Megaproject

# Delivering European Megaprojects

A Guide for Policy Makers and Practitioners

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# About this report

## Who should read this guide?

This guide is aimed at policy-makers and practitioners who are involved in the commissioning, design and delivery of megaprojects in Europe. The target population includes;

- Best practice organisations concerned with megaproject design and delivery (construction, project management and other related areas such as contract management)
- Sections of international funding organisations concerned with infrastructural project capacity development (e.g. Capacity Development Resource Center, The World Bank: The Projects Directorate, The European Investment Bank)
- Private sector organisations concerned with megaproject design and delivery including client and contractor organisations
- Appropriate Directorate Generals of The European Commission (Energy, Mobility and Transport and Regional Development
- National Governmental Organisations responsible for the commissioning of infrastructural projects or for the governance of the commissioning process
- Bodies involved in developing EU funded research priorities

## What is the purpose of this guide?

This guide translates the research findings of the MEGAPROJECT COST Action into actionable recommendations for policy and practice. MEGAPROJECT is a network of over 80 researchers from 25 countries that are working together to improve the design and delivery of megaprojects across sectors in Europe. More information about MEGAPROJECT can be found at www.mega-project.eu and the names and the affiliations of the participants are given in Appendix A.

## What is the provenance of this guide?

MEGAPROJECT is based on the fundamental premise that any recommendations on improving megaproject performance must be based on real-life evidence. To this end, MEGAPROJECT has bought together the experiences of over 50 European megaprojects to establish what patterns of characteristics are associated with good and bad megaproject delivery performance. They have gathered together a group of 30 cross-sectoral cases into the MEGAPROJECT Portfolio. This is an open.-source freely available group of cases available online in a standardised format searchable with key words. This is available to any individual or organisation to

benchmark their own megaproject experiences. The MEGAPROJECT Portfolio can be accessed at www.mega-project.eu/Portfolio and the MEGAPROJECT Cases are listed in Appendix B of this document.

Once MEGAPROJECT had gathered together its evidence, it began a series of rigorous and systematic analyses to arrive at evidence-based recommendations to improve megaproject performance. MEGAPROJECT employed established and well-regarded qualitative and 'cutting-edge' quantitative techniques in its analysis processes. In particular it used novel statistical approaches to cope with the variability and (comparatively) small sample sizes encountered in megaproject research. It also used innovative machine learning techniques that specialize in spotting relationships in complex characteristics like those present in megaprojects. The width, breadth and depth of approaches of MEGAPROJECT are unique both in Europe and globally. This analysis approaches have identified the key drivers that are presented here in this guide.

Researching megaprojects is to be multi-disciplinary in nature and this needs to be reflected in the diversity of its investigators. The MEGAPROJECT contains finance specialists, civil engineers, construction management experts, legal researchers and behavioural and social scientists.

## What is the structure of this guide?

This guide is based on the outputs from the MEGAPROJECT network. MEGAPROJECT has undertaken workshops, 'think-tanks', short-term scientific missions under the auspices of seven working groups structured around sectors and themes[1]. The work of MEGAPROJECT is documented in 'sister' reports to this guide entitled:

- A Megaproject Research Framework
- The MEGAPROJECT Portfolio
- Risk in the Front-End of Megaprojects
- Managing Stakeholders in Megaprojects
- Special Purpose Entities in Megaprojects

All the guides can be downloaded from the MEGAPROJECT website (www.mega-project.eu)

The structure of the guide begins by using MEGAPROJECT data to benchmark the performance of European megaprojects across sectors and sub-sectors. This enables the readers to gauge the overall delivery of projects in Europe today. The guide then presents the key drivers of megaproject delivery performance identified by MEGAPROJECT namely:

[1] Thematic working groups referred to in this report were the INNOMET Working Group (innovative methods to learn across projects), the RFE Working Group ( risks at the front-end of megaprojects, the SPE Working Group (the role of SPEs in megaprojects) and the MS Working Group ( managing stakeholders in megaprojects).

- Engaging external stakeholders
- Designing good governance
- Learning across megaprojects

Key learning points are highlighted throughout the guide. The guide concludes by bringing these points together into a 'meta' megaproject improvement table.

## MEGAPROJECT's European Context

All of the data from which MEGAPROJECT has derived its findings has been obtained from European megaprojects. It is important that the limitations of this context are understood. For example, whilst the power of external stakeholders to influence megaproject performance may be immense in Western democracies, that power may be much greatly diminished in more autocratic political systems. It is also true to say that different procurement philosophies may be in use in countries outside of Europe that allow more stable patterns of client, contractor and sub-contractors for similar megaprojects to develop. This promotes a 'learning effect' on megaproject performance and benchmarking may therefore yield much better performance on similar megaproject sectors outside Europe. The guidance in this document holds true for European megaprojects: more work needs to be undertaken to see if it holds true for the rest of the world.

# Benchmarking the performance of European megaprojects

## Measuring Megaproject Performance

The performance of megaprojects has long been seen as problematic in terms of overall on-time and too-budget delivery and in terms of the utility of the megaproject once in operation (i.e. the megaproject does produce the intended societal benefits.) The proportion of megaproject delivery failure has been put as high as 66%[2] and a similar proportion of megaprojects are viewed as failing to meet the objectives for which they were constructed[3].

This overview is, however, somewhat simplistic. The multiplicity of stakeholders within a megaproject mean that very different views on the success (or otherwise) of the endeavor can exist. For example, EPC (engineer, procure, construct) contractors can make profits on contracts that clients, once they have commissioned the megaproject, realize were wrongly construed. The overall cost of megaprojects are also extremely difficult to discern as 'fixed-price' contracts may hide additional cost increases and commercial confidentiality precludes the disclosure of much cost information anyway. Furthermore, the length of time to commission, design and deliver a megaproject runs into decades without even considering the megaproject's operational service. This means that it is impossible to judge the success or failure of most of the megaprojects currently being delivered as they simply have not been operating long enough to tell.

Despite these issues, it still makes sense to measure the overall delivery performance of megaprojects in terms of schedule and cost. Firstly, this at least enables us to 'benchmark' the performance of different megaproject sectors against each other to identify where key cross-sectoral learning can occur. Secondly, the highly capital intensive nature of megaprojects means that entry into service ( and hence the beginning or a revenue stream to off-set against the cost of capital) marks an important point in the life-cycle of a megaproject.

The process of gaining the data to make these sort of benchmarking comparisons is fundamental to the quality of the monitoring megaproject performance. (The proverbial rule 'garbage in equals garbage out') is as true in this context as in any other). MEGAPROJECT gained its data for megaproject performance comparisons was obtained from two sources:

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2 Merrow, Edward W. *Industrial megaprojects: concepts, strategies, and practices for success*. Vol. 1. Chichester, UK: Wiley, 2011.

3 Miller, R., Lessard, D. R., Michaud, P., & Floricel, S. (2001). *The strategic management of large engineering projects: Shaping institutions, risks, and governance*. MIT press.

- credible publically available sources ( e.g. government reports etc.)
- direct interview with stakeholders

In order to make comparisons, strict definitions were introduced that related to both schedule adherence and budget adherence. ( See Table 1)

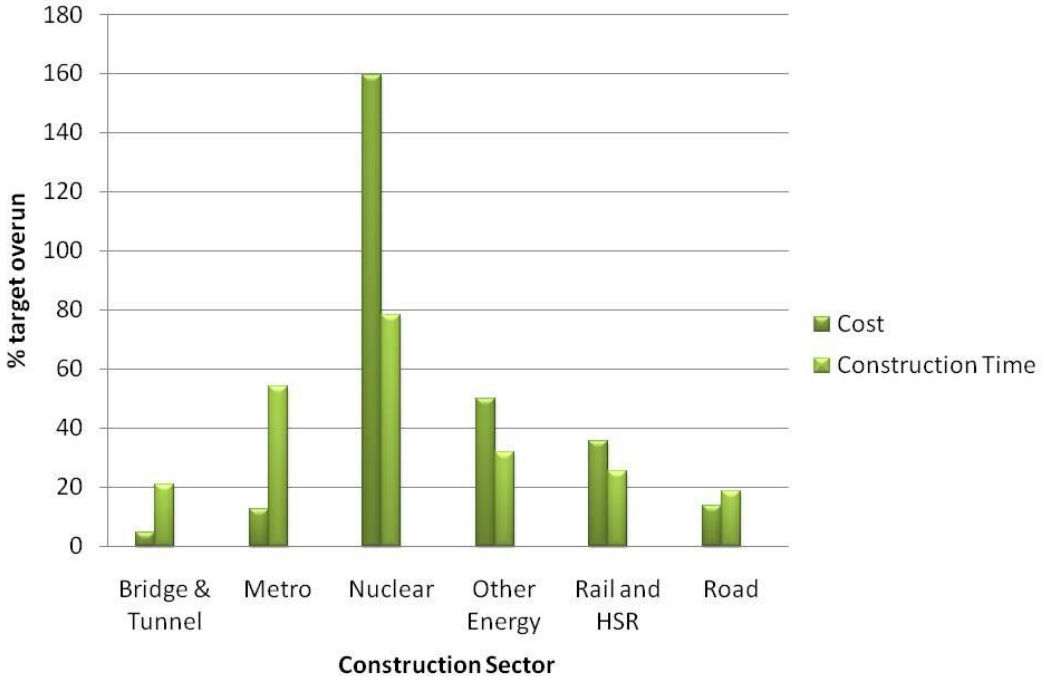
| Performance Variable | Definition |
|---|---|
| The project was over-budget | • The project was judged to be overbudget if the final cost of the project was greater than the 110% of the original estimate (adjusted for the inflation).<br>• The estimated cost was taken to be a publically available figure obtained either through direct interview with the project client or through public review at the time as close as possible to the point at which the first formal activity (such as the first stage in the acquisition of any land rights required for the project) was entered into.<br>• The final cost was taken to be a publically available figure obtained either through direct interview with the project client or through public review at the point at which the project entered operation.<br>• The final cost and initial estimate were assumed to have been made on the same basis. |
| The project was delayed in the planning phase | The project was judged to be delayed in the planning if the actual commencement of physical construction was more than 12 months later than the planned date for the commencement of construction.<br><br>The planned date for the commencement of construction was taken to be a publically available figure obtained either through direct interview with the project client or through public review at the time as close as possible to the point at which the first formal activity (such as the first stage in the acquisition of any land rights required for the project) was entered into.<br><br>The actual date for the commencement of construction was taken at the point at which any physical construction activity related directly to key functionality of the project was undertaken as reported through direct interview with the project client or through public review |
| The project was delayed in the construction phase | The project was judged to be delayed in the construction phase if it exceeded the planned date for entry into service by 12 months set at the point of entry into construction.<br><br>The planned date for the entry into service was taken to be a publically available figure obtained either through direct interview with the project client or through public review at the time as close as possible to the commencement of construction work.<br><br>The actual date for the entry into service was taken at the point at which output from the project was first provided to its intended beneficiaries as reported through direct interview with the project client or through public review |

**Table 1: MEGAPROJECT's Performance Definitions**

As Table 1 indicates, MEGAPROJECT gained data on both absolute performance and performance against target (the latter being a measure of the 'cost certainty' of the megaproject.)

## Cross-Sectoral Performance of European Megaprojects Against Targets

Figure 1 gives a cross-sectoral comparison of megaproject's ability to be delivered on target in terms of both schedule and budget. Firstly it demonstrates that MEGAPROJECT's findings echo those of other researchers in the area. European megaprojects across all sectors are uniformly delivered late and over-budget. It




does, however, demonstrate significant variations across the sectors in that performance.

**Figure 1: Cross-Sectoral Delivery Performance for European Megaprojects**

Whilst bridge and tunnel, rail and road megaprojects appear to have the least average target overrun proportion, nuclear megaprojects fare far worse[4]. Nuclear megaprojects appear to have a 'perfect storm' of FOAK (first–of-a-kind) technology, very powerful external stakeholders and complex governance which leads to a huge amount of schedule and cost uncertainty. It is interesting to contrast this situation with renewable energy megaprojects. (See Table 2). Renewable energy megaprojects are much less likely to have powerful external stakeholders opposing the project and to have more developed technology which means that they are actually likely to be delivered on time.

| | |
|---|---|
| The project is nuclear | 89% certainty that a nuclear project will be overbudget |
| The project is renewable | 95% certainty that a renewable energy project will be delivered on-time |

[4] The situation is actually far worse than shown here as many of the projects surveyed were still to complete i.e. they will overrun by even a greater percentage

**Table 2: Comparisons in Delivery Performance for Nuclear vs Renewable Energy Megaprojects**

The difference in performance of energy megaprojects versus transport megaprojects suggests that there are characteristics that are highly contextual and reflect a very different underlying business model in the Transport and Energy sectors. Obtaining planning consents appears far more complex in transport projects (which are much more likely to cross many planning jurisdictions) and hence take significantly longer than in energy projects.

| Megaproject Sector | Planning & Construction Leadtimes (Years) | Construction Leadtimes (Years) | Project Size (€bn) |
|---|---|---|---|
| Energy | 10 | 8 | 4.7 |
| Transport | 19 | 10 | 3.4 |

**Table 3: Comparisons in Performance Between Energy and Transport Megaprojects**

As Table 3 indicates, energy megaprojects are far more likely to predicate schedule adherence over budget adherence. This could be because their business model depends on getting the megaproject operational as soon as possible so that the client can benefit from the large revenue stream that will ensue. This situation is not the same in transport megaprojects.

**Key Lessons:**

- European megaprojects fail to meet their delivery targets across all sectors
- Some sectors are better than others with the nuclear sector being particularly problematic
- The different business models in transport and energy megaprojects produce different performance profiles

# Key Drivers of Megaproject Performance

MEGAPROJECT's analysis identified three key drivers for improving megaproject delivery performance in Europe:

- Engaging external stakeholders
- Designing good governance
- Learning across megaprojects

Each of these drivers is examined in turn.

## Engaging External Stakeholders

All projects have external stakeholders and megaprojects have mega networks of external stakeholders. Stakeholders can be defined as shown in Figure 2 :

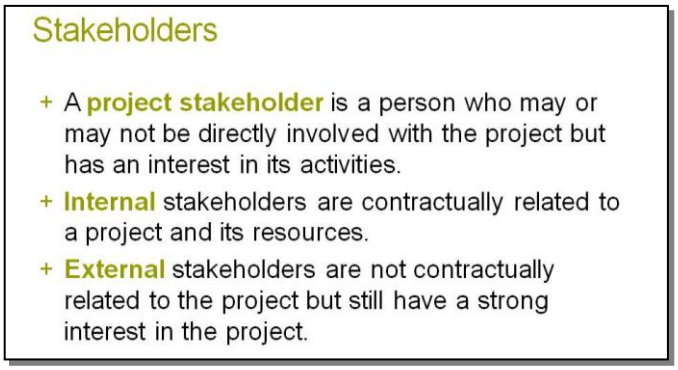



**Figure 2: The Definition of Stakeholders Adopted by MEGAPROJECT**

There are very many categories of internal and external stakeholders. MEGAPROJECT's 'Managing Stakeholders' Working Group demonstrated that external stakeholders such as local residents, regulatory agencies and environmentalists were far more likely to have a negative impact on megaprojects than other stakeholder categories. (See Table 4).

| Stakeholder groupings having a positive influence on megaprojects | Stakeholder groupings having a negative effect on megaprojects |
|---|---|
| • principal contractors<br>• national government<br>• client/owner<br>• financiers<br>• project team<br>• local government | • principal contractors<br>• **local residents**<br>• **environmentalists**<br>• **regulatory agencies**<br>• suppliers<br>• local government |

**Table 4: Influential Stakeholders in European Megaprojects**

MEGAPROJECT's findings that suggest that it is useful to split external stakeholders into two categories:

- regulators
- environmental activists ( comprising both local populations and non-governmental organizations)

Powerful regulators have a legal or regulatory role over megaprojects. They also have a profound impact on the delivery performance of a megaproject as Table 5 shows

| | |
|---|---|
| A regulatory authority fined the an actor in a megaproject | The megaproject will fail to meet construction schedule target (95% certainty of relationship)<br><br>The megaproject will fail to meet its budget target (94% certainty of relationship) |
| A regulatory authority delayed an activity in a megaproject | The megaproject will fail to meet its planning schedule target (97% certainty of relationship) |

**Table 5: Influence of Powerful Regulatory Stakeholders**

For clients and contractors, the importance of engaging with regulatory stakeholders is self-evident. The nature of the interaction will, to a large extent, be determined by the philosophy of the regulatory framework but will as a minimum should involve defining and enquiring if not consulting and refining.

For governments seeking to commission megaprojects, it is important that they do not contradict their intent with by initiating a situation where the 'left hand does not know what the right hand is doing.' i.e. one government departments is seeking to implement a megaproject and a second govern department is making that more difficult through its regulatory activities.

**Key Lessons:**

- Clients and contractors must consult with regulators and refine their processes accordingly
- Megaprojects demand 'joined-up' policy-making across governmental departments

Effective engagement of environmental activists also is very important to insure good megaproject delivery performance as shown in Table 6.

| | |
|---|---|
| Environmental activists were engaged *ex-ante* not *ex-post* | The megaproject will fail to meet construction schedule target (99% certainty of relationship) |
| Environmental NGOs objected to the project | The megaproject will fail to meet construction schedule target (97% certainty of relationship) |
| No protests took place at a national level from NGO's or local populations | The megaproject will fail to meet its planning schedule target (98% certainty of relationship) |

**Table 6: The Impact of Environmental Activists on Megaproject Delivery**

This effect is illustrated by the following cases from the MEGAPROJECT portfolio:

Datteln 4 Power Plant, Germany: A €1.8bn coal-fired power plant, Datteln 4, in Germany was fully built by E.ON but could not be operated because BUND (a national environmental organization) and local residents successfully sued the local authority for illegal zoning and planning procedures. Although E.ON appealed this decision, the case of BUND and Datteln local residents was supported by all of the higher German courts. This situation has continued for over six years and the plant which has been completed is still not in operation. This is despite that fact that three other coal-fired power plants have been successfully operating in this site for over twenty years.

Norra Lanken Ring Road, Sweden: A €1.8bn link road , Norra Lanken, was planned in Sweden outside Stockhom. It comprised 11km of tunnels and was design and implemented through and assortment of design, design-build and build contracts. The original route was planned to go through a royal park in the north of Stockholm. A local residents association was formed called 'Association for Ekoparken.' It successfully sued the project and caused a dely in construction of over five years whilst alternative routes were sought.

Madrid-Seville High Speed Rail(HSR) Link, Spain: A HSR link was delivered between Madrid and Seville in 1992 at a cost of 448,000 million pesetas (the equivalent of €1.5 bn.) The budget had to be increased by the equivalent of €100M because of the changes required by Agencia de Medio Ambiente-AMA (the Spanish Environmental Agency). These changes were required to mitigate the effect of noise in residential areas and the effect of the megaproject and fauna and flora in the region of the River Manzares.

These findings indicate that it is vital that external stakeholders are considered at the start of the megaproject lifecycle. It is important to discern who influential environmentalists might be and to understand their attitude to the megaproject in question. MEGAPROJECT's 'Managing Stakeholders' Working Group has devised a series of frameworks that can be used to capture stakeholder attitudes and details of these can be found in their report 'Managing Stakeholders in Megaprojects'[5]

**Key Lessons:**

- Environmental NGOs and local community groups that will be affected by the megaproject should be identified and engaged as soon as possible in itslifecycle
- Structured frameworks should be used to assess their attitude to the megaproject

## Designing Good Governance

Project governance is the decision making and authority framework that is established to operate the project. Megaproject governance is complex and dispersed across a network of participant organisations. MEGAPROJECT has shown that mastering the complexity of project governance is vital for megaproject success. MEGAPROJECT's 'Risk in the Front End' Working Group identified that project governance acts as a major source of uncertainty. More information of the overlap between governance and risk management can be found in their working group report[6]. MEGAPROJECT has identified two critical points in the governance schematic that significantly influence performance.

- The client-contractor relationship
- The use of special-purpose-entities (SPEs) in megaproject governance.

[5] 'Managing Stakeholders in Megaprojects' ed. Paul Littau, University of Leeds, April 2015 ISBN 978-0-9576805-2-4
[6] 'Risk in the Front End of Megaprojects' ed Ivana Burcar Dunovic, University of Leeds, April 2015 ISBN 978-0-9576805-4-8

### The Client- Contractor Relationship

MEGAPROJECT has identified that the nationality of client and contractor has a significant effect on successful megaproject delivery as shown in Table 7.

| | |
|---|---|
| The client and EPC contractor shared the same nationality | The megaproject will meet its budget targets (92% certainty of relationship) |

**Table 7:Impact of Client/Contractor nationality on megaproject delivery**

At first glance, a rationale for the impact of nationality on the client contractor relationship appears opaque. However, MEGAPROJECT proposes that this relationship arises because of two factors: learning effects and psychic distance.

Learning effects: 'Learning effects' is the name given to the phenomenon where learning is created and transferred between megaprojects. Research shows that these learning effects in all projects, not just megaprojects, are supported by social processes. If the same 'social network' of client and contractor is repeatedly used on similar megaprojects, learning effects between megaprojects have a better chance of occurring. The repeated use of the same 'social network' is more likely to happen if the client and contractor have the same nationality.

Psychic Distance: 'Psychic distance' is a term used in cross-cultural management to explain the difficulty in communicating across national cultural groups. Psychic distance between two very dissimilar cultures (e.g. Chinese and UK cultures) is large and therefore communication is difficult. Psychic distance between more similar cultures (e.g. UK and US) is much smaller and the psychic distance between two individuals or organisations from the same culture is non-existent. As psychic distance shrinks, communication capability increases and this easier communication enables megaproject events to happen more smoothly and budgets to become more easy to adhere to.

This finding suggests that it may be important to maintain client-contractor relationships across a series of similar megaprojects. This is possible, for example, when considering a programme of new power-plant introductions or a series of major road or rail investments. By maintaining these relationships, learning effects are enhanced and psychic distance increased meaning that communication can become much more effective and result in better budget adherence. Clients need to ask if they wish to trade 'price certainty' in order to contract with a cheaper, but less well known, contractor.

**Key Lessons:**

- Cost-certainty can be achieved through using the same client-contractor pairing across megaprojects

## Governance through Special Purpose Entities

The resources and risk required to design, develop and deliver a megaproject are immense. They are so large that they frequently lie beyond the capability or appetite of one organisation. In order to go forward, organisations frequently join together to create a new 'special purpose entity' (SPE) organisation that is completely aligned with the megaproject design, delivery and, frequently, operation. MEGAPROJECT's experience indicates that over 50% of megaprojects are delivered involving the use of an SPE. SPE's can be defined as follows:

*"A Special Purpose Entity (SPE) is a fenced organisation having limited pre-defined purposes and a legal existence[7]"*

An SPE is also sometimes known as a 'project company.' Figure 3 shows a typical configuration of the SPE within a project.

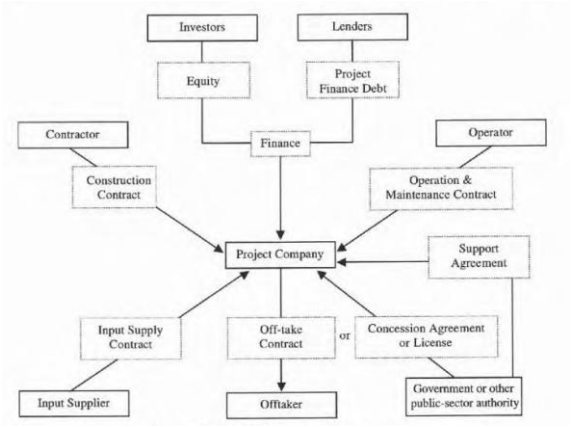



**Figure 3: A Typical SPE Configuration in a Megaproject[8]**

Usually SPEs adopt a structure of a corporation (e.g. a trust, partnership, limited liability partnership, limited liability company, mutual fund etc.) Rules applied to SPEs are highly contextularised in the national legal framework in whch they operate and the use of megaprojects in public-private partnerships often requires the introduction of specific legislation.

Traditionally, the establishment of an SPE for megaproject has been initiated and is viewed as a mechanism for gaining the finance for a megaproject. SPEs provide a way in which the finances and risk need can be linked to the megaproject. An SPE's legally independent structure enables its 'bankruptcy remoteness' and hence its ability to highlight and isolate the project risk. SPEs promote the increase of financial leverage at lower cost.

[7] Basel Committee on Banking Supervision, The Joint Forum–Report on Special Purpose Entities, 2009.
[8] J. D. Finnerty, Project financing asset-based financial engineering, third edition. Hoboken, N.J.: John Wiley & Sons, 2013

Whatis not always considered at the point of designing the SPE, is the impact that this will have on the whole of the governance of the megaproject. The SPE through its external governance ( its contractual links with other actors in the project, its shareholder agreements with its owners, its finance agreements) and its own internal governance ( the policies and processes that it formulates for its operation) encompasses a substantive proportion of the authority and decision-making that will be undertaken during the megaproject's life-cycle.

The impact of SPE governance is clearly felt in terms of a megaproject's overall schedule and budget performance. The INNOMET Working Group's findings indicated that the presence of an SPE had the strongest statistical impact of ANY megaproject characteristic. (The findings are given in Table 9)

| Megaproject Performance Attribute | Presence of an SPE in the megaproject |
|---|---|
| Budget Adherence | The megaproject will adhere to the overall budget (98% certain that a beneficial relationship exists) |
| Construction Schedule Adherence | The megaproject will be on-time with respect to the construction schedule (95% certain that a beneficial relationship exists) |
| Planning Schedule Adherence | The megaproject will be late with respect to the planning schedule (90% certain that a inimical relationship exists) |

**Table 9: The Impact of the Presence of an SPE on Megaproject Delivery Performance**

An SPE appears to make a megaproject late in its planning phase but then enable a project to be on-time in its construction and to adhere to its overall budget. This finding is not surprising. The introduction of an SPE is heralded by a significant negotiation process and a substantial amount of due-diligence all of which could have the tendency to increase the planning leadtime for a megaproject. However, the due diligence and governance set in place for the SPE during the planning phase means that and SPE structured megaproject is less likely to encounter problems during its operation and more likely to cope with them better if it does.

This leads to some in interesting implications for practitioners and policy-makers. Firstly, all involved parties need to be realistic about the time needed to develop an SPE especially given its substantive ongoing role in the governance of the megaproject. The second factor relates to the advantages that SPEs bring to megaproject. Whilst SPEs have traditionally been adopted by megaprojects for reasons of project finance, policy-makers and practitioners should be aware of the additional benefits that they bring in certainty of adhering to budget and construction schedule. In fact the diversity of functions that can be provided by an SPE for a megaproject is immense and is captured in Figure 4.


**Figure 4: Functions of an SPE in a Megaproject**

**Key Lessons:**

- Insure that realistic time is allocated for the development of an SPE for a megaproject
- Be aware that SPEs offer advantages over and above sharing financing and risk in a megaproject

## Learning Across Megaprojects

MEGAPROJECT has confirmed the poor performance of the delivery of megaprojects in Europe. Given that the poor delivery performance of megaprojects has been highlighted for decades, it appears safe to assume that European policy-makers and practitioners alike have not learnt effectively from their megaproject experiences. They have singularly failed to transfer the lessons from one megaproject to another.

The complexity and scale of megaprojects mean that learning across projects must transcend individual experience. Two issues have prevented this happening in the past:

- The presence of data with which to make reasonable comparisons. This has usually only been available on a proprietary basis for particular sectors of megaproject implementations.
- The mechanisms to make comparisons. The relatively small populations sizes for different megaproject implementations and the complex nature of megaprojects has made it difficult to identify ways to make rigorous and statistically significant analyses of megaproject performance.

MEGAPROJECT has addressed both of these issues and arrived at solutions that can be used by megaproject policy-makers and practitioners alike.

Firstly, the MEGAPROJECT Portfolio and its associated datasets provide an open-source repository which can be used to make comparisons. The MEGAPROJECT Portfolio (www.mega-project.eu/Portfolio) contains a cross-sectoral representation of European megaprojects from dams to hospitals, high speed rail links and even ocean going liners. The Portfolio draws its cases from 17 countries. All of the megaprojects in the Portfolio are described in Table 10. The Portfolio provides an invaluable resource for anyone seeking data with which to compare their own megaproject experiences.

Secondly, MEGAPROJECT's INNOMET Working Group has devised approaches by which organisations can learn across their own megaproject experiences. This approach allows organisations to analyse their megaproject portfolios to identify which characteristics of their megaprojects were associated with failure and which were associated with success. These mechanisms take, as their starting point, a matrix where each megaproject is 'coded' to ascertain whether or not they possess the characteristic in question and to identify their performance characteristics. (See Figure 5)

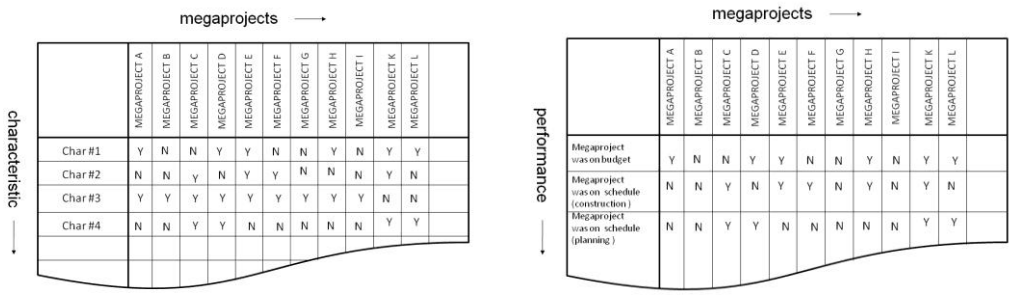



**Figure 5: Data Entry Matrices for Megaproject Performance Analysis**

This matrices (entered as an Excel spreadsheet) can then be analysed to identify (with statistical significance) which of the megaproject characteristics were identified with which of the criteria (e.g. megaprojects with Characteristic #1 are late in construction and run over budget). Further details on this analysis tool can be founs in the INNOMET Working Group's final report 'Learning Across Megaprojects.[9]'

This analysis tool provides invaluable assistance in enabling and organisations to learn from its previous megaproject experiences in a way that is systematic and rigorous.

**Key Lessons:**

- Always 'benchmark' any new megaproject against a closest previous experience
- Use systematic and rigorous analysis to draw lessons from previous megaproject experiences

[9] 'Learning Across Megaprojects' ed Naomi Brookes, University of Leeds, April 2015
ISBN 978-0-9576805-5-5

# Key MEGAPROJECT Lessons

The key MEGAPROJECT lessons are presented here in two ways Firstly, the megaproject characteristics that are most strongly associated with a successful megaproject delivery and a failing megaproject delivery are identified. Secondly the key lessons from across this guide are gathered together and addresses to their relevant megaproject target audience.

## What characteristics are associated with megaproject success and megaproject failure?

Table 10 gives the characteristics that are most associated with the successful delivery of a megaproject and with a failing delivery of a megaproject.

| GOOD MEGAPROJECT DELIVERY | | BAD MEGAPROJECT DELIVERY | |
|---|---|---|---|
| | % certainty | | % certainty |
| Have no protests from Environmental NGOs or the local population | 99 | Have delays incurred by a regulatory authority | 97 |
| Use SPEs for project governance *(to budget and to construction schedule*) | 98 | Have environmental NGOs objecting to them | 97 |
| Involve Environmental Activists ex-ante not ex-post | 97 | Receive fines from a regulatory authority | 95 |
| Are renewable energy projects | 95 | Use SPEs for project governance *(are late in planning schedule)* | 90 |
| Have the same nationality of client and contractor | 92 | Are nuclear energy projects | 89 |

**Table 10: Characteristics Associated with Good and Bad Megaproject Delivery**

Paradoxically, SPEs appear on both sides of the table. Governance with SPEs is associated with running over schedule during the project planning phase but being on schedule for the construction phase and overall delivering to budget.

## What are the key lessons that megaproject policy-makers and practitioners should take from the work of MEGAPROJECT?

| | | TARGET GROUP | | | | |
|---|---|---|---|---|---|---|
| | | Commissioners | Clients | Contractors | Financiers | Best Practice Orgns. |
| BENCHMARKING | European megaprojects fail to meet their delivery targets across all sectors | √ | √ | √ | √ | √ |
| | Some sectors are better than others with the nuclear sector being particularly problematic | √ | √ | | √ | √ |
| | The different business models in transport and energy megaprojects produce different performance profiles | √ | | | √ | √ |
| STAKEHOLDERS | Clients and contractors must consult with regulators and refine their processes accordingly | | √ | √ | | √ |
| | Megaprojects demand 'joined-up' policy-making across governmental departments | √ | | | √ | √ |
| | Environmental NGOs and local community groups that will be affected by the megaproject should be identified and engaged as soon as possible in its lifecycle | √ | √ | √ | | √ |
| | Structured frameworks should be used to assess external stakeholders attitude to the megaproject | √ | √ | √ | | √ |
| GOVERNANCE | Cost-certainty can be achieved through using the same client-contractor pairing across megaprojects | √ | √ | √ | √ | √ |
| | Insure that a realistic time is allocated for the development of an SPE for a megaproject | √ | √ | | √ | √ |
| | Be aware that SPEs offer advantages to megaprojects over and above sharing financing and risk in a megaproject in terms of a better delivery profile | √ | √ | √ | √ | √ |
| LEARNING | Always 'benchmark' any new megaproject against a closest previous experience | | √ | √ | | √ |
| | Use systematic and rigorous analysis to draw lessons from previous megaproject experiences | √ | √ | √ | √ | √ |

# Appendix A: Participants in MEGAPROJECT

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# Appendix B: MEGAPROJECT Cases

| Megaproject | Sector | Sub-Sector | Location |
|---|---|---|---|
| **MEGAPROJECT Portfolio Cases** | | | |
| High Tech Park | Cross Sector | | Bulgaria |
| Industrial Zones Development Scheme | | | Bulgaria |
| MOSE Venice Flood Protection | | | Italy |
| Redevelopment of Utrecht station area | | | Netherlands |
| River Sava Megaproject Development | | | Slovenia/Croatia |
| Vienna North Hospital | | | Austria |
| Oasis Ocean Going Liner | | | Finland |
| Raciborz Resevoir | | | Silesia |
| Andasol Solar Power Station | Energy | Solar Power | Spain |
| Flamanville 3 Nuclear Power Plant | | Nuclear Power | France |
| Greater Gabbard Offshore Wind Farm | | Wind Power | UK |
| Hinkley Point Nuclear Power Plant | | Nuclear Power | UK |
| Rovigo LNG Plant | | Oil & Gas | Italy |
| Anholt Off-Shore Windfarm | | Wind Power | Denmark |
| Moorburg | | Coal Power | Germany |
| Lunen | | Coal Power | Germany |
| Mochovce Nuclear Power Plant | | Nuclear Power | Slovakia |
| A2 Motorway | Transport | Road | Poland |
| Edinburgh Tram Network | | Rail | UK |
| High Speed Rail Madrid - Barcelona – Figueres | | Rail | Spain |
| High Speed Rail Vigo - Oporto - Lisbon – Madrid | | Rail | Portugal |
| High Speed Rail Seville – Madrid | | Rail | Spain |
| Brno City Road Circuit | | Road | Czech Republic |
| Oresund Link (Oresundsbron) | | Road | Denmark – Sweden |
| Channel Tunnel Rail Link, UK | | Rail | UK |
| Spanish Metro Line (Metro de Sevilla) | | Rail | Spain |
| Norra Lanken | | Road | Spain |
| HSR Ingoldstadt - Nuremberg | | Rail | Germany |
| Athens Ring Road | | Road | Athens |
| Western Europe- Western China International Transit Corridor | | Road | Western Europe-Western China |

| Additional Working Group Cases | | | |
|---|---|---|---|
| Datteln | Energy | Coal Power | Germany |
| Oskarshamn Modernisation | | Nuclear Power | Sweden |
| Torrevaldaliga Nord | | Coal Power | Italy |
| EPC1 Offshore Platform | | Oil & Gas | Italy |
| Bundesautobahn 20 | Transport | Road | Germany |
| Tgv Med, Valence-Marseille | | Rail | France |
| Beneluxlijn ,Rotterdam-Schiedam-Spijkenisse | | Metro | Netherlands |
| HSL Zuid, Amsterdam-Rotterdam-Antwerp), | | Rail | Netherlands/Belgium |
| Attiko Metro (Athens Metro Base Project) | | Metro | Greece |
| HSR Neubaustrecke (Nbs) Köln-Rhein/Main, Cologne-Frankfurt, | | Rail | Germany |
| Tiergarten Tunnel, Berlin | | Road & Rail | Germany |
| Thameslink | | Rail | Germany |
| High Speed 1 | | Rail | UK |
| High Speed 2 | | Rail | UK |
| HSR West Coast Main Line | | Rail | UK |
| Crossrail | | Rail | UK |
| Arlanda Rail Link | | Rail | Sweden |
| Rion-Antirion Bridge (Harilaos Trikoupis Bridge | | Road & Bridge | Greece |
| Millau Viaduct, | | Road & Bridge | France |
| M6 Toll | | Road | UK |
| Météor | | Metro | France |
| Jubilee Line Extension | | Metro | UK |
| Larnaca And Paphos International Airports | | Air | Cyprus |
| Danube Bridge2 | | Bridge | Bulgaria & Romania |
| FERGATUS Train Concession | | Rail | Portugal |
| A1 Highway | | Road | Croatia |
| City Tunnel | | Road | Leipzig |
| VDE8 HSR | | Rail | Germany |