveals two causal mechanisms that together can lead private beneficiaries to decide to voluntarily contribute to urban infrastructure. Based on the empirical evidence and our theoretical framework, we have identified specific conditions that appear to be necessary for both mechanisms to work.

6.1. *Overcoming the game of chicken through rational choice*

In general, it is not rational for a group of private beneficiaries to contribute within an institutional context where such contributions are not common. In the simplified matrices in Fig. 1, each quadrant shows the payoff to both the public and private sectors resulting from their decisions to contribute or not. To emphasise the non-mathematical use of game theory, we have used symbols rather than numbers. As can be seen in Fig. 1A, when private contributions are uncommon, it is more advantageous for the private sector to wait until the government provides all the funding. However, the Brainport case demonstrates that contributing can become a rational choice for private beneficiaries. In this case, this happened because contributing helped them to achieve a goal that was both highly desirable and urgent, with no more beneficial options available. As shown in Fig. 1B, this changes the private sector's payoff and thus its incentive to contribute.

Three conditions were found to be necessary for this rational choice mechanism to work. First, the contribution must help the beneficiaries achieve a highly desirable goal, because the collective payoff for contributing should be higher than the payoff for not contributing. The Brainport case shows that this goal is not necessarily an increase in land value, as much of the VC literature assumes. Rather, as the observations and interviews showed, in both processes, the beneficiaries saw the infrastructure that could be realised with their contributions as conditional for growing their business in the region. This focus on economic growth as the primary goal is also evident in the prospectus drafted to persuade more companies to contribute (Brainport Partnerfonds, 2024). Additionally, it is consistent with previous studies (Aveline-Dubach & Blandeau, 2019; Mboumoua, 2017), which have shown that the existence of local growth coalitions fostered the use of VC instruments.

Moreover, the Brainport case demonstrates that beneficiaries do not only consider the material benefits of contributing, but also the degree of fairness involved. For example, a delegate from the regional business community explained in an interview that many companies felt it was unfair that they had to contribute while companies in Amsterdam or The Hague did not. This consideration of fairness is in line with studies that proved that individuals are willing to sacrifice their own material gains in order to punish those who are unfair (Fehr & Schmidt, 1999; Loewenstein et al., 1989; Rabin, 1993). An option is more likely to be perceived as unfair the more it deviates from the status quo (Kahneman et al., 1986a, 1986b). However, the motivation to consider fairness

[2] The other three funds focus on social impact and equity; attracting talent to the region; and affordable housing, which builds on previous contributions from ASML for that purpose and should eventually become a revolving fund.

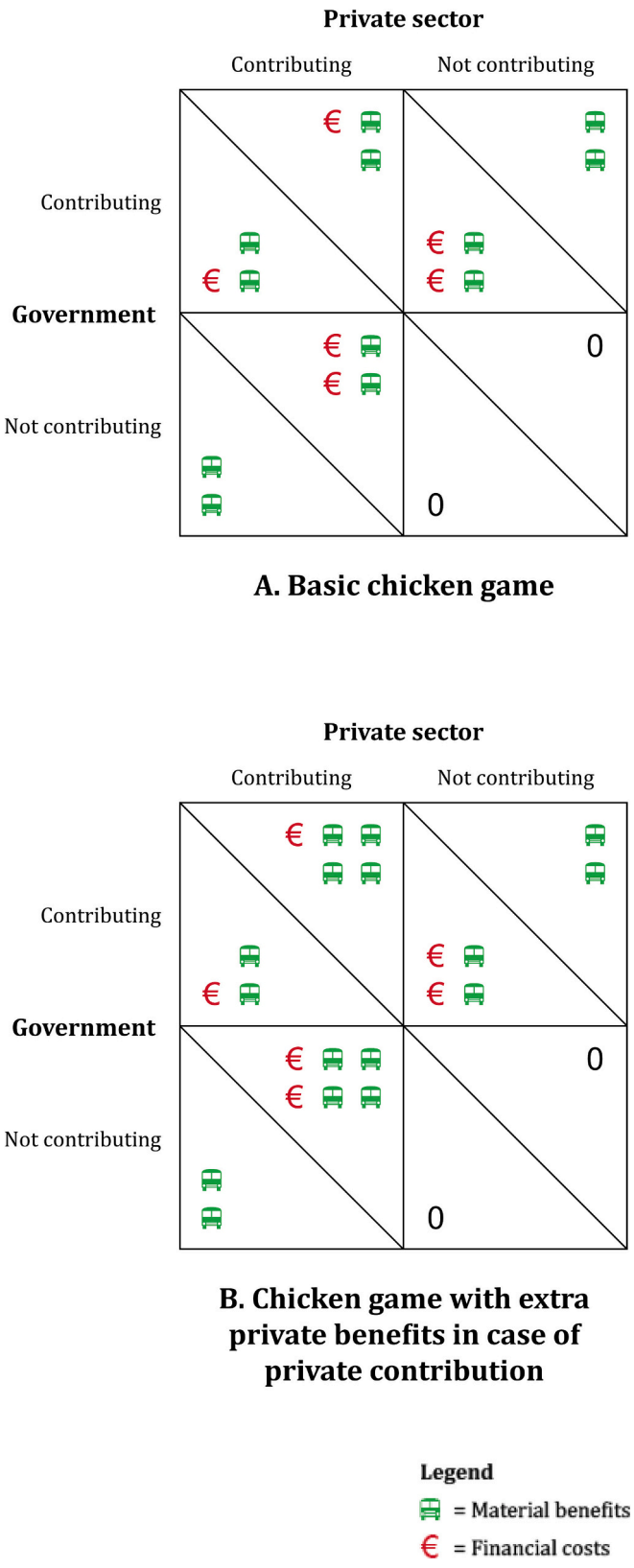

Fig. 1. A simplified payoff matrix of the chicken game in the implementation of private sector infrastructure funding (A) and one solution: a private sector contribution leads to extra benefits for the private sector (B).

diminishes as the material costs of sacrifice increases (Rabin, 1993). This suggests that in countries where private funding contributions are uncommon, the goal that beneficiaries want to achieve with their contribution must be sufficiently desirable to overcome the associated sense of unfairness.

Secondly, our game-theoretical perspective helps to explain that contributing should not only serve a desired goal, but that beneficiaries should also have no more attractive options to achieve that goal. Only when this is the case does a game of chicken become an assurance game, characterised by the fact that the maximum payoff for both parties can only be achieved if both cooperate (Taylor, 1987). Therefore, the beneficiaries should be convinced that the regular mode of funding – typically public funding – is insufficient to achieve their desired goal. This confirms earlier studies, for example on the UK's Crossrail infrastructure project, where the business community proved willing to contribute after the state had clearly communicated that it would not pay the full price (Buck, 2017).

Finally, the findings suggest that the goal that the beneficiaries are pursuing by contributing should be urgent. Implementing a novel funding strategy can be time-consuming and uncertain. This is even more so when agreements must be made among multiple individuals. As a result, beneficiaries may postpone this process, even in situations where the associated benefits are both desired and scarce.

The inertia resulting from this procrastination could be counteracted through a sense of urgency, of which our case revealed two sources. First, it helps if a beneficiary has a high discount factor, meaning that the benefits are worth more to them now than in the future. Secondly, a fear of missing out can incentivise actors to act now, for instance because a one-off opportunity with a strict deadline presents itself.

6.2. *Overcoming the free-rider problem through normative pressure*

When an urban infrastructure project has only one beneficiary, the rational choice mechanism can be sufficient to cause this actor to contribute. However, infrastructure projects often have multiple beneficiaries, if not many, creating a free-rider problem among them. This prisoner's dilemma is visualised in simplified form in Fig. 2A. This figure shows the payoffs that a company receives if it does or does not contribute, taking into account the action of another company.[3]

The process leading to the Run package demonstrates that a group can become privileged if one of the beneficiaries – in this case ASML – is willing to be the only private actor to contribute. However, this necessitates the presence of a beneficiary for whom the benefits are so valuable that it is worth contributing even if they alone pay the full share, as shown in Fig. 2B. These conditions are unlikely to exist for many large infrastructure investments, suggesting that another mechanism will often be needed to get multiple beneficiaries to contribute.

In the absence of formal rules to overcome this free-rider problem, the necessary collective action can also arise through a causal mechanism called normative pressure. With normative pressure, individuals are incentivised to adopt new actions or behaviours. However, no material incentives or forms of coercion are used. Rather, this mechanism relies solely on the use of norms to persuade, shame or praise actors into changing their policies (Kelley, 2004). Adopters of norm-following behaviour receive social rewards, while nonadopters receive social sanctions (DiMaggio & Garip, 2012).

As shown in Fig. 2C, these normative incentives lower the payoff of freeriding, while increasing the payoff of contributing. When both the relative material and normative benefits are high enough, this causes individuals to behave cooperatively (Schimmelfennig, 2001).

[3] For simplicity, the matrices show a two-person prisoner's dilemma. In reality, agreement will often have to be reached between more than two beneficiaries, also known in game theory as an N-person prisoner's dilemma. This exacerbates the free rider problem.

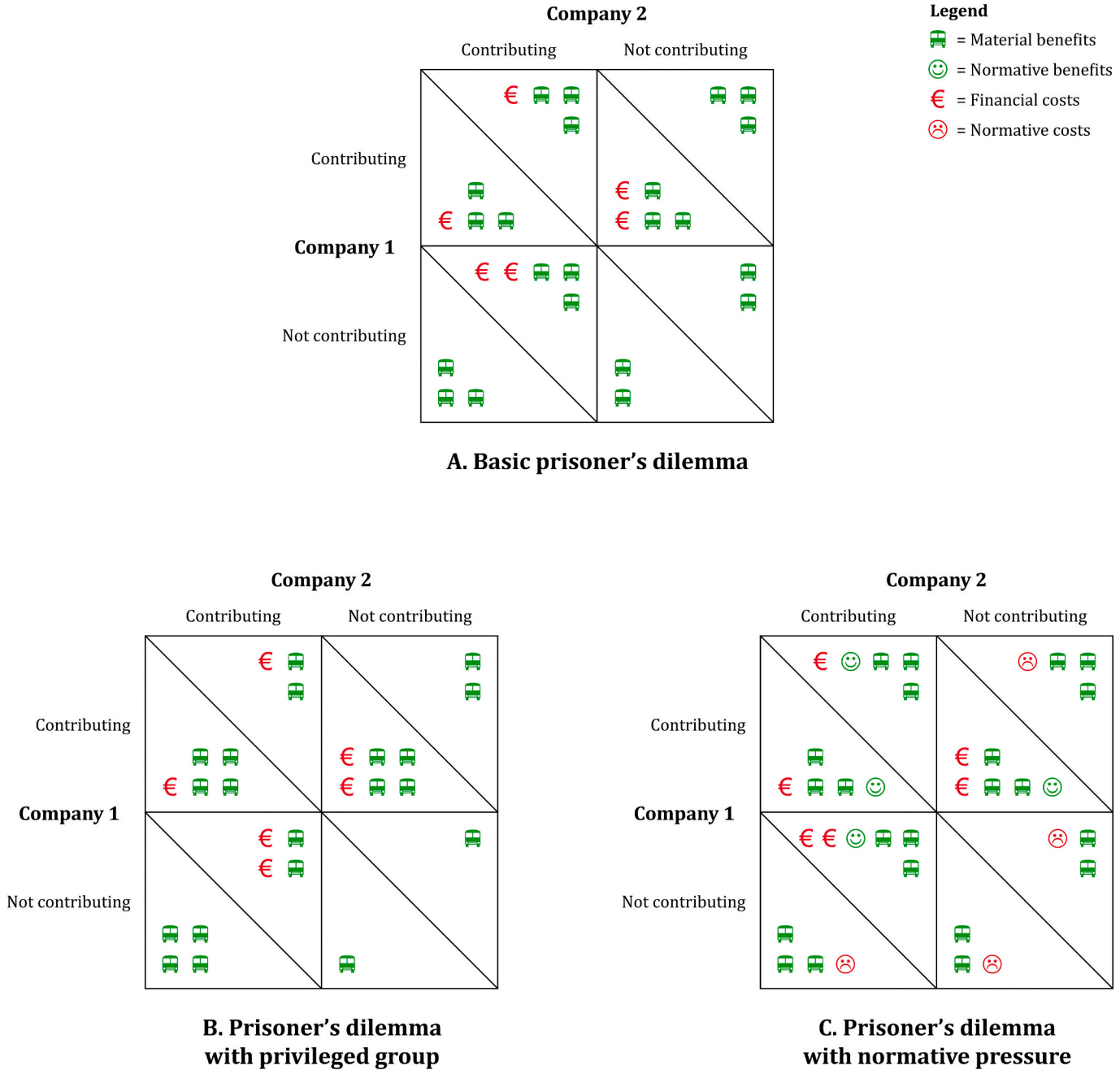

Fig. 2. A simplified payoff matrix of the prisoner's dilemma in the implementation of private sector infrastructure funding (A) and two possible solutions: the presence of a privileged group (B) and the presence of normative pressure (C).

The 12 companies that have formally committed to contribute all did so voluntarily, while they could have chosen to freeride. The participant observation provided clear evidence of the use of normative arguments to persuade companies to contribute, which was later confirmed by two company delegates interviewed. Another company delegate indicated not being able to comment on the use of social pressure, giving a somewhat mixed picture. However, this may be due to the sensitive nature of such strategic action. Moreover, in a brief interview conducted after the first formal commitments were announced, a consultant who had played a key role in the process leading to this breakthrough confirmed the importance of social pressure in getting individual companies to cooperate.

The usage of normative arguments and social pressure is not new in this region, as one of the interviewed business representatives disclosed. When discussing the process leading up to private funding contributions to an international school, he stated:

> At some point there comes such a pressure on you as a company … a kind of social pressure, a pressure like 'yes, but listen, if we want to move this Brainport region forward, and we think that a number of facilities must be in place, then we as private parties, or you as private parties, will have to contribute.'

We identified three causal conditions that appear to be necessary for normative pressure to work. First, contributing to urban infrastructure should be consistent with pre-existing norms of cooperation. Evidently, financial contributions to urban infrastructure cannot be normalised before they are applied for the first time. However, normative pressure can also be successful when based on a new frame, as long as that frame

aligns with norms that are already dominant within a community (Waas & Rittberger, 2024).

In the inter-company meetings observed, the collaborative culture in the Brainport region, including its custom of public and private actors pursuing public goals together, was repeatedly used to legitimise and normalise private funding contributions. As such, a new frame was constructed based on pre-existing norms, to put social pressure on those individuals who might oppose the idea of contributing.

The second causal condition we identified is the existence of a tight-knit community, with a high interaction density among a relatively stable group of beneficiaries. When there are lots of repeated interactions among the same participants in a group, a reputation of being cooperative becomes an asset, while deviating from normalised behaviour can be punished (Ostrom & Ahn, 2009; Schimmelfennig, 2001). Moreover, the existence of a tight-knit community helps in the dissemination of a new frame. Hence, a tight-knit group of beneficiaries is likely to be conditional for normative pressure to work.

Finally, it is shown to be important that the group of beneficiaries is homogeneous, confirming previous studies on the conditions for endogenous solutions to the free-rider problem (Ostrom, 2007a). Specifically for private funding contributions, it appears important that beneficiaries benefit equally from the infrastructure projects. An explanation for this is that a norm does not replace a material payoff, but rather complements it (Ostrom, 2005, p. 123). This suggests that normative pressure is most successful in changing the behaviour of those actors who also stand to gain a great deal materially from the infrastructure to which they might contribute.

The interviews highlighted the difficulties that can arise when the amounts of benefits vary. For example, a representative of a company located relatively far from the infrastructure to be built explained its reluctance to contribute as follows:

> The initial attitude at [company name omitted] is we do not actually need it at all. So we are going to help pay for a problem that we do not experience ourselves.

Given the place-based nature of urban infrastructure, beneficiaries can always be expected to benefit from infrastructure to different degrees, and the urgency of these benefits can also vary widely. These differences between beneficiaries may therefore hinder the emergence of voluntary contributions. At the same time, the presence of an actor for whom the benefits are significantly more important than for the rest - ASML in this case - can also increase the likelihood of an actor taking the initiative.

Two strategies can be identified by which actors tried to move towards a more widely supported contribution. The first is to focus on an objective that benefits more companies than just those in the immediate vicinity of the infrastructure - in this case, the economic growth of the region. The second is to take into account the different degrees of urgency of these benefits when calculating the amount of contribution, which is higher for companies in sectors that are more dependent on this growth. Nevertheless, it remains to be seen whether this will be enough to convince enough actors to contribute over a longer period, or whether formal legislation will be needed in the longer term.

6.3. *Institutionalisation potential of value capture innovations*

Private contributions to urban infrastructure are not yet institutionalised in the Brainport region, but the two funding agreements could be significant steps in that direction. The path-dependent practice of public funding in the Netherlands results in a lock-in from which, as our case confirms, it is difficult to break free. Nevertheless, the process in Brainport Eindhoven demonstrates that under specific conditions, private funding can become an attractive and feasible alternative. The funding agreements already achieved here may serve as a precedent for future projects, in the Brainport region and possibly beyond.

There are already signs of this setting of precedents visible in the Brainport region. In early 2024, the Dutch central government signed an investment agreement with the region worth €2.51 billion for mobility, housing, and talent development, €778 million of which is to be raised by regional governments and the business community (Adriaansens et al., 2024). Although the percentage of private funding has not yet been decided, nor which private parties will contribute,[4] it suggests that private contributions are already perceived by decision makers in the region as a credible option.

Our institutional perspective highlights the importance of norms in the institutionalisation of private funding contributions. The findings suggest that, on the one hand, beneficiaries' behaviour is shaped by regional norms, which can enable normative pressure to work in specific places. On the other hand, beneficiaries also look at what is happening in other cities when assessing the fairness of a contribution. How they weigh these different norms appears to be influenced by various factors, some of which are beyond the scope of this study, such as the local roots of private sector decision-makers. Nevertheless, it is conceivable that the absence of private contributions in other regions, due to the lack of necessary conditions there, may also hinder their institutionalisation in the Brainport region.

7. Conclusion and recommendations

This article presented an investigation into how financial contributions from private beneficiaries to public infrastructure can be implemented and what conditions need to be in place for this to happen. Owners and users of existing real estate often benefit greatly from new public infrastructure projects, but rarely contribute to them directly. Using game theory, we first showed that a game of chicken between the public and the private sector and a free-rider problem among private beneficiaries discourage them from doing so. Yet, in the Brainport region in the Netherlands, two funding agreements were recently signed with significant contributions from the business community. Our qualitative case study provides insights into how this deviant practice became possible. Using process tracing, we identified plausible causal mechanisms and associated causal conditions through which the unlikely support for contributions from the business community emerged.

We found that private beneficiaries can collectively decide to contribute through rational choice, but our findings suggest that this will only happen when this decision serves a goal that is highly desirable and urgent to them, and when no more beneficial options are available. If there are many beneficiaries, the free-rider problem can subsequently be overcome by normative pressure. However, the evidence suggests that this mechanism requires the existence of a homogeneous, tight-knit group of beneficiaries in which private funding contributions conform to pre-existing norms, such as a local custom that companies contribute to public causes. We expect these mechanisms to work in market economies where it is politically unfeasible to introduce compulsory contributions, particularly because such regulations violate private property rights. We advocate follow-up research using theory-testing process tracing (Beach, 2020) to investigate whether these mechanisms and conditions generate similar outcomes in other cases.

In countries where obliging private actors to contribute is not an option, voluntary contributions can be a promising form of infrastructure funding. The Brainport case demonstrates that support for such contributions can emerge but depends on rather specific conditions. In particular, the deep-rooted culture of cooperation that appeared necessary in the absence of formal regulations is less prevalent in many other regions in the Netherlands and beyond. Our insights on the

[4] This investment agreement, called 'Operation Beethoven', is primarily aimed at facilitating the further growth of ASML in the Netherlands, following an urgent plea from ASML that this was not possible without further investment. ASML is therefore the main beneficiary of the investments, which makes it obvious that ASML will be (one of the) private contributors.

necessity of relatively scarce conditions helps to explain the limited application of private sector infrastructure funding, and the discrepancy we have observed between the great promise of this type of value capture and its limited use to date.

Moreover, our study shows that the prevailing practice of publicly funding urban infrastructure discourages private beneficiaries from contributing, both by offering them an attractive alternative and by making them perceive it as unfair that they should start to contribute. Our theoretical insights suggest that governments seeking to increase private sector funding are best advised to start with projects where the benefits to a group of private actors are high enough to overcome their material and normative reservations. Governments could further incentivise such groups to contribute by, for example, restricting access to public funds or by rewarding private funding. In the absence of such deliberate interventions in our case study, further research is needed to assess their effectiveness.

In addition, it is well conceivable that despite the possibility of voluntary contributions to emerge, the institutionalisation of private funding contributions will require policy makers to implement formal legislation in the future. Such legislation can help to address the free-rider problem in regions that do not have a strong cooperative culture, as well as to ensure more structural funding streams in regions that do. An initial, voluntary use of private contributions, such as in the Brainport, may spark a debate on such more far-reaching government interventions, in which it can act as a proof of concept.

Finally, policy-makers would do well to foster a culture of co-operation both among companies and between companies and the government, for example by supporting organisations such as Brainport Development. Such a public-private network organisation cannot only help to provide a breeding ground for cooperation among companies, but can also provide a space to discuss possibilities for formal legislation. However, this is by no means a quick fix - as the cooperative culture in the Brainport also took decades to materialise.

Despite the limitations of studying a single, ongoing case, we hope to have contributed to an understanding of why a promising solution to the growing difficulty of securing infrastructure funding is so difficult to implement. Our account shows that a better understanding of the material and normative considerations of individuals is crucial to advancing new ways in which human society meets its collective challenges.

CRediT authorship contribution statement

Simon van Zoest: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Tom A. Daamen:** Writing – review & editing, Supervision, Conceptualization.

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Data availability

The data that has been used is confidential.

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