Hertie School
of Governance

Large Infrastructure Projects in Germany
Between Ambition and Realities

Working Paper 2

Public Infrastructure Project Planning in Germany:
The Case of the Elb Philharmonic in Hamburg

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Introduction

The Elbphilharmonie recently scored ninth on a list of the ten most expensive skyscrapers ever built.[1] With its southeastern corner at 110m, it marginally enters the skyscraper category, but is now in the prominent company of Taipeh 101, Burj-al-Chalifa or One World Trade Center. Alas, the city of Hamburg never desired a position in this ranking. When the city signed the construction contract in 2006, it planned for total project costs to be €351.8 million and to open the Elbphilharmonie in 2010.[2] Over the following years, costs progressively escalated, while project progress was delayed. It became a planning disaster, with total project costs rising to €560.8 million by 2008.[3]

In 2011, the project was on the brink of failure, as several contract amendments had not successfully limited further cost escalations. Construction stopped for over 18 months. After a long, informal negotiation process, decision makers achieved a complete project turnaround in 2013. For this amendment, decision-makers did not try to only satisfy the construction company's run up financial claims, but renegotiated the project governance setup. Project schedule and budget have remained stable since: As of Spring 2015, the Elbphilharmonie is planned to open in January 2017 at total project costs of €865 million.[4]

As was pointed out in the introduction to this volume, large public infrastructure projects often face time and cost overruns, and scholars have studied reasons for the "curse of the megaproject" in small and large sample studies.[5] The Elbphilharmonie project, represents an extreme case: It is a signature project that faced cost escalations of 145.9%, up to a multifold of planned costs and an opening delay of seven years.[6] This justifies an individual investigation.[7]

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[1] Manager Magazin: Hamburger Elbphilharmonie in einer Liga mit One World Trade Center. 05.12.2014, last access 12.03.2015.
[2] Bürgerschaft der Freien und Hansestadt Hamburg: Drucksache 20/11500. Bericht des Parlamentarischen Ausschusses Elbphilharmonie. 03.04.2014, p. 25. (Cited as B/PUA).
[3] Bürgerschaft der Freien und Hansestadt Hamburg: Drucksache 19/1841. Mitteilung des Senats an die Bürgerschaft. Haushaltsplan-Entwurf 2009/2010; Realisierung des Projektes Elbphilharmonie; Sachstandsbericht zum 23. Dezember 2008 und Ergänzung des Haushaltsplan-Entwurfs 2009/2010 zur Finanzierung von Mehrkosten. 23.12.2008, p. 5; B/PUA, p. 25.
[4] Frankfurter Allgemeine Zeitung Online: Millionengrab Elbphilharmonie. Der große Eisberg über der Stadt. 14.02.2015, last access 13.03.2015; Nachtrag 5 zum Leistungsvertrag für das Projekt Elbphilharmonie. Neuordnungsvereinbarung. 08.04.2013, p. 15, last access 13.03.2015.
[5] Flyvbjerg, Bent: Policy and Planning for Large Infrastructure Projects. Problems, Causes, Cures. In: World Bank Policy Research Working Paper 3781 (2005); Flyvbjerg, Bent: Curbing Optimism Bias and Strategic Misrepresentation in Planning: Reference Class Forecasting in Practice. In: European Planning Studies 16 (2008), pp. 3 – 21; Flyvbjerg, Bent; Garbuio, Massimo; Lovallo, Dan: Delusion and Deception in Large Infrastructure Projects. Two Models for Explaining and Preventing Executive Disaster. In: California Management Review 51 (2009), pp. 170 - 193; Flyvbjerg, Bent: Survival of the unfittest: why the worst infrastructure gets built—and what we can do about it. In: Oxford Review of Economic Policy 25 (2009), pp. 344 – 367; Lessard, Donald; Millard, Roger: Understanding and Managing Risks in Large Engineering Projects. In: SLOAN Working Paper 4214-01 (2001)
[6] As signature projects, we understand projects with unique characteristics: Pioneering new technologies, combine functions in a special way, or symbolic meaning.
[7] This is a single case, interpretative case study. Our sources are one interview conducted in Hamburg on 09.01.2015, one telephone interview conducted on 12.02.2015, newspaper reports, academic articles, publically available official documentation, and published expert opinions.

We find that the largest share of cost overruns was an unavoidable result of decisions and external influence factors in the projects development phase before construction contract signature in late 2006 (ex-ante), with weak Hamburg-internal oversight enabling over-optimism and strategic deception. A lack of detailed planning, insufficient risk management, an over-ambitious tender schedule, and public pressure led to a premature lump sum contract signature with unrealistically low cost assumptions when measured against the value of the envisaged building.[8]

Most influential, we identify three intertwined project governance decisions partially made very late in the tender process as drivers of cost escalations: The external governance setup in which the city's project management agency served as main interface between the architects and the construction company, the choice of a forfeit model instead of an investor model to finance construction, and the parallel processing of planning and construction. Each individual decision's entailed risk was felt manageable, but project leaders drastically underestimated their interdependency. They impacted project performance devastatingly.

While we argue that cost escalations had after contract signature (ex-post) been unavoidable, we also find that through well-run project management, cost escalations could have been mitigated before the project turnaround in 2013.

This chapter proceeds as follows. We first describe the Elbphilharmonie's project planning phase from the idea in 2003 to contract closure in 2006, highlighting key developments, explaining decisions, and showing early path dependencies. We illustrate the role of public expectations and pressure in this phase, which led to flawed strategic decisions, embedded in an internal governance setup with limited oversight possibilities. We introduce the concept of Rightly Foreseeable Costs to distinguish between unavoidable cost escalations and potential for later cost mitigation.

We then select the mentioned three critical governance decisions and describe their impact potential in detail. After that, we portray the project developments until the turnaround in 2013, point out missed opportunities to mitigate cost escalations and give an estimate for potential cost reductions through better project management.

We conclude by presenting lessons learned from the Elbphilharmonie project, and give some recommendations for better large public infrastructure project management in Germany.

[8] Budäus, p. 8 speaks of a "point of no return" for parliaments.

Project Milestones until Contract Closure

2000 – 2003 Initial Idea and Early Path Dependencies

In February 2000, the government of Hamburg, the Senate, adopted the Masterplan for "HafenCity", an ambitious city development project around the harbor areal premises on the north side of the river Elbe.[9] One of the prominent sites was Kaispeicher A, a post-World War II warehouse on a triangularly shaped land tongue in the middle of the Elbe River. As part of "HafenCity", an office tower was supposed to replace the old storehouse. Unrelated to the project, but around the same time, public figures in Hamburg identified the need for a new, large concert hall, but were cautious to develop plans. As in the wake of the early 2000s new economy crisis another office tower seemed one too much to the real estate developer Alexander Gerard, he designed a concept to build the new concert hall at the on top of the old warehouse at Kaispeicher A.[10]

Gerard suggested finding a private investor to construct a double-use building at the Kaispeicher A. The core of the building would be public, consisting of a large and a small concert hall, necessary backstage areas and offices, and an open plaza. This core would be surrounded by a "commercial envelope", investor-owned areas, consisting of a hotel, gastronomy, a parking garage, and several for sale apartments. The commercial envelope should generate enough profit to satisfy the investor and simultaneously subsidize the public core's construction. The city would endow the investor with the lot and collect private donations. Apart from that, Gerard envisioned, no further public funding was required.

In March 2003, Gerard asked Swiss architects Pierre de Meuron and Jacques Herzog from Herzog & de Meuron (HdM) to design a visualization study. The three had studied architecture together and were personal friends. While HdM worked on the study, Gerard, secretly introduced his idea to selected politicians, artists, and prominent people of Hamburg. HdM, already famous worldwide for uniquely ambitious projects, developed the design of a new glass-and-steel "wave" on top of the brick-and-stone warehouse. In June 2003, with a wooden-and-plastic model at hand, a construction cost

[9] HafenCity Hamburg GmbH: Hafencity Hamburg. Der Masterplan. Hamburg 2000.
[10] Hamburger Abendblatt: Wunschkonzert. Wie aus einer genialen Idee der größte Bauskandal in Hamburgs Historie wurde. Die unglaubliche Geschichte der Elbphilharmonie. Sonderausgabe, 13.12.2013, pp. 2f. (Cited as Abendblatt)

estimate of €75.3 million and a total project cost estimate of €116.3 million, Mr. Gerard called a press conference. The concept quickly gained wide support and enthused the city's public.[11]

Fig. 1: Clarification of Different Cost Estimates

Construction Costs	This refers to the pure cost of construction of the Elbphilharmonie, which is virtually equal to the value of the construction contract and its amendments between Hochtief and Hamburg.
Additional Costs	These costs mark all non-construction related project costs, such as planning costs incurred by the architects, costs for the project management ReGe, financing costs, taxes, and fees.
Total Project Costs	These are the complete project costs, construction and additional.
Notes	Due to the cost misrepresentation in different estimates, the presented data cannot be verified beyond doubt, as strategically, project developers took different budget positions out at different times to reduce the cost estimates. Thus, cost estimates have to be taken with some precaution. Also, the final costs of the Elbphilharmonie and with that the burden on taxpayers cannot be marked before the sale of the commercial envelope in 2030.

In December 2003, the Senate decided to investigate realization possibilities for the newly called "Elbphilharmonie" project and subsequently dropped the plans for an office tower. HdM's design was informally accepted without a further open bidding process.[12]

From a project perspective, neither construction plans, nor sound financial calculations existed at the end of 2003 - only a raw sketch of the building design. But Gerard had already created four of the most important path dependencies for the project: First, the idea of a publicly-owned cultural building core, its construction being cross-financed by a commercial envelope. Second, the desire to make it Hamburg's new landmark, designed by world-famous architects with a personal connection to Gerard, which would later have a significant impact on the planning contract. Fourth and finally, the belief that such a building could be constructed without straining Hamburg's budget.[13]

[11] Abendblatt, pp. 2f; B/PUA, p. 21, p. 142.
[12] B/PUA, p. 5.
[13] Path dependencies however can also be desirable to a certain extent, as they reduce complexity. Budäus, Dietrich: Fehlentwicklungen bei öffentlichen Großprojekten. Ursachen und Maßnahmen zu deren Vermeidung unter besonderer Berücksichtigung des Projekts „Elbphilharmonie" und der öffentlichen Beschaffungsvariante Public Private Partnership. Erstellt für die Bürgerschaft der Freien und Hansestadt Hamburg. Hamburg, 11.02.2013., pp. 12f.

2004 - Project Development and Internal Governance Setup

Early in 2004, Gerard, intending to become the lead investor, asked Hamburg to install a project coordinator as a single point of contact on the city's side to smoothen project development and negotiation processes, instead of talking to the various partaking city agencies himself.[14]

In May, Hartmut Wegener, an experienced project manager, agreed to do the job under two conditions.[15] First, he wanted to report directly to the First Mayor of Hamburg, Ole von Beust. He made the case this would enable a quicker, more flexible management outside of slow-paced, static city bureaucracy. Second, he wanted a private, but publically owned company for project management – the Projekt-Realisierungsgesellschaft mbH (ReGe).[16] ReGe had already managed several construction projects for the city. It employed a personnel of 22 of which six staff members were dedicated to the Elbphilharmonie full-time. As head of the firm, Wegener favored a LEAN approach to managing the project.[17]

Mr. Gerard tried to convince banks to partake in the project, but could not provide substantial securities as a private investor. The Kaispeicher lot could have served as security, but Hamburg was unwilling to transfer ownership before having a guarantee for construction.[18] With such high risk resting with the investor, Gerard did not find a bank. Also, Mr. Wegener and Mr. Gerard were not able to create a fruitful working relationship and repeatedly got into conflicts. Gerard finally gave up. In late 2004, Hamburg bought him out of the project and entered the existing contract with HdM.[19]

Thereby, ReGe's role increased dramatically. From the agency only managing the stakes of the city in a public-private project, it became its overall developer, planner, and manager. The core elements of the Hamburg-internal governance setup were determined. The public company, led by a single, powerful project coordinator would hitherto develop the project. ReGe would report directly to the First

[14] Abendblatt, p. 3.
[15] While experienced in handling large construction projects, Mr. Wegener did not have special credentials in highly complex, multi-use, above ground-level projects.
[16] B/PUA identifies Mr. Wegener as the Head of ReGe and project coordinator as one of the main decision makers responsible for the Elbphilharmonie's cost and time overruns. Mr. Wegener denies these accusations. This chapter is not an investigation into ReGe's internal dynamics, nor is its aim to assign personal blame. We avoid attributing decisions to individuals. Budäus, p. 10 mentions that explaining cost overruns through personal factors limits the opportunities for general improvement.
[17] Wegener, Hartmut; Uhl, Axel: Success and Failure Factors for Mega Projects. A Focus on the Airbus Plant Expansion and the Elbphilharmonie Construction in the Hamburg Metropolitan. In: 360° - the Business Transformation Journal 11 (2014), pp. 55 - 65, here p. 55. By LEAN Management, Mr. Wegener meant a small core team working on the project, hiring external knowledge for specific tasks and outsourcing others.
[18] B/PUA, p. 21, pp. 143f.
[19] Abendblatt, p. 4; B/PUA, pp. 144ff.

Mayor and worked closely with his office, but was only loosely linked to the city's administrative processes.[20]

2005 – External Governance & Tender Offer

Early in the year, ReGe extended the contract with HdM, making them the general planner for the Elbphilharmonie project. The relationship between the architects, the city, and the prospective construction company – the external governance setup - was particular: In complex construction projects, it is common to subject the planner to the construction company from the stage of execution planning on, to ease communication and release synergies.[21] Construction companies then often intervene in the planning process, seeking rents from low-quality execution, and limiting the architects' influence on construction. In this project, ReGe would serve as the interface between HdM and the construction company. By that, the city intended to satisfy the high standard of the world-famous architects.[22]

Hamburg invited Europe-wide tenders and started negotiations with six bidders on the basis of a feasibility study finished in July. The selected company should build the Elbphilharmonie and operate the commercial envelope (parking garage, hotel, apartments). From lease and sale profits, it should cross-finance the concert hall, invoking minimal financial input from the city. The feasibility study predicted total project costs of €186.7 million. The commercial envelope, financed by the private investor, was estimated at €69.7 million, the public core at €117 million. The costs for the public core would mainly be provided by private donations (€30 – 35 million) and the city (€77 million). The missing amount of around €10 million would be the expected cross-financing by the private investor.[23]

Private donations came quickly. In fall, a single donation by a renowned Hamburg entrepreneur provided €30 million, another €10 million each came from two different private sources. The city created the Stiftung Elbphilharmonie (Elbphilharmonie Foundation) to collect more private donations. With the sale of minted coins, auctions and other public relations activities, the foundation generated over €67 million up to 2008.

[20] Interview conducted in Hamburg by Jobst Fiedler & Sascha Schuster on 09.01.2015; Telephone interview conducted by Jobst Fiedler on 12.02.2015.
[21] B/PUA, pp. 114f. Budäus, pp. 13 mentions that a separation of planning responsibility is a disadvantageous arrangement in a complex project.
[22] Neither the official report by the Parliamentary Inquiry Commission, nor our interview partners could beyond doubt clarify whether this setup was desired by the city, the architects, or both. B/PUA pp. 113-118.
[23] See B/PUA, p. 30.

In the rest of the year (and continuing in 2006), after the feasibility study, the Elbphilharmonie still experienced some dramatic design changes. For example, deep into the tender process, the height between floors was reduced to enable more hotel rooms and condominiums, thereby increasing a possible profit margin.[24] The public started to get confused, as partially fundamental design changes led to repeated, publically quoted re-estimation of costs. Some new estimates seemed to contradict previous ones. They suffered from a lack of clarity of what was actually included – was it total project costs, pure construction costs, or the city's share in these costs?[25]

In 2005, an external governance setup in which ReGe would take on an important interface function was introduced. The resolve with which wealthy citizens supported the project fueled public support, fostering path dependencies.[26] Also, the tender process began. As part of that, design elements were changed several times to satisfy the investors' and Hamburg's claims to the performance and profitability of the project. As planning and tender process progressed, cost estimates increased.

2006 – Ownership Structure & Contract Closure

The tender process continued in 2006 with two remaining bidders. Estimated total project costs were at €228.6 million in April 2006, €143.7 million for the public core, €84.9 million for the commercial envelope.[27] In May, ReGe formulated a total project cost target of €210 million. With increasing cost figures, public support began to wane. Project leaders in ReGe and the Mayor's Office wanted to achieve a symbolic, but significant cost reduction to ensure continued public support.[28]

Construction company Hochtief suggested changing from the hitherto used investor model – in which the private investor would finance and operate the commercial envelope and give the concert hall to the public upon completion - to a forfeit model.[29] Here, Hamburg would take ownership of most of the commercial envelope – parking garage, gastronomy, and hotel (but not including the apartments).[30] The construction company would receive loans directly from the bank and bill Hamburg for construction

[24] Abendblatt, p. 5; B/PUA, pp. 65-69.
[25] Abendblatt, p. 5.
[26] Abendblatt, p. 6.
[27] B/PUA, p. 31.
[28] Abendblatt, pp. 6f.
[29] Hochtief represented the investor consortium Admanata as the official bidder in the tender process. Apart from Hochtief, Adamanta included a financial investor and potential tenants for the commercial envelope. We speak of Hochtief instead of Adamanta, since it was the major representative of stakeholder interests on Adamanta's side.
[30] Apartments stayed under ownership of Adamanta's sub-investor Skyliving, whom Hamburg would charge for the apartment construction. B/PUA, p. 10.

progress. However, they would actually sell this claim back to the loan-giving bank. Hamburg would thereby become the bank's creditor. As a public entity, it received better interest rates than a private firm. The resulting savings in interest payments reduced the projected cost by around €10 million.[31] Hamburg, now the owner of the commercial envelope, planned to lease it to the construction company for 20 years after end of construction, and use the income to cover interest payments. In 2030 (given a planned opening in 2010) the city would sell the commercial envelope and use the revenue to pay the remaining debt. The forfeit model seemed attractive not only due to cost reduction, but also since it promised higher control over construction execution and operation of a then city-owned commercial envelope. If, for example, a tenant in the commercial envelope went bankrupt, it would be Hamburg, not the private investor, who could select the new tenant. That promised a higher operations standard.[32] With more control, less cost, and only changed timing and origin of cash flows, the forfeit model seemed convincing.[33] Hamburg chose it.

In September, Hamburg awarded the project to Hochtief. Competing bidder STRABAG had not handed in a final offer but instead threatened legal action. They claimed that, due to the deficient planning stage, they could not make substantiated cost estimates, and make an offer only if charging a considerable risk premium of about €100 million.[34] Hochtief handed in an offer, and threatened legal action themselves if negotiations were not continued exclusively with them. Facing progress-hindering legal threats from both bidders, Hamburg resolved the situation by awarding the Elbphilharmonie contract to Hochtief, while promising other contracts worth €3 million to STRABAG.[35] Hochtief's offer of €257.4 million was considered slightly too high and revised again. The final package of contracts was signed in December. The lump sum agreement was worth €241.3 million, of which €142.3 million would be provided by the city.[36] Adding to this the additional costs of €110.5 million, total project costs were at €351.8 million.

The decision for the forfeit model, increasing external pressure, and the hasty tender process were core developments of the project in 2006. The cost reduction achieved through the forfeit model was a signal to the public: The city was committed to building the Elbphilharmonie - at reasonable cost.[37]

[31] Simplified description. See B/PUA, pp. 148-160, or Budäus, pp. 42ff.
[32] This was a specific scenario considered. Interview from 12.02.2015.
[33] Interview from 12.02.2015
[34] B/PUA, pp. 75f. Since we do not see a change in the tender process to potentially having resulted in better project delivery, we do not analyze it closer. A detailed reconstruction can be found under B/PUA, pp. 63-82.
[35] Interview from 12.02.2015
[36] B/PUA, pp. 75ff.
[37] Abendblatt, pp. 6f.

With contract signature, the mix of decisions made and influence factors had formed the setup that would lead to dramatic cost overruns.

Fig. 2: Selected Cost Estimates up to Contract Closure*

Cost Estimate	Construction Costs	Additional Costs	Total Project Costs	Comment
Project Description Gerard November 2003	€75.3 million	€41 million	€116.3 million	
Feasibility Study July 2005	€151.2 million	€35.5 million	€186.7 million	The building had been enlarged by around 50% from the previous estimate; The city's share of costs was estimated at €77 million.
„Second Cost Estimate" April 2006	unknown	unkown	€228.6 million	
Contract December 2006	€241.3 million	€110.5 million	€351.8 million	The city's share of costs was estimated at €142.3 million

* Sources: Bürgerschaft der Freien und Hansestadt Hamburg: Drucksache 20/11500. Bericht des Parlamentarischen Ausschusses Elbphilharmonie. 03.04.2014. Part 2, Chapter 1, pp. 20 – 62; Own estimates.

Ex-Ante Cost Underestimation

The massive case of cost underestimation was possible through a specific environment of weak oversight and pressure on ReGe. This enabled optimism bias and strategic misrepresentation of costs in the form of insufficient risk management and unfinished planning. Both enablers and the form of cost underestimation deserve closer investigation.

Outside Pressure and High Expectations

Since Mr. Gerard in December 2003 had published his ideas for the Elbphilharmonie, Hamburg was eager to see the project realized. Project leaders and the public were willing to accept that a project as ambitious as the Elbphilharmonie would not come free of charge, but in the run-up phase between late 2005 and late 2006, project costs seemed to explode. While project internals knew that cost increases were caused by planning progress and design changes, the external audience could not retrace why costs would escalate substantially.

With public support dwindling in the face of higher project costs, ReGe was determined to close the contract sooner rather than later. Project managers in ReGe and the Mayor's Office also saw pressure looming in the future: For budget reasons, they wanted to secure the project to be able to list

in the fiscal budget of 2007. Additionally, 2008 was election year, and ReGe wanted the project to be signed before election campaigns started to keep the project out of a possible line of fire.[38]

To keep public support stable and ensure parliamentary approval, ReGe needed to maintain a certain proportion of costs between public areas and commercial envelope: under the forfeit model, the lease and sale of the commercial envelope should generate surplus used to subsidize the building's public areas – a principle called positive cross-financing. In the project status of late 2006, it was one of the few remaining elements linking the 2006 publicly-owned Elbphilharmonie to its 2003 public-private partnership origin. ReGe had to make sure that construction costs for the commercial envelope would not reach a level above projected income. Otherwise, construction of the commercial envelope would have needed public support – taxpayers would have subsidized a luxury hotel, not as planned the other way round. ReGe played with the internal allocation of costs between the public and private building areas, lease rates and sale price to make sure this scenario of "negative cross-financing" would be avoided in the project planning phase.[39]

The external pressure resulted in the reduction of projected costs both unintentionally due to a too optimistic risk assessment and deliberately, against better knowledge. The described action imperatives could only take effect in a specific Hamburg-internal project governance environment. ReGe's special position in the city's administrative landscape enabled weak oversight over project managers' activities and enabled them to underestimate and miscalculate project costs without notice.[40]

Internal Governance Setup and Lack of Skepticism

As the project coordinator had wished when he came to the project in 2004, the Elbphilharmonie project was managed by an existing privately run company in public ownership. The head of ReGe and project coordinator reported directly to the First Mayor of Hamburg via the Mayor's Office, giving him a quasi-Senator status. The leading figures in ReGe and the Mayor's Office were the core team on the public side for the project until contract signature.[41] This core team was also a result of Hamburg's lack of capacity. The city had previously reduced its construction management capacity for

[38] B/PUA, pp. 69-72.
[39] The potential worst case scenario of a negative cross-financing was discussed within Hamburg's agencies before the decision for the forfeit model was made. Civil servants raised concerns over a public entity becoming the owner of a high-class hotel. B/PUA, pp. 149-155.
[40] It is undesirable to label single decisions as either "delusional" or "deceptive", since both work together. We suggest that for some decisions, the intentional aspect was stronger. Budäus, pp. 20, comes to similar conclusion regarding the effects of the "Elbphilharmonie-euphoria".
[41] Interview from 12.02.2015

above-ground projects.[42] Appointing ReGe as a management agency seemed a viable option. The general enthusiasm and perceived importance contributed to this setup. The project seemed to lend itself to be managed on a high level, outside of stiff city bureaucracy. Thus, it did not evolve through the administrative checks-and-balances process of the city government.[43]

This setup enabled ReGe to deceive the Hamburg Senate and Bürgerschaft in the run-up phase of the project because of an information asymmetry.[44] While the Senate requested expert outside opinions on critical project decisions, it tasked ReGe to gather this information. With that, possibly critical opinions would go through ReGe first before being presented to Senate or Bürgerschaft. Without engaging an external auditing entity for ReGe, both were dependent on ReGe's reports on project progress.[45] ReGe could filter every external piece of information (expert opinions) before presenting it to decision makers. For example, the Senate requested external opinions on a potential sale price of the hotel after the lease cycle would end in 2030. €130 million needed to be achieved to pay back the construction loan. ReGe tasked two companies with a report. Both warned of market insecurities and raised concerns that achieving the desired price over more than 20 years ahead was highly insecure. ReGe however ordered them to rephrase their reports several times before presenting it. In the final reports, both companies suggested that achieving €130 million was likely.[46]

In the beginning of 2007, the city added a board of supervisors as a more formal way of overseeing ReGe's work, replacing the direct reporting tie from ReGe to the First Mayor and the informal working process between ReGe and the Mayor's Office. The Head of ReGe had to report regularly and inform the board on important business developments. Board members mainly came from the senate. While various governmental institutions now received information on project progress, no Senate board member was a construction specialist, some came from the finance or culture department.[47] Also the process in which outside expert opinions were requested was not changed. The board was poorly equipped to establish an effective control over ReGe's activities.

The city agencies on their hand also did not try to engage more with the project. In parliamentary sessions and steering meetings, critical questions or raised concerns on cost assumptions were rare. The installation of the board of supervisors was to fulfill formal requirements rather to exert

[42] B/PUA, pp. 386f.
[43] Interview from 09.01.2015.
[44] Budäus, pp. 24.
[45] B/PUA, pp. 398ff.
[46] B/PUA, pp. 363-371, pp. 373-378.
[47] B/PUA, pp. 441f.

more direct control. General goodwill dominated.[48] Hamburg's government had no reason to be skeptical against the project or the work done by the Mayor's office and ReGe.

With ReGe serving as the only point of contact for all other agencies of the city and the partaking companies, it could filter all stakeholder communication. This enabled the deception of decision makers regarding projected costs before contract signature, and the concealment of the project's negative development until 2008. While inside ReGe the true status of Hochtief's additional claims was well known, ReGe had the opportunity not to report bad news. It took the high cost escalation levels of 2008 until ReGe itself took the initiative to inform the board of supervisors on the true status of the project – being way behind schedule and with serious financial claims at hand.

Lack of Risk Contingencies

An important source of cost and time overruns in projects is optimism bias - the tendency to underestimate project risks and overestimate its benefits, resulting in the insufficient accumulation of funds for unforeseen events.[49] Risk contingencies become especially important in projects with high technological risks, such as the signature project Elbphilharmonie. There was no previous experience in some architectural designs and technologies used, like the ceiling of the main concert hall ("White Skin") and the curved glass façade.[50]

Furthermore, deception played a role in the underprovision of contingency funds. Due to information asymmetry, project planners could underreport some high impact risks to lower cost projections: funds for bad weather days affecting construction were insufficient.[51] There was few information on the risk of installing critical and technologically challenging building elements. One requested expert opinion on the carrying capacity of the old Kaispeicher's foundation was still awaited at the time of contract closure. Only after construction had started, engineers found that other than expected, the concrete poles under the Kaispeicher lacked sufficient capacity to carry the Elbphilharmonie. This required additional placing of hundreds of more poles and entailed cost escalations.[52]

[48] Interview from 09.01.2015.
[49] Flyvbjerg (2005, 2009), passim.
[50] Abendblatt, p. 6; B/PUA, p. 574, pp. 57-60.
[51] B/PUA p. 243.
[52] B/PUA, pp. 185f; Abendblatt, p. 10.

Similarly, planners underestimated the technological challenge of the Elbphilharmonie's façade. Until 2006, there was no capable subcontractor for the world-wide unique facade consisting of thousands of individually shaped, differently curved, and laminated glass elements, and only rough cost estimates were available. In the contractual budget position, there were no reserves for possible production and delivery problems or damages during the installation process.[53]

In the cases presented, it would have been possible to improve the precision of cost estimates at the time of planning: By awaiting the report on the Kaispeicher's foundation and offers for the façade, and by taking a more cautious stance on average weather forecasts.

Unfinished Planning

At the time of contract signature, the planning of the Elbphilharmonie was far from finished, which meant that further planning continued parallel to construction. In large construction projects, the due process usually follows a sequence of 9 phases.[54] In the first phases, the relationship between client and architect is the dominant theme. After the client explains his functional needs and architectural taste, the architect drafts first sketches. Over a period of reciprocal interaction, the drafts become more detailed and planning for the building and its parts more specific. Ideally, the design plan phase is finished and all necessary plans exist. They give a full description of the building and should enable a precise cost estimation. At this point latest, a construction company joins the process. The design plans now need to be transformed into execution plans – the actual building manual with which the construction company gets exhaustive information on when and where to place what. At this point, the often creative client – architect relationship is replaced by a relationship between the architects and the construction company. The client rarely is concerned with the details of the execution planning and often, the architect formally reports and works according to the construction company's guidance. If a lump sum has been agreed between construction company and client, the construction company is responsible of on-time, on-budget, and on-quality delivery of the building. Only changes to the original planning at the client's request should imply additional costs for him. Risks from the execution planning or construction lie with the construction company. According to the contract and the client's intentions, the client can hire the construction company either at the time when also the execution planning has been finalized – resulting in an overall longer process, but with a high precision of cost estimates, or he

[53] Abendblatt, p. 6.
[54] This is a simplified description used for a vivid illustration of the process. See B/PUA, pp. 89-93, pp. 113-130.

can chose to start constructing with the design plans and in parallel continue with construction and execution planning. This saves time, but would trigger the construction company (in a fixed price contract) to charge a risk premium for a possible difference between design and execution plans. For highly standardized construction processes (like family homes, airplane hangars, or administrative buildings), the second option is a reasonable way forward, because technological and quality risks are seen as low and potential time savings are high.[55] For a highly unique building, a fixed price contract can be dangerous due to the risks involved. Costly change requests may easily be triggered.

When the construction contract for the Elbphilharmonie was signed in December 2006, different parts of the building had reached various planning stages: Very few had reached the status of execution planning, from which an actual construction would have been possible. Many had reached a design phase planning status. Some crucial building elements however had up to that point barely been included in the detailed planning process. In the definition of the scope of construction (Bausoll), some of these parts were indicated with just budget positions, with no substantiated calculations underlying cost assumptions. These budget positions were primarily used to reduce cost estimations, because no detailed information was backing up the claims, and thus the projected cost for individual budget positions later proved to be unrealistic. Due to the weak internal oversight setup, some unrealistic assessments went unnoticed. This includes the main concert hall's stage machinery. During the negotiation process, the budget for this position had shrunk from €13 million to just €7.5 million.[56] At no point had it ever been actually planned.

The unfinished planning of the Elbphilharmonie was a crucial factor for cost overruns. In the building contract, Hochtief agreed to build the Elbphilharmonie as defined in the Bausoll for a "lump sum" of €241.3 million. The Bausoll that was mentioned in the contract was enclosed as an appendix, yet it lacked a detailed level of planning for many parts of the building. When the Bausoll changed, Hochtief had a right for compensation, allowing them to claim remuneration in a formal process. ReGe and the Mayor's office were at that time also unaware that large construction companies like Hochtief had developed impressive claim management capacity not known in previous decades.[57]

[55] B/PUA pp. 113-130.
[56] Abendblatt, p. 7; in contract amendment four, the budget was increased to €16.2 million B/PUA, pp. 57-60, pp. 252f.
[57] As we will further explain below.

The incomplete definition of the Bausoll almost annulled the "lump sum" agreement of the contract. ReGe drastically underestimated the incompletion of planning. This enabled an extensive claim management by Hochtief, which serves as the main driver of cost escalations after contract signature.[58]

Interim Result: Hamburg's Joy, Hidden, and Rightly Foreseeable Costs

As we have shown, the unrealistically low cost projections in the 2006 contract were possible because of weak oversight and high outside pressure. Measures ranging from contingency-cutting over recalculations of unsubstantiated budget positions to handwritten "corrections" in external, critical reports were elements of optimism bias and strategic cost misrepresentation which first seemed to have a successful output: The contract was approved by the Hamburg parliament. It seemed to have fulfilled all expectations that the public, city government, and ReGe had created together. The contract promised the erection of a piece of architecture that would become Hamburg's landmark, uniquely combining its cultural purpose with a commercial envelope. A timely contract agreement had been achieved, as well as the goal of preventing negative cross-financing.

In the weeks following the contract signature, Hamburg was very satisfied with the impressive agreement project managers had reached with Hochtief. ReGe repeatedly declared publically that a guaranteed fixed price contract had been signed in which construction cost escalations would not lead to cost increases for the city. In a parliamentary question session, project leaders uttered their conviction that there was no possible cost increase for the city due to construction cost escalations.[59] These statements were legally correct, but still misleading. Only construction cost escalation during execution (e.g. rising prices for steel and concrete, construction damages or mistakes) would be at the construction company's risk. Other sources of cost increases, like change requests, were not covered by the lump sum.

Within the city's government and ReGe, well-informed employees and managers must have presumed or known that the contract did not only not offer a price guarantee, but that instead costs would necessarily increase in the construction process. In supervisory and working group meetings, employees had warned of the high risks unfinished planning entailed.[60] HdM had warned they needed

[58] We explain claim management below.
[59] B/PUA, pp. 455-460.
[60] B/PUA, pp. 65f, pp. 70ff.

more time to deliver a more detailed level of planning, and insisted that on the plans enclosed to the contract, a note was added reading "Not appropriate for constructing".[61]

ReGe and the Mayor's office knew that the Elbphilharmonie project was worth more than the €351.8 million of the lump sum agreement. However, they underestimated the difference between the value of the contract and the value of the planned building.[62] The ferocity with which decision makers in public declared that they had achieved a fixed price agreement with no chances of cost increases seems surprising. They hoped it would send a message to HdM and Hochtief to stick to the agreed contract and the lump sum.[63] But this strategy did not work out. Hamburg underestimated Hochtief's dedication to increasing its profit margin.[64] Also, with its public evocation of cost security, the public was even more shocked when cost escalations arose.

We do not see the cost escalations resulting from unfinished planning as sufficiently explaining cost overruns. Instead, the 2006 cost miscalculations were ex-ante hiding the actual – or Rightly Foreseeable – costs of the Elbphilharmonie. If due diligence had been applied to supervision, a more detailed planning level had been reached, and more realistic risk contingencies had been included in the contract, the insecurity about a final price could have been lowered substantially. Years into the construction process and with a finished planning stage, the hidden costs have mostly been revealed, thus ex-post presenting the Rightly Foreseeable Costs (RFC). We define them as those total project costs that could ex-ante have been disclosed before contract closure if planning had reached a full design status, all available and requested information on technological risks had been included in the calculation process, and effective compliance had been carried out by Hamburg's government. It is a counterfactual concept, as they can only be estimated in hindsight.[65] First, we lack information on future sale price and lease of the commercial envelope and the resulting intertemporal cash flow. Second, it is impossible to determine the monetary equivalent of single decisions in an interdependent environment. Though speculative, available data allows for an extrapolation of actual cost range.[66] They could have been determined if ReGe had made cost security its primary directive, giving planners the time they wanted to finish the planning process.[67] RFC are identical to the value of the Elbphilharmonie planned in

[61] B/PUA, pp. 110-113.
[62] Interview from 09.01.2015.
[63] Interview from 12.02.2015.
[64] Interview from 12.02.2015
[65] Though not using the concept, Dietrich Budäus, tasked with an economic investigation into the Elbphilharmonie's problems similarly speaks of the lack of transparency of ex-ante cost estimates: Budäus, p. 6.
[66] Hamburg's government tried to estimate RFC, but stopped the process because of its difficulty and its ex-post limited practicability for project delivery. Interview from 09.01.2015.
[67] Naturally entailing a longer planning and negotiation process, resulting in additional costs.

2006. Ex-post change requests are not covered by RFC. In order to give an estimate for the Elbphilharmonie's RFC, we have established lower and upper boundaries: They must be above the 2006 total project costs of €351.8 million because a) Most later PÄMs and budget increases would have been necessary anyway; b) The construction schedule was overambitious - a longer construction phase would have been necessary; and c) An extended planning phase would have been necessary. Analog for the upper boundary, RFC must be below the 2013 gross projects costs of €865 million because a) Many hold-ups could have been avoided; b) Transaction costs could have been mitigated before contract closure (synchronization of planning…); and c) Project cycle extensions (construction interruptions, negotiation phases…) entailed recursive cost overruns (opportunity costs, holding construction, planning, and management capacities, additional synchronization effort).[68] We assume them to be €550 - 650 million.

The concept of Rightly Foreseeable Costs does not entail that the project could have been realized at a lower price. But in 2006, decision makers had necessary information to give a better estimate for the final price. They could have known realizing the Elbphilharmonie would have cost €550 – 650 million, not €351.8 million.

There remains a gap between RFC, and the renegotiated contractual costs in 2013 of €865 million that deserves explanation. In different phases before the contract signature, the city made three fundamental decisions regarding the project's governance. Other than the factors described above, the consequences of these decisions were not assessable at the time they were made. Decision makers hoped they would result in cost reductions and more direct control over the Elbphilharmonie, ensuring the project's high quality standards. All three decisions put additional work and management effort on ReGe's team, the extent of which was underestimated. Each decision entailed high financial risk, which would have needed tremendous management effort. Also, the decisions were interdependent and worked together with the unfinished planning status. Their entangled nature and ReGe's inability to manage their impact worked devastatingly on the project's performance, resulting in cost and time overruns.

[68] The role of transaction costs is for example explained in Budäus, pp. 26.

Fundamental Flaws in Project Governance: Door Opener for Additional Costs

Forfeit Model

Amid the running tender process, not long before contract closure in December 2006, Hamburg agreed to forego the investor model for the forfeit model. ReGe hoped to achieve cost reductions in lower future interest payments. Taking full responsibility for the commercial envelope eliminated many interfaces between previously public and private areas of the building. With full control over the planning and construction process for the whole Elbphilharmonie, conflict potential between investors and the public side seemed drastically reduced, which should have ensured a high-standard delivery of the Elbphilharmonie's quality. The projected savings in future interest payments of around €10 - 15 million, stood against a tremendous amount of risk shifted from the investors to the city.

Hamburg first took over the full construction risk for the commercial envelope. Second, responsibility for finalization of planning for the commercial envelope moved from the previous investors to the city. Third, it took on financial risk: If construction was delayed, lease of the commercial envelope could not start on time to cover loan payments.[69] Finally, Hamburg needed to integrate the existing plans done by the investor into the overall plans. All factors later added directly to the city's bill, but at that time in a hardly predictable amount.[70] The shift in planning responsibility increased ReGe's workload, because it added up the pile of plan transfers they needed to coordinate between HdM and Hochtief.

ReGe highly underestimated the impact this decision would have on project governance and cost development. With the remaining insecurity about the future income generated by the lease and sale of the commercial envelope, the total impact on additional costs triggered by the forfeit model is speculative. Like many other decisions made in the run-up phase, it was caused by an underestimation of entailed risks and tacit acceptance of future cost increases. It was therefore delusive and deceptive in and of itself. What is more, taking ownership for the commercial envelope multiplied the available scope for optimism bias and miscalculations through insufficient risk assessment and exploitation of unsubstantiated cost estimations for then unplanned building elements. For the finalization of planning, the integration of investor planning, additional workload, interim financing, hold-ups, and realized

[69] B/PUA, pp. 152-156.

[70] The integration of the investor planning was the first big fight between ReGe and Hochtief – ReGe took the position that the integration of investor's planning was included in the contract, Hochtief argued it was not. After receiving extended legal advice, ReGe gave up its position and accepted Hochtief's claims. Interview from 09.01.2015, B/PUA, pp. 192-207.

construction risk, this decision created a multitude of additional costs vis-à-vis the realized savings in interest of €10 - 15 million.[71]

External Governance Setup

In the contract signed between ReGe and HdM when Hamburg took over the project from Mr. Gerard in 2004, it was agreed to leave the main responsibility for most of the execution planning with the architects. They would deliver the plans to ReGe, who would verify them and pass them on to the construction company. This arrangement did not count for the detailed planning of the supporting structure and technical building equipment (Light, Air Conditioning, etc.), which should be done by the prospective construction company.[72] As we have described above, in many construction projects the architects carry out the execution planning according to the construction company's orders, because it gives the client a higher cost security in a fixed price agreement. In the resulting hierarchical relationship between construction company and architect, the direct contact should enable a swift work progress.

ReGe's decision created a governance constellation in which almost all interaction between the architects and the construction company would take place through ReGe. This setup was created with two goals. First, to keep the architects as the city's advocate with some form of monitoring power over Hochtief's activity. Second, to ensure the realization of HdM's top standards in execution of the Elbphilharmonie.[73]

But the decision created a myriad of interfaces that needed to be managed by ReGe. Since some part of the planning was transferred to Hochtief, ReGe took on the task of aligning the content of both Hochtief's and HdM's plans for the building. They also needed to synchronize the on-time delivery of plans, since each plan possibly had to be transferred between the construction company and the architects several times so every partner could add their responsible share of planning.

The consequences of this setup, the additionally necessary work hours to define and synchronize planning may not have been clearly visible at the time the contract was signed in 2006. But ReGe underestimated the necessary work effort and was overburdened with planning synchronization shortly after construction start. As a result, the architects and Hochtief lost confidence in ReGe's work.

[71] One of our interview partners suggested that the necessary renegotation of the loan payment schedule in the face of the opening delay alone has cost more than €15 million. Interview from 09.01.2015.
[72] B/PUA, pp. 115-129.
[73] Interview from 09.01.2015; B/PUA, p. 114.

Additionally, their work relationship worsened, as they began accusing each other of delaying construction by withholding plans or not delivering them on-time. Hochtief started sending hold-up notifications to ReGe, with which they claimed additional funds for holding capacities ready without being able to build.[74] Overcoming the destructive working relationship posed as the main challenge in negotiating the 2013 project turnaround.[75]

By positioning itself as an interface between HdM and Hochtief, ReGe got better monitoring power and control over planning and construction execution. But ReGe's underestimation of the work effort to synchronize plans led to large cost escalations and time overruns. Furthermore, ReGe's weak compliance contributed to this growing backlog remaining hidden until 2008.

Parallel Processing of Construction & Planning

Hamburg decided to go for a parallel process of construction and planning for the Elbphilharmonie. This decision was motivated by a variety of reasons. First, ReGe had some limited experience with this procedure from some previously managed building projects. Those however were far less complex. Still, ReGe thought the potential impact in coordination effort to be manageable.[76] Second, ReGe felt that the option of a finalized planning before construction start was not desirable, despite the architects repeated warnings that they needed more time for planning before construction start, and that starting construction too early would result in substantial cost overruns. ReGe decided to continue despite this warning for two reasons. The project coordinator argued that architects would have a natural incentive to plead for more planning time before a construction start. They would use this time for more than just finer planning. He feared that in a signature project like the Elbphilharmonie, planned by architects of worldwide reputation, HdM would also use additional time to increase the building standard by including potentially extravagant elements that would cause additional costs. By pressuring them, he hoped they would focus on simple, more standardized execution planning rather than including more expensive "dream material".[77] ReGe itself worked under the pressure of possible project cancellation. The more detailed plans got before closure of the tender process, the higher projected costs got, eventually approaching the Rightly Foreseeable Costs. Since ReGe feared a political veto to the project if costs estimates got too high, they worked towards a swift

[74] Abendblatt, p. 6; Interview from 09.01.2015; B/PUA, pp. 129f.
[75] Interview from 09.01.2015.
[76] B/PUA, pp. 69-75.
[77] B/PUA, pp. 69-75.

contract signature at the risk of later cost escalations due to planning refinement. The decision was driven by a mixture of felt necessity and outside political pressure. It was deceitful because the unfinished planning paved the way for a quick lump sum agreement. But it was also subject to optimism bias, since ReGe once more underestimated the decision's impact. ReGe lacked the expertise to reliably assess the planning status at contract closure and the internal governance setup hindered the flow of critical information, such as the architects' warnings.

With the decisions to go for the forfeit model, the external governance setup, and parallel processing, ReGe found itself in a unique position as the projects primary interface between all partaking entities. Due to the self-overestimation of its capabilities - mainly by the project coordinator - it had not only taken on all of the city's stakes in operational management, but also important parts of project management that would have been directed to HdM and Hochtief under a more standardized governance setup. ReGe was the coordinator between the city, the architects, and the construction company in a project with unfinished, unsynchronized, uncoordinated planning, and divided planning responsibility. The plans also needed to be quality-checked by ReGe to make sure they met the city's requirements without entailing costly extravagancies. The workload this coordination effort caused for ReGe was tremendous. ReGe was overwhelmed with the management of the planning process soon after construction had started. It resulted in the late delivery of partially barely checked construction plans to Hochtief, which enabled them to realize a massive amount of financial claims due to planning changes and emerging time overruns.

Cost Escalations: Change Requests and Claim Management

After the contract had been signed, user change requests added to the quickly escalating costs. These user change requests were not results from the continuation of planning, but external wishes for partially fundamental alterations of the Elbphilharmonie's functionality. Change requests came from Hamburg's government, such as the cultural authority, or the Bürgerschaft. Among other things, their change requests contained the inclusion of a third, smaller concert hall that could serve as a choir rehearsal room, the enlargement of the ticketing area, and the addition of a cafeteria.[78] The implementation of these changes required rescheduling of many parts of the buildings, resulting in cost escalations for planning and construction. The responsibility for these changes does not rest with ReGe

[78] B/PUA, pp. 53f. The report claims user change requests were made one month before contract closure. This would still be insufficient time to include such drastic changes in an ongoing planning process.

or its supervisory body, but were an avowed will of the city's political representatives.[79] The implementation of change requests altered the scope of construction (Bausoll), the heart of the Elbphilharmonie's contractual lump sum agreement. Costs of user change requests were therefore not part of the contract and were claimed by Hochtief.

Still, the unfinished planning status had a drastically higher impact on cost escalations, because it enabled Hochtief to carry out an extensive claim management.

Claim management means the systematical demand for financial compensation by taking the legal position that new plans deviated from the Bausoll.[80] This became possible because Hochtief in its contractual lump sum offer used calculations based on experience in similar projects and standard unit prices, while the plans the architects made set a high-level quality standard. The decision to parallel process construction and planning in this high-quality project opened up the floor for legal arguments on what distinguishes a *more detailed* from a *different* plan – is a detailed high-quality execution plan qualitatively different from the imprecise standard-quality design plan? Or is it just a plan refinement included in the lump sum agreement?

In practice, when execution plans reached Hochtief, they would take the position it deviated from the Bausoll covered by the fixed price agreement, and claimed funds. ReGe would counter arguing the execution plans were just more detailed descriptions of the agreed Bausoll, and thereby part of the lump sum. Even if the construction costs were higher than the associated budget position, this would be at the construction company's risk, for which they would have to bear the additional costs.

In the first step of the claim management process, the construction company sends a Projektänderungsmeldung (Project Change Notification, PÄM), with which they notify the client of additional costs due to new plans. The client then has three options. First, they could veto the PÄM and argue that the new plan was just a more detailed description of the Bausoll, opening the floor for a long, costly, and complex legal process with an uncertain verdict. Second, they could accept the PÄM and pay the claimed price on top of the initial contract costs. Third, they could accept the PÄM, but try to reduce its price tag. This may be possible because a construction company is not obliged to search for the lowest available price for the realization of the new plans. But if the client successfully shows that there

[79] Cost escalations due to user change requests are investigated in the B/PUA. They assess them to be at €0.1 million, pointing at the higher shell construction prices. Shell construction is only a small share of overall construction costs. The changed areas needed equipment, interior fittings, and rescheduling of plans. The assessment is unrealistic. It would also contradict existing research, which identifies user change requests in a running project as a main driver of cost escalations.

[80] Simplified description of the claim management process. See B/PUA, pp. 171f, Chapter 5 (pp. 170-269) for more detail.

are cheaper offers available, the construction company must take that offer. Since the PÄM usually already entails detailed cost estimations, disproving the construction company can be an expensive endeavor.

For ReGe, a fourth option existed to prevent claim management in the first place. They could have precisely checked all execution plans finished by the architects, compared them to the Bausoll, and anticipated arising PÄMs. If they found possible problems, they could have returned the plans to the architects and demanded revision.

Extensive claim management has been called a structural element of the German construction business.[81] Since public entities are required to take the cheapest offer for a construction project, companies tend to underbid each other below a profit margin, assuming increased profitability after construction start through claim management. Many construction companies possess an advanced legal capacity to build effective claim management, making a legal confrontation expensive for the client.[82] Hochtief exercised a drastic form of claim management, since it found itself under pressure. The company had lost profitability and was under risk of being taken over. Claim management should help it to increase revenue again. Hamburg did not take sufficiently into account the bad situation in which Hochtief was, but also the previous build-up of their claim management capacity. So, it found itself in an unfavorable situation.[83]

To effectively counter a well-done claim management, the client needs to establish an anti-claim management of his own, which either entails having a legal service that counters the legality of PÄMs, or having experienced civil engineer department capable of renegotiating the price tag of the PÄM. The formation of claim management can be hindered by starting constructing with a finalized execution planning, or by having the construction company do the execution planning.

Developments until Project Turnaround 2013

2007 – 2008: Contract Amendments

In the four months between contract signature and the foundation stone ceremony on April 1st, 2007, several events hit the project. In early march, hold-up notifications by HdM and Hochtief reached

[81] See for example: Handelsblatt: Die Stunde der Claim Manager. Sie handeln, wo Chef und Syndikus versagen. 03.04.2005, last access 13.03.2015.
[82] Interview from 09.01.2015.
[83] Interview from 12.02.2015. Budäus, pp. 20ff gives a game theoretic account of claim management.

ReGe, and the first PÄMs dropped in. One day before the ceremony, ReGe's second in charge, project manager Heribert Leutner, resigned.[84] Already in March, the first contract amendment was agreed between ReGe and the construction company. Hold-ups due to missing plans resulted in €1.657 million additional costs for Hamburg.[85] From there until the end of 2007, the decisions on governance processes and setup all came together and resulted in an overstrained ReGe not capable of coordinating the planning process. ReGe failed to verify the architects' plans, and did not have the resources to build a substantial anti-claim management. For an extended period of time, PÄMs and hold-up notifications arrived in ReGe's offices on a daily basis.[86] They originated in user change requests as in the case of the third concert hall, late delivery of plans, a lack of precise planning, realized risks as in the case of the concrete poles, or changes necessary due to EU-wide requirements on fire and flood protection.[87] For many PÄMs, a checking process did not take place. For others, the process just consisted of the project coordinator refusing to pay the quoted price by a handwritten amendment of the document.[88] The costly integration of investor planning took until summer 2007. ReGe's incapability to synchronize plan delivery resulted in a mass of costly hold-up notifications.[89]

On June 18th, 2007, the integration of the investor planning was finished. As of then, the existing PÄMs totaled around €10 million.

Soon after, ReGe reacted. In October 2007, it ordered to pass HdM's plans on to Hochtief without checking. Also, ReGe decided to stop trying to verify individual PÄMs and aim for a packet solution paying Hochtief a sum for all backlogged PÄMs. Also in October, the second amendment to the contract was agreed, which rescheduled the loan payment plan. It resulted in €0.5 million additional costs due to rising financing expenditures.[90]

The city government was informed and agreed to the first two contract amendments, which totaled slightly above €2 million. Both did not point at further project-internal problems. The more critical developments regarding rising PÄM demands and hold-up notifications, ReGe's lack of resources,

[84] Abendblatt, p. 10.
[85] B/PUA, p. 48.
[86] Abendblatt, p. 10.
[87] B/PUA, p. 564.
[88] Mr. Wegener's personal style of anti-claim management seems sometimes successful. When notified that Hochtief claimed over €5 million for the additionally necessary concrete poles founding the Kaispeicher, he sent back the document, commenting "We are paying for this unsubstantiated impertinence!" The city finally paid around €1.35 million. B/PUA, pp. 185ff.
[89] One of our interview partner suggested this was the single most expensive mistake. Interview from 12.02.2015.
[90] Bürgerschaft der Freien und Hansestadt Hamburg: Drucksache 18/6905. Mitteilung des Senats an die Bürgerschaft. Bericht über den Stand des Projektes Elbphilharmonie Hamburg. 04.09.2007, p. 2; B/PUA, p. 49.

and the destructive work atmosphere were not reported to the board of supervisors, the First Mayor, or the Bürgerschaft.

After the Hamburg general election of early 2008, resulting in the Mayor's reelection, main actors in the internal setup changed. The administrative responsibility was shifted from the city development department to the cultural department, and key personnel in the First Mayor's Senate Chancellery changed. The cultural department had the impression that project control had not been exercised well enough before, and decided to delve deeper into the project's status.[91] Under the new setup, and with different members, the board of supervisors started to pay closer attention to the project's progress, just in time when information on the project's critical status had started to diffuse into the city government.

In the summer of 2008, enough information on the project's critical status had escalated to the First Mayor that major steps seemed necessary. The claims in collected PÄMs Hochtief made now summed up to over €60 million. Additionally, Hochtief informed ReGe of its claim of over €90 million for construction hold-ups. While Mr. Wegener as head of ReGe tried to reach a package agreement in confidential meetings with high-ranking members of Hochtief – contract amendment three about all hold-ups and PÄMs - other members of ReGe and the city government dissociated themselves from him. The Bürgerschaft remained unaware of the project's problems, depending mainly on rumors and newspapers information. Officially raised questions on the project status were mostly answered not at all or evasive.[92] Mr. Wegener seemed unsuccessful in his negotiations and the city government finally lost trust in him, leading to his resignation in early September 2008.[93] Heribert Leutner, the previous project manager who had left ReGe in March 2007, became its new head shortly thereafter. He began with a new negotiation for a packet agreement called contract amendment four (since three under Mr. Wegener's leadership had failed). The city decided to more directly control ReGe's activity and installed a construction committee alongside the board of supervisors. It was supposed to be staffed with construction experts and gave the board the power for expert opinions unfiltered by ReGe. Its influence remained limited.[94]

[91] Interview from 09.01.2015.
[92] ReGe argued that it could not give information to the parliament pertaining the progress of negotiations with Hochtief, because they would get published and thereby weaken ReGe's bargaining position. See for example Bürgerschaft der Freien und Hansestadt Hamburg: Drucksache 18/6943 from 18.09.2007; 18/7278 from 13.11.2007; 18/7408 from 30.11.2007; 18/7641 from 11.01.2008; 19/73 from 04.04.2008. Full citation provided in bibliography.
[93] B/PUA, pp. 292-310.
[94] Interview from 09.01.2015.

On the 26th of November 2008, contract amendment four was signed.[95] The €137 million consist of €48.2 million for run-up PÄMs, €22 million for budget increases for still unplanned positions, €36.8 million for hold-ups, and €30 million as an agreement sum. With that agreement, all existing and then expected financial claims had been settled. The unique governance setup that had fundamentally caused the claims remained unchanged. Planning was still unfinished, as the €22 million for budget increases point at. Neither was there cost security, nor a robust completion date.

2009 – 2013 Hardening of Positions & Turnaround

As hold-up notifications and PÄMs started coming in again in 2009, the insufficiency of contract amendment four became obvious to ReGe and the city government, their frustration now starting to turn against Hochtief. After the devastating revelations of the summer of 2008, the city government exerted control over the project wherever possible. The project remained on top of the city government's agenda. The parliament installed an inquiry commission to investigate the events of 2008 and the run-up phase before 2006, trying to identify a responsible actor.[96] To counter the newly arising claims, ReGe's staff was doubled to build better anti-claim management.[97] This could not stop the run up of claims and only contributed to the already poisoned work atmosphere. The city and the construction company continued to threaten each other with legal action.

In a timeframe between 2010 and 2011, the Elbphilharmonie project started to damage both HdM's and Hochtief's professional reputation. Also, important actors left the scene. On February 20th, 2011, a new First Mayor was elected who quickly familiarized himself with the project's status. Within Hochtief and HdM, key personnel changed, which enabled a new approach to the project. But before that became effective, the fronts hardened. A first attempt to renegotiate another contract amendment that would also target the project governance setup (suggested by Hochtief) failed because it did not include a solution for run-up claims. Shortly afterwards, in October 2011, construction activity fully stopped. Hochtief argued that due to concerns over the structural capacity of the building, it would be dangerous to lower the roof.[98] Hamburg and HdM vetoed and demanded the roof's lowering. This showed that apart from hold-ups and planning changes, also construction shortcomings and the question of their accountability had added to the disputed claims. Until the summer of 2012, several

[95] B/PUA, pp. 50-61.
[96] B/PUA, pp. 1f.
[97] Budäus, pp. 23.
[98] For details about the construction stop, see Abendblatt, p. 14.

offers for a contract amendment including a new governance setup were exchanged between the city, the architects, and the construction company. They all include the suggestion for a new governance setup, but all leave out the settling of past claims on construction execution and risk ownership. Legal threats and ultimatums still dominated the atmosphere.

While contract termination and legal scenarios were drafted and discarded on the operational level between all project parties, the new city government started to engage in informal meetings with high-ranking members of HdM and Hochtief – ReGe was mainly left out of the process, since an agreement between the parties on the operational level seemed unachievable. All sides expressed their willingness to successfully carry out the project. The city was convinced that the most important goal was to re-establish trust between HdM's architects and Hochtief's engineers on the operational level. The negotiations continued through 2012 and slowly took form. On December 12th, 2012, the mayor presented the cornerstones of a new agreement with Hochtief during an extended press conference.

On April 9th, 2013, contract amendment five was signed – with far reaching concessions made by Hochtief.[99] For the construction cost sum of €575 million, Hochtief agreed to take on all liabilities for already constructed and still to be constructed parts of the Elbphilharmonie. The architects were subjected under the direction of Hochtief, planning was to be finalized according to Hochtief's guidance, with HdM keeping a creative leadership. A fixed schedule with contractual penalty arrangements was included as well as Hochtief's guarantee to refrain from further claim management if the city stopped change requests.

Since April 2013, no new financial claims have been asserted. The current construction progress is before schedule. On mid-January 2015, the city announced the opening of the Elbphilharmonie for January 11th, 2017.

[99] Abendblatt, p. 14f.

Fig. 3: Contract Amendment Overview*

Contract Amendment	Value of Amendment	Construction Costs	Additional Costs	Total Project Costs	Comment
Contract Amendment 1 March 2007	€1.6 million	The amendment was necessary due to a six week long delay in construction. The amendment sum was agreed upon only together with amendment 4.			
Contract Amendment 2 October 2007	€0.5 million	Increase in financing costs due to a reorganization of the payment schedule and an agreement on the final loan interest (4.85% p.a.) for the forfeit loan.			
Contract Amendment 4 November 2008	€137 million	€378.3 million	€182.5 million	€560.8 million	
New Contract 2013		€575 million	€290 million	€865 million	No value of amendment given, since new contract.

* Sources: Bürgerschaft der Freien und Hansestadt Hamburg: Drucksache 20/11500. Bericht des Parlamentarischen Ausschusses Elbphilharmonie. 03.04.2014. Part 2, Chapter 1, pp. 20 – 62; Own estimates.

Additional Costs and Possible Impact Mitigation

It took Hamburg over six years to reach an agreement on a new contractual setup including the project's governance. This new contract has been called highly beneficial and secure for the city by several experts and seems to have successfully locked costs.[100] While cost overruns up to the point of Rightly Foreseeable Costs had been unavoidable, the city missed opportunities to limit the impact of the decisions for the forfeit model, the external governance setup, and parallel processing. Though ReGe tried to adapt to the situation it had gotten itself into, neither a change of ReGe's leadership, nor its decision for a packet solution could hinder a further escalation of costs after 2008. The increase of oversight on ReGe's activities after the contract amendments in 2008 did also not contribute project success. The turnaround became possible through an informal negotiation process involving a changed leadership in all partaking entities.

The city could have tried to stop further cost escalations already at the time of (or even before) the fourth amendment in 2008. First, ReGe could have increased its operational capacity, which later happened in 2010. The additional staff could have worked on three possible issues: the synchronization of planning, hindering construction hold-ups, an in-depth examination on architects' plans, trying to anticipate and eliminating their impact on additional PÄMs, or an increased anti-claim management to reduce Hochtief's financial demands. All four actions could have reduced cost escalations in the existing governance setup, while only increasing ReGe's operational costs in an acceptable amount. When ReGe did increase its capacity in 2010, it focused on anti-claim management driven by legal threats. The effect

[100] Abendblatt, p. 14f.

on cost mitigation then was low, but it contributed to a hardening of the situation and the resulting construction stop. This made clear to all parties that without a final settlement, a long and costly legal process was lurking, in which a clear winner was unlikely.

Second, ReGe could have tried to reach an agreement on a preliminary construction stop with Hochtief to finalize planning before further construction. While this would have been costly and cause delays, a finalization of planning could have limited further cost escalations driven by PÄMs and contribute to hindering further hold-ups due to late plan delivery.

Third, the city government could have tried more forcefully to reach an agreement to renegotiate the external governance setup and subjugate HdM to Hochtief's guidance, as was finally agreed in 2013. This may have caused a significant additional risk surcharge and long negotiation process, but could have hindered further hold-ups, limited the amount of future PÄMs, and reduced the costs arising due to ReGe's mismanagement earlier.

Finally, ReGe could have urged the city not to bring in change requests after contract signature, and proceed with the Elbphilharmonie that had been designed by December 2006. This option could have contributed to a lowering of cost escalation in an easy to estimate amount.[101]

With each cost mitigation attempt, ReGe could have reduced hold-ups and cost escalations. At the same time, each of these cost mitigation measures would have probably altered the now final planning status of the Elbphilharmonie. The continuation of planning according to the architect's highest quality standards was an important factor in cost escalation. Cost mitigation attempts could also have lowered the execution standard. Whether the now possibly higher standard is worth the cost increase cannot be answered here.

Mr. Wegener as the original head of ReGe followed a LEAN management approach and wanted to manage the project with a small team, hiring external capacity when necessary. It quickly became visible that this approach was not suitable for the tasks ReGe had taken on. He tried to solve the problematic situation by sticking to his approach and the governance setup, reaching a one-time agreement with Hochtief in 2008, and hiding the devastating situation from supervision in hope for a personal solution. This failed and was driven by unrealistic expectations.

[101] By the amount of overall user change requests, which we assess to be underestimated in B/PUA.

After Hamburg had signed on to the 2008 agreement, the city again was convinced to have reached a sustainable agreement, and that planning had largely been finished, despite internal memos pointing at the possibility that the 2008 agreement may not be the final solution. The city discarded thoughts on a change of the external governance setup, because it did not want to give up control over quality after already having lost control over costs and schedule.[102] It remains unclear why even under an increased supervision, not enough information became available to the city government to see that planning remained unfinished and would again cause cost escalations.

It has been argued that Hamburg missed an opportunity to reduce costs by not re-opening the tender process after the penultimate bidder had dropped out of the process. We disagree with that notion. In 2006, ReGe was incentivized to present the contract with the lowest offer acceptable to decision makers, and private competitors were incentivized to present the lowest possible offer. With a reopened tender process, competitors may have underbid each other, but mainly through more deception. There was no incentive for a realistic cost assessment in 2006, since it would have led to a withdrawal from the construction process. With a reopened tender process, better offers for the city may have been agreed to, but not better contracts resulting in lower costs.

Lessons Learned

The cost and time overruns occurred due to a unique interplay of governance decisions resulting from the conceptually established factors delusion and deception. The lessons we can draw from the Elbphilharmonie case are therefore mostly confirming other researchers' conclusions.

1. A finished planning process should lie at the heart of any contractual agreement. Unfinished planning is an invitation for ex-ante miscalculations of costs which later lead to cost escalations. A thorough planning process is therefore necessary to avoid later cost escalations.[103]

2. Change requests after project start are a main driver of cost escalations and time overruns. With the decision to plan thoroughly, change requests should also be neglected after project start to avoid cost escalation.

[102] Interview from 09.01.2015.
[103] Also in Budäus, pp. 8.

3. A strong supervision over project managers' assumptions and calculations should be established. External, expert oversight over the project status is necessary to avoid deception.

4. A realistic risk management is needed. In the negotiation phase, contingencies offer an easy option of cutting predicted costs. Unrealistic risk assessments lead to costs escalations.

The above lessons can all be challenged. Repeatedly, project managers of public megaprojects in Germany have argued that deception would be the only way to realize a project in the beginning.[104] If projected costs would be assessed more realistically, the realization of projects that required political approval would become impossible once costs reached a critical level. Therefore, project managers have an incentive to avoid strong oversight and start projects in phases of unfinished planning, knowing that costs will escalate. Once a political will to realize a project has formed, a later cancellation of the project, even if costs rise substantially, is unlikely.[105] Unfinished planning and change requests, by that argument, would be necessary parts of public projects. Also, while change requests lead to cost escalations, they can also be a worthy value added to the project.

The demand for a better risk provision may be unrealistic as well. If the public side included higher contingencies to make up for optimism bias and potentially arising planning changes, it would be very unlikely that a profit-driven company would not find a way to argue that the risks had realized and claim the full amount of contingencies. In a public – private contractual setting, risk contingencies run the danger of fully being used if no mechanism is contractually included to circumvent it.[106]

To a certain extent, cost and time overruns in public megaprojects seem to be innate in the system of tender processes. A German federal commission is currently working on suggestions to improve this system.[107]

If we accept that deception is a necessary part of project planning, and that many beloved buildings across the world would never have come to life if decision makers had known ex-ante what they would cost, these are still no arguments for a fatalistic view of the world. While public project managers and private contractors may be incentivized to ex-ante hide true costs of projects, they are not incentivized to let projects fail or almost fail, inflicting damage on the public's or private sector's reputation, or

[104] Stated by architect Mr. Gerkan in an interview together with Mr. de Meuron. Der Spiegel: Versaute Verhältnisse. 10.06.2013, last access 13.03.2015.
[105] While this is a common belief of decision makers and can serve to justify deception, we have not found any example of a large public infrastructure project that has been cancelled in a political process because pre-contractual cost estimates got too high.
[106] This is an idea developed during an informal talk in the German Ministry of Finance.
[107] Bundesministerium für Verkehr und digitale Infrastruktur: Reformkommission Bau von Großprojekten, last access 13.03.2015.

damaging decision-makers' careers. There should be an incentive for well-done project management under operational conditions. This has also failed under ReGe's lead. Apart from generally applicable, yet hard to implement lessons in the current system, we can derive additional lessons from the Elbphilharmonie case.

5. Project Managers should early on try to manage public and political expectations into what a project can achieve through strategic communication and measures of participatory governance. With public stakeholders first expecting a cost-free, and then cheap Elbphilharmonie, frustration was almost sure to follow. This was exacerbated by ReGe's insistence that the 2006 contract offered cost security, despite better knowledge. The continued attempt to hide the project's current status additionally increased the impact of the 2008 shock.

6. Project managers must analyze the potential interdependencies of governance decisions made over time and estimate their potential consequences. Parallel processing of planning and construction and the chosen external governance setup each had dramatic potential impacts on project management, but it was their entanglement that caused ReGe's capacity overload. An early made assessment on these consequences could have led to a better estimate on the decisions' risk, and to a necessary re-adjustment of the project management approach.

7. Executives must quickly adapt to changed circumstances. ReGe knew that costs would escalate after contract signature, but the intensity with which the claim management started came as a surprise to them, which was not aware of the cultural change of large construction companies. The negative consequences of the governance setup were clearly visible by then, but ReGe failed to strategically react to the challenges at hand through trying to realize one of the suggestions above, but instead continued its previous management style.

8. Project Managers must escalate the negotiation process if necessary. ReGe's decision to proceed with the complex project management on their operational level and hide the project challenges only contributed to the 2008 shock. The 2012 renegotiation was possible on a political level. Escalating project governance in time may have resulted in an earlier agreement. Political responsibility for the project was above the operational level. A process escalation may then internally have cast an unfriendly light on ReGe's acting head, but Hamburg's administrative level was incentivized to prevent project failure just as much as ReGe.

Conclusion

Optimism bias and deception were the causes of cost and time overruns in the Elbphilharmonie case. They were fostered by public and political pressure and high expectations, and manifested as insufficient risk management, unfinished planning at construction start, weak oversight, and three critical governance decisions whose impact was devastatingly underestimated: Putting ReGe as an interface between HdM and Hochtief, parallel processing of planning and construction, and taking ownership of the full building. The work effort resulting from the interdependency of these decisions overwhelmed project managers. But it remained hidden up to 2008. Change requests added to rising costs. All flaws were codified in the 2006 contractual setup. Cost escalations up to Rightly Foreseeable Costs were unavoidable. Nevertheless, Hamburg missed chances to mitigate further cost escalations through a mutually agreed construction stop, anti-claim management, or an attempt to renegotiate the governance setup. Even after cost escalations had shocked the city in 2008, project management was not significantly adapted, nor did the city try to reach a new governance setup. Mistakes of 2006 were repeated in 2008, since optimism still reigned. While considering a scenario for a new governance setup, Hamburg decided it was not willing to risk losing control over execution quality after already having lost control over time and cost schedules. Project managers underestimated how much Hochtief was dependent on claim management to make the project profitable and what pitfalls still laid in unfinished planning in 2008. As the project continued and another round of cost escalations followed, Hamburg saw the necessity for a new governance setup. But in the process-driven, legally constrained environment of a German public entity, Hamburg had limited opportunity for action against a private company. After almost all personnel on operational and politically accountable level had changed in Hamburg and Hochtief, an agreement came in reach. It took a continued exchange of legal threats and a long process of informal negotiations to reestablish trust, and finally to sign the new contract that in 2013.

Hamburg is to blame for the flaws of the 2006 contractual setup, the initial governance setup, and the repetition of mistakes in 2008. Chances for cost mitigation were missed due to a continued optimism bias. Getting out of the disadvantageous position vis-à-vis the construction company was a difficult challenge, as the constraints of a public entity limited Hamburg's bargaining position against Hochtief. The 2013 contract offers cost security for the city, but achieving this contract was costly itself.

For future projects, decision makers need to pay closer attention to the interdependency of governance decisions, and their structurally limited range of actions to repair damage done.

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