



When the Shovel Hits the Ground: Evaluation, Management and Public-Private Cooperation in Transport Infrastructure Projects

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Overview

- ∞ Background of the research
- ∞ Two case studies (finished)
- ∞ Comparison of the two cases
- ∞ Comparison of 27 projects (preliminary analysis and results)
- ∞ References



Background

- ∞ There is a constant need to progress in the realization of transportation infrastructure projects (e.g. Merrow 1988; WRR 1994; Flyvbjerg et al. 2003; TCI 2004; Hodge & Greve 2007; VBI 2008; Cantarelli 2011)

- ∞ Focus of the PhD research:
 - ∞ Evaluation of transportation infrastructure projects (methodological innovation)
 - ∞ Management and public-private cooperation
 - ∞ Project implementation, i.e. after contract closure



Background

- ∞ Evaluation of transportation infrastructure projects
 - ∞ Projects have both differences (i.e. unique properties) *and* similarities
 - ∞ Differences in conditions can explain different outcomes in/of projects
 - ∞ Similarities in conditions provide clues for learning in/across projects
- ∞ Qualitative Comparative Analysis (i.e. QCA) (Ragin 1987; 2008) as a method that can systematically evaluate both differences and similarities between infrastructure projects for explaining outcomes



Verweij & Gerrits (2013). [Understanding and researching complexity with qualitative comparative analysis: Evaluating transportation infrastructure projects](#). *Evaluation*, 19(1), 40-55.

Background

- ∞ Management and public-private cooperation in transportation infrastructure project implementation
 - ∞ Project plans are “repositories of expectations” (Söderholm 2008)
 - ∞ But in implementation - ‘when the shovel hits the ground’ - events occur that were sometimes unexpected and that need to be managed still
- ∞ Empirical research question:
 - ∞ How do public and private managers respond to these events?
 - ∞ And what management responses yield (un)satisfactory outcomes?
 - ∞ How can these outcomes be explained?

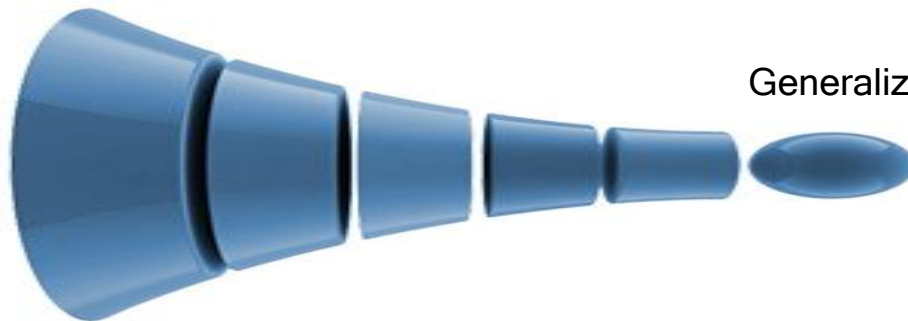


Background - Design

- ∞ Two case studies
 - ∞ [A2 Maastricht](#) (Verweij & Gerrits 2014 - published)
 - ∞ [A15 Maasvlakte-Vaanplein](#) (Verweij 2014 - published)
- ∞ Comparison of the case studies (Verweij, Teisman & Gerrits - Review)
- ∞ Can we find further evidence for the patterns in the case studies?
 - ∞ Comparison of 27 Dutch transport infrastructure projects (Verweij - Review)



In-depth, highlighting differences



Generalization, highlighting similarities

Background

- ∞ Funder: Next Generation Infrastructures
- ∞ Period: 2011-2014 (expected defense: 2015)
- ∞ Article-based thesis:
 - ∞ Two methodological articles (2 x published)
 - ∞ Four empirical articles (2 x published, 2 x in-review)
- ∞ Promotor: prof. dr. ing. Geert R. Teisman (Erasmus University)
- ∞ Copromotor: prof. dr. Lasse M. Gerrits (University of Bamberg)
- ∞ More information: www.stefanverweij.eu

Two case studies

- ∞ A2 Maastricht

- ∞ Eighteen interviews with public and private managers (09-2011 to 12-2011)
- ∞ Identified 18 events

- ∞ A15 Maasvlakte-Vaanplein

- ∞ Twenty interviews with public and private managers (05-2012 to 01-2013)
- ∞ Identified 20 events

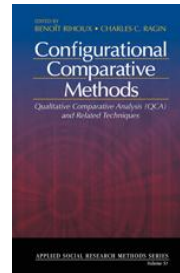
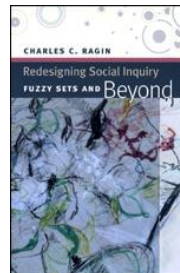
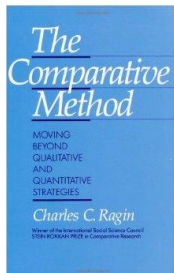


- ∞ Example of an event (A15 MaVa)

- ∞ The Municipality of Rotterdam objected to the design of Ramp700 (a land abutment for the Botlekbridge) as it would make future access to certain cables and pipelines impossible - the Municipality felt that the design did not meet the requirements agreed upon in the implementation agreement (Verweij 2014)

Two case studies

- ∞ Each event was qualitatively coded on the following conditions:
 - ∞ Source of the event: social (stakeholders) or physical system
 - ∞ Management response to the event:
 - ∞ Internal (project-inward, shielding the project from the environment) or external (project-outward, engaging with the environment) orientated
 - ∞ Cooperation (acting together) or public/private actors respond autonomously (stressing public-private boundaries, not acting together)
 - ∞ Outcome: satisfaction
- ∞ Qualitative Comparative Analysis of the management of events



Two case studies

∞ QCA, example of basic logic (A2 Maastricht)

1. Qualitative case constructions
2. Data matrix
3. Truth table
4. Truth table minimization

2

| Case-ID | EVENT | MAN | INTERA | SATIS |
|---------|-------|-----|--------|-------|
| TUN | 0 | 0 | 2 | 1 |
| BII | 1 | 0 | 1 | 0 |
| BI2 | 1 | 1 | 0 | 0 |
| WAT | 1 | 1 | 2 | 0 |
| LAN | 1 | 1 | 0 | 1 |
| ZON | 1 | 1 | 0 | 1 |
| ENV | 1 | 0 | 0 | 1 |
| LEE | 1 | 1 | 0 | 1 |
| WES | 1 | 1 | 1 | 1 |
| RIJ | 1 | 1 | 2 | 1 |
| TRA | 1 | 0 | 1 | 0 |
| CR1 | 0 | 0 | 1 | 0 |
| CR2 | 0 | 0 | 0 | 1 |
| SOI | 0 | 0 | 1 | 0 |
| BAD | 0 | 0 | 1 | 0 |
| PRO | 1 | 1 | 0 | 0 |
| CIV | 1 | 1 | 2 | 1 |
| THE | 0 | 0 | 1 | 0 |

3

| EVENT | MAN | INTERA | SATIS | N | Cases |
|-------|-----|--------|-------|---|-------------------------|
| 0 | 0 | 2 | 1 | 1 | TUN |
| 1 | 0 | 1 | 0 | 2 | BII, TRA |
| 1 | 1 | 0 | C | 5 | BI2, LAN, ZON, LEE, PRO |
| 1 | 1 | 2 | C | 3 | WAT, RIJ, CIV |
| 1 | 0 | 0 | 1 | 1 | ENV |
| 1 | 1 | 1 | 1 | 1 | WES |
| 0 | 0 | 1 | 0 | 4 | CR1, SOI, BAD, THE |
| 0 | 0 | 0 | 1 | 1 | CR2 |

4



| | Statement of sufficiency | Outcome |
|--------|--|----------|
| [1] | MAN{0}*INTERA{1} | SATIS{0} |
| Cases | BII, TRA+CR1, SOI, BAD, THE | |
| [2A-C] | MAN{0}*INTERA{0}+ EVENT{0}*MAN{0}*INTERA{2}+ EVENT{1}*MAN{1}*INTERA{1} | SATIS{1} |
| Cases | ENV+CR2 TUN WES | |

Two case studies

- ∞ Pairwise comparison, example of basic logic
 - ∞ Event 1: an event with a **social source** was responded to with a **project-inward** orientation and the private managers **acted autonomously** → unsatisfactory outcome
 - ∞ Event 2: an event with a **social source** was responded to with a **project-inward** orientation and the managers **acted together** → unsatisfactory outcome
 - ∞ Therefore: whether public and private managers cooperated or not in responding to the event, the outcome was unsatisfactory anyhow
 - ∞ Solution: project-inward management responses produce unsatisfactory outcomes

Comparison of cases

∞ Comparing patterns found in the case studies (1)

| Configuration | Conditions | | | Satisfaction | Events |
|---------------|---------------------|----------------------|------------------------------|--------------|-----------------------------------|
| | Source of the event | Response orientation | Cooperation | | |
| A | Social | Internal | | Low | 9 (A15 MaVa) |
| B | | Internal | Private actor autonomously | Low | 6 (A2 Maastricht) 7 (A15 MaVa) |
| C | | Internal | Public actor autonomously | High | 2 (A2 Maastricht) |
| D | Physical | Internal | Cooperation between partners | High | 1 (A2 Maastricht) |
| E | Physical | Internal | Public partner intermediates | High | 1 (A15 MaVa) |
| F | Social | External | | High | 9 (A2 Maastricht) 7 (A15 MaVa) |



Comparison of cases

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Two case studies

∞ Comparing patterns found in the case studies (2)

| | A2 Maastricht | A15 MaVa |
|--------------|---|---|
| Events | Mostly social source (12 out of 18 - 67%) | Mostly social source (16 out of 20 - 80%) |
| Management | Internal-oriented: 50% of events External-oriented: 50% of events | Internal-oriented: 65% of events External-oriented: 35% of events |
| Cooperation | More cooperation-oriented, working together in responding to events | More acting autonomously, stressing boundaries between public and private partners |
| Satisfaction | Lower (50% of events) - Higher (50% of events) Qualitative: generally project was going well | Lower (60% of events) - Higher (40% of events) Qualitative: difficult project implementation |
| | | |
| | | |
| | | |



Two case studies

∞ Comparing patterns found in the case studies (2): other factors?

| | A2 Maastricht | A15 MaVa |
|--|---|---|
| Events | Mostly social source (12 out of 18 - 67%) | Mostly social source (16 out of 20 - 80%) |
| Management | Internal-oriented: 50% of events External-oriented: 50% of events | Internal-oriented: 65% of events External-oriented: 35% of events |
| Cooperation | More cooperation-oriented, working together in responding to events | More acting autonomously, stressing boundaries between public and private partners |
| Satisfaction | Lower (50% of events) - Higher (50% of events) Qualitative: generally project was going well | Lower (60% of events) - Higher (40% of events) Qualitative: difficult project implementation |
| Contract type | D&C and 'alliance-ish' elements | DBFM |
| Scope | Integral project | Transportation infrastructure |
| Project size (Cantarelli et al. 2012) | Smaller | Larger |



Comparison 27 projects

- ∞ A comparison of 27 projects
 - ∞ *Attempt* to test the patterns from the case studies
 - ∞ Data were derived from the Rijkswaterstaat Project Database
 - ∞ Worked as a visiting researcher at Rijkswaterstaat (GPO, Project Management) from 11-2013 to 10-2014 (1 year)
 - ∞ Not only qualitative data, but both qualitative and quantitative data
 - ∞ More generalization at the expense of in-depth case knowledge
 - ∞ Using another type of QCA:
fuzzy-set QCA



Rijkswaterstaat



Comparison 27 projects

- ∞ The project data: 27 projects
 - ∞ Average completeness-level: 73% (M 74%, SD 17%)
 - ∞ Days from 'shovel in the ground' to 'now' divided by days between 'shovel in the ground' until (planned) project delivery date
 - ∞ Average satisfaction: 13.16 on a scale from 0 to 16 (quantitative)
 - ∞ Contract: 4 x DBFM, 23 x D&C
 - ∞ Few integral projects
 - ∞ Average project size: €k 386.206 (i.e. over € 386 million) (quantitative)
 - ∞ Periodical management reports (qualitative)
 - ∞ Information about management and cooperation orientations
 - ∞ Total of 202 pages



Comparison 27 projects

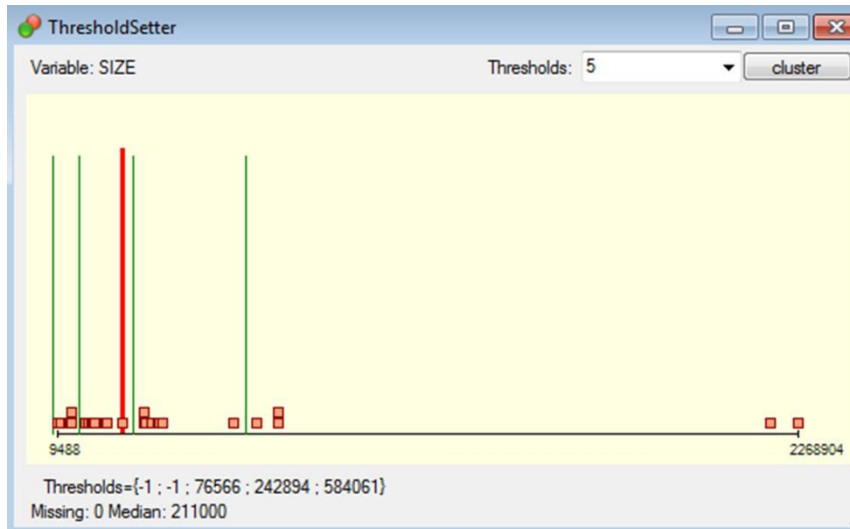
∞ Determining the fuzzy-set values of the projects: calibration

| | Calibration: how are the fuzzy-set values arrived at? |
|--|---|
| Events | NA |
| Management | <ol style="list-style-type: none"> 1. Coding qualitative management reports of the projects on management indicators (total 202 pages) 2. Qualitatively cross-comparing projects, scoring |
| Cooperation | <ol style="list-style-type: none"> 1. Coding qualitative management reports of the projects on management indicators (total 202 pages) 2. Qualitatively cross-comparing projects, scoring |
| Satisfaction | <ol style="list-style-type: none"> 1. Calibrating project manager's quantitative periodic assessments using Tosmana Threshold Setter 2. 0.00 (8.67-10.17), 0.33 (10.18-12.34), 0.67 (12.35-13.50) and 1.00 (13.51-16.00) |
| Contract type | <ol style="list-style-type: none"> 1. Data derived from project managers and database 2. Direct coding |
| Scope | <ol style="list-style-type: none"> 1. Examining data from project descriptions from Project Database and MIRT Project Books 2. Direct coding |
| Project size (Cantarelli et al. 2012) | <ol style="list-style-type: none"> 1. Calibrating most recent prospective project costs using Tosmana Threshold Setter 2. 0.00 (9.488-75.566), 0.33 (76.567-242.894), 0.67 (242.895-584.061) and 1.00 (584.062-2.268.904) |



Comparison 27 projects

- ∞ Example of calibration: project size and satisfaction
 - ∞ Similar cases are grouped together, different cases are separated
 - ∞ Tosmana Threshold Setter performs a cluster analysis



Comparison 27 projects

∞ Summary of calibrated conditions

| | Lower fuzzy-set values 0.00 and 0.33 | Higher fuzzy-set values 0.67 and 1.00 |
|--|---|--|
| Events | NA | NA |
| Management | Internally-oriented | Externally-oriented |
| Cooperation | More contract-oriented | More cooperation-oriented |
| Satisfaction | Lower | Higher |
| Contract type | DBMF | D&C |
| Scope | Narrow scope | More integral projects |
| Project size (Cantarelli et al. 2012) | Smaller | Larger |



Comparison 27 projects

- ∞ Analysis step 1: data matrix
- ∞ Analysis step 2: truth table

| No. | CONT | SCOPE | SIZE | MAN | COOP | SATIS | N | incl. | PRI | Cases |
|-----|------|-------|------|-----|------|-------|---|-------|-------|--|
| 8 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 1.000 | 1.000 | P.0247, P.0351 |
| 28 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1.000 | 1.000 | P.0196 |
| 21 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0.909 | 0.875 | P.0029 |
| 32 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 0.898 | 0.854 | P.0034, P.0094 |
| 19 | 1 | 0 | 0 | 1 | 0 | 1 | 7 | 0.884 | 0.864 | P.0059, P.0095, P.0102, P.0179, P.0200, P.0631, P.0641 |
| 23 | 1 | 0 | 1 | 1 | 0 | 1 | 2 | 0.875 | 0.819 | P.0008, P.2365 |
| 24 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0.875 | 0.834 | P.0272 |
| 31 | 1 | 1 | 1 | 1 | 0 | 0 | 3 | 0.724 | 0.568 | P.0077, P.0149, P.0227 |
| 17 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 0.681 | 0.597 | P.0096, P.0165, P.0319, P.0755, P.1106, P.2355 |
| 15 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0.493 | 0.000 | P.0218 |
| 13 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0.330 | 0.000 | P.0190 |

Number of logical remainders: 21



Comparison 27 projects

∞ Analysis step 3: Truth table minimization

| | | incl. | cov.r | cov.u | Cases |
|---|----------------------|-------|-------|-------|---|
| 1 | CONT*SCOPE*MAN*COOP | 0.907 | 0.181 | 0.091 | P.0196; P.0034, P.0094 |
| 2 | CONT*scope*MAN*coop | 0.871 | 0.491 | 0.237 | P.0059, P.0095, P.0102, P.0179, P.0200, P.0631, P.0641; P.0008, P.2365 |
| 3 | CONT*scope*SIZE*coop | 0.883 | 0.272 | 0.019 | P.0029; P.0008, P.2365 |
| 4 | scope*SIZE*MAN*COOP | 0.929 | 0.236 | 0.128 | P.0247, P.0351; P.0272 |
| | Solution | 0.891 | 0.746 | | |

∞ *Preliminary results, do not quote or copy*

Comparison 27 projects

- ∞ First, preliminary conclusions (1)
 - ∞ Integral projects with a D&C contract are characterized by externally-oriented management and a cooperative orientation, and this is associated with high satisfaction
 - ∞ Projects with one spatial function and a D&C contract are characterized by externally-oriented management and a contractual orientation, and this is associated with high satisfaction
 - ∞ Large projects with one spatial function and a D&C contract are characterized by a contractual orientation, and this is associated with high satisfaction
 - ∞ Large projects with one spatial function are characterized by externally-oriented management and a cooperative orientation, and this is associated with high satisfaction

- ∞ *Preliminary results, do not quote or copy*



Comparison 27 projects

- ∞ First, preliminary conclusions (2): some highlights
 - ∞ Externally-oriented management and public-private cooperation are indeed important contributors to satisfaction in transportation infrastructure project implementation (confirms case-study results)
 - ∞ Smaller projects with a single spatial function (narrow scope) can be managed satisfactorily with less cooperation, and more strictly by contract
 - ∞ Larger, integral projects need more externally-oriented management and a more intensive public-private cooperation beyond the contract

- ∞ *Preliminary results, do not quote or copy*



References

- ∞ Some publications based on this PhD research
 - ∞ Verweij (2014). Achieving satisfaction when implementing PPP transportation infrastructure projects: A qualitative comparative analysis of the A15 highway DBFM project. [*International Journal of Project Management*](#).
 - ∞ Verweij & Gerrits (2014). How satisfaction is achieved in the implementation phase of large transportation infrastructure projects: A qualitative comparative analysis into the A2 tunnel project. [*Public Works Management & Policy*](#).
 - ∞ Verweij & Gerrits (2013). Understanding and researching complexity with qualitative comparative analysis: Evaluating transportation infrastructure projects. [*Evaluation*](#).
 - ∞ Verweij (2012). Management as system synchronization: The case of the Dutch A2 passageway Maastricht project. [*Emergence: Complexity & Organization*](#).
 - ∞ Reynaers & Verweij (2014). Kritisch kijken naar kansen: De schaduwzijden van DBFMO. [*ROmagazine*](#).
 - ∞ Verweij (2013). Ingewikkeld? Kijk goed om je heen! Sociale complexiteit in de uitvoering vraagt om een blik naar buiten. [*Infra*](#).
 - ∞ Verweij (2012). Systeemsynchronisatie bij gebiedsontwikkeling Avenue2 Maastricht: Overheid en markt doen beide waar ze goed in zijn. [*ROmagazine*](#).
- ∞ See www.stefanverweij.eu for more references and presentations
- ∞ Contact: verweij@fsw.eur.nl

