

Prediction Markets and Megaprojects

Max Werner^{a*}, Klaus Eissing^b

^aDoctoral student / Helmut-Schmidt-University, Wendenstraße 503, Hamburg and 20537, Germany

^bMBA student, Schenefelder Landstrasse 87, Hamburg and 22589, Germany

^aEmail: werner.max@hsu-hh.de

^bEmail: eissing@me.com

Abstract

This short essay estimates the suitability of prediction markets to solve fundamental megaproject management issues. The underlying analysis was designed using relevant and state of the art literature in the respective field. First, megaprojects were defined in general, clarifying the subject of the study. Concurrently the research setup was explained to outline the scope of the essay. The following central analysis section specifies multiple megaproject management issues and describes the most common ones (cost overruns and project delays) separately. The last content section applies state of the art prediction market insights on the previously specified megaproject management issues. Finally, this essay reveals a fundamental promise that prediction markets are likely to be the cure for some of the megaproject management issues specified.

Keywords: Megaprojects; prediction markets; project management; internal control; project controlling; megaproject paradox.

1. Introduction

The relevance of megaprojects increases every year. Over the years the budget of these projects becomes equivalent or even exceeds the gross domestic product of many national economics. Although these projects become bigger and bigger, adequate adjustments of project management is still missing. For example, the planned costs and duration of the project Channel Tunnel between Britain and France were 4.9 Billion pounds and 6 years. In reality costs turned out to be 9.7 Billion pounds and the duration exceeded the planned time with 1.5 years [1]. Instead of the expected 30 million passages only 10 million people use the tunnel per year twenty years after opening.

* Corresponding author.

2. Megaprojects

According to Flyvbjergs [2] Megaprojects are defined as large scale and complex multi-billion ventures involving multiple private and public stakeholders are transformational and which impact on the lives of millions of people. Megaprojects have always been a part of history as is evidenced by the pyramids of Giza or the Great Wall of China and in today's world where national economies are themselves gigantic; megaprojects are a norm rather than the exception. Examples of megaprojects today include the Channel Tunnel between Britain and France, the International Space Station, the Large Hadron Collider and the development of the high-speed rail network in China. Each of these projects involved billions of dollars, great policy deliberations and had and continues to have huge public stakes.

Flyvbjerg [2] notes that mega projects are increasingly becoming the preferred delivery model for goods and services in many sectors and across a range of businesses. These include infrastructure, water and energy, mining, supply chains, information technology, defense, banking, industrial processing plants, space exploration, artificial intelligence, offshore gas and oil extraction and so on.

The scale of megaprojects and their impact on the global economy and national economies is best understood by comparing them to national economies or the structure of national economies themselves. Flyvbjerg, for instance takes note that the American debt to China worth trillions of dollars and which has the potential to destabilize the world if handled improperly is just twice the size of the cost of the Chinese rail project combined with the Pentagon's Joint Striker Program. The scale of these projects is equivalent to the gross domestic product of many national economies [2].

The megaproject business is a big one with Dobbs [3] estimating that global infrastructure spending to be \$3.4 trillion or the equivalent of 4% of global GDP. Another estimate by the Economist Intelligence Unit in 2008, noted that infrastructure spending by developing nations amount to about \$2.2 trillion and all of these projects were and are expected to be delivered as megaprojects.

3. Research setup

3.1. Problem

Although the appeal of megaprojects is broad and necessitated by the complex needs of today's modern economies, research projects and business needs, megaprojects are plagued by many ills that need redressing. The redressing is of particular importance given the huge stakes that megaprojects carry for national economies. A case in point is the 2004 Olympics held in Greece in which the Greek government spent heavily on new infrastructure projects that were soon plagued by cost overruns and low rates of return when complete. According to Malkoutzis [4] Greece spent an equivalent of \$11 billion with Greek taxpayers footing much of the bill. The spending is said to have pushed the country's deficient to 6.1 % of GDP and the debt at 110.6% of GDP. A year later Greece was placed under fiscal monitoring by the EU and has since defaulted on its debts many times.

3.2. Objective

In the following sections of this paper, the ills of megaprojects shall be discussed with the intention of building consensus towards the conclusion that a solution to the problem posed by megaprojects is long overdue and necessary as the case of Greece and a countless other examples will show. The solution proposed here is the use of prediction markets, or exchange traded markets that trade outcomes of an event. In a prediction market, market prices can be used to indicate what the crowd thinks of the probability of a favorable outcome is. But first, it is important to know the kind of problems that needs solving in the first place.

4. Analysis

4.1. Cost overrun

One of the many problems with megaprojects is cost overruns. Flyvbjerg [2], observes that nine out of ten projects have cost overruns; the overruns can sometimes exceed as much as 50%. Flyvbjerg, goes ahead to give examples of cost overruns in notable projects. In the Channel Tunnel the longest underwater rail tunnel in Europe, the cost overrun was as much as 80% in real terms. The Denver Airport project experienced a cost overrun of 200%, the Boston Big Dig 220%, The UK National Health Service IT system 400-700%, and the Sydney Opera House a cost overrun of 1,400%. These are just some notable projects while there are thousands of them going on in many countries around the world. Flyvbjerg also notes that for the 70 years in which comparable data is available, cost overruns are the norm not only that but mega projects are also plagued with benefits shortfall which can be up to 50% in some cases. And there are as Flyvbjerg [5] notes no signs of improvement over time and geographical region.

Just like in all other projects, a lot of planning happens for megaprojects too and looking back at the planning for these projects based on the cost overruns, environmental impact assessments, and cost versus benefits scenarios, Flyvbjerg [2] says that the planning cannot be trusted. Flyvbjerg goes on to point out that for rail projects, there is an average cost overrun of 44.7% and a demand shortfall of 51.4%. For roads, the average cost overrun is 20.4% with a 50-50 chance that the demand is also misrepresented by as much as 20%.

Flyvbjerg [2], gives the example of the construction of the Channel Tunnel connecting Britain and continental Europe through France. Promoted as highly beneficial economically and financially during its initial public offering with a 10% cap on possible cost overruns and as a hugely profitable venture, the Channel tunnel turned out to be anything but cost-effective and attractive. Cost overruns went up to 80% of projected budget and 140% of expected financing. At the same time, revenues were half of those forecasted resulting to an internal rate of return that was negative and which stood at -14%. Overall, the British economy lost an estimated 17.8 billion USD. A report commissioned to look into the channel project concluded that "the British Economy would have been better off had the Tunnel never been constructed"[6]. Flyvbjerg and Budzier [7] note that ICT-related megaprojects are even riskier when it comes to cost overruns compared to infrastructural projects. Outliners in this category, for instance, are noted as having as much as 200% cost overrun. The authors also go on to point out that the total waste from underperforming ICT projects in the US amounts to \$55 billion dollars annually

citing a study by Standish Group conducted in 2009.

4.2. Project delay

Another problem that haunts mega projects is delay this causes both cost overruns and benefits shortfalls [7]. An Oxford university study based on a large database on megaprojects found that delays on dam construction are an average of 45% at the same time [8] by modeling the relationship between cost overruns and implementation dates of construction projects found that one year delay on project completion date results to a cost overrun of 4.64 percent. For dams this would translate to a cost overrun of 20.8% if a dam is planned for completion within ten years.

4.3. General risks

Flyvbjerg [2] notes that megaprojects have several characteristics that goes on to influence their success rate. First megaprojects are inherently risky because of their long planning horizons and multiple interfaces between projects parts and between project and its context. Secondly, decision and policy makers usually have conflicting interests in a project, also the scope of the project change significantly over time. Lastly, unplanned events are often unaccounted for making contingency plans and budgets inadequate in handling their occurrence.

More importantly however there is a lot of misinformation that goes about when it comes to megaprojects especially about their costs and benefits and Flyvbjerg [9] points out the three main types of explanations that are put forth to account for the discrepancy in costs and benefits estimates with what they actually are. The three reasons are technical explanations, psychological explanations and political economic explanations. Flyvbjerg [9] notes that technical explanations for cost overruns and benefit shortfalls include relying on outdated data, the use of inappropriate forecasting models, lack of experience, and honest mistakes. On the other hand, psychological explanations include planning fallacy and optimism bias. In this case planners and project promoters and beneficiaries make decisions based on delusional optimism instead of weighing properly the costs and benefits [10]. The benefits are exaggerated and the costs downplayed during deliberations.

The last explanation as to why megaprojects end up costing more than they are planned for is that the promoters of the projects overstate their benefits while under estimating their costs deliberately in order to win favor for their policy objectives over those of others. If one considers that for most national megaprojects that it is politicians who wield the ultimate power as to whether a project should go ahead or not, it becomes clear that such manipulations of analyses cost and benefits go on to be incorporated as part of the final plan. Flyvbjerg [10] note that manipulations of costs and benefits figures results to ventures that are hard to meet budget expectations or meet their time limit.

4.4. Successful megaprojects

As noted earlier, successful megaprojects are rare for many reasons Flyvbjerg [9] calls the outliers, the exception rather than the norm. However they do exist and examples include The Guggenheim museum in

Bilbao and metro extensions in Madrid as noted by Flyvbjerg [5] these were built within time and under set budget. The failure of megaprojects to fall within the limits of set time and budget constraints is an important part of study given the huge stakes involved for involved national economies.

4.4. The megaproject paradox

Megaprojects are increasingly needed and are being pursued relentlessly by governments and corporations and this is despite their obvious wastefulness and benefit shortfalls which leads to the question of why. Flyvbjerg [11] call this a paradox; “the megaprojects paradox”

It is apparent based on the failures of megaprojects for the 70 years that data is available that megaproject managers and planners have no clue on how to go about delivering successful megaprojects or are without the incentives or support to do so. Sooner rather than later poor planning and over optimistic estimates about projects soon catches up with the planners and all sorts of things go wrong. Once the problems have been identified they are quickly fixed through further budgeting for instance but hardly does a megaproject stop despite the wastefulness surrounding it.

It would for many politicians and policy makers be a public relations disaster to halt a megaproject because of cost overruns or any other reason for that matter. There are reputations involved, public expectations to meet and a lot of capital already invested. Furthermore some politicians and policy makers are already convinced that cost overruns when it comes to megaprojects are to be expected. The basis for the argument is that nothing would ever be built if the real cost of megaprojects was known beforehand. An example of such argument was advanced by Willie Brown [12] a former California State assembly speaker and mayor of San Francisco in a San Francisco Chronicle column when he noted thus about cost overruns on the San Francisco Transbay terminal in July 28, 2013. “News that the Transbay Terminal is something like \$300 million over budget should not come as a shock to anyone. We always knew the initial estimate was way under the real cost. Just like we never had a real cost for the San Francisco Central Subway or the San Francisco Oakland Bay Bridge or any other massive construction project. So get off it. In the world of civic projects, the first budget is really just a down payment. If people knew the real cost from the start, nothing would ever be approved. The idea is to get going. Start digging a hole and make it so big, there's no alternative to coming up with the money to fill it in.”

Policy makers with such ideas in mind influence cost estimates knowingly with the intention of having a project kick off believing that it's the right thing to do and this to say the least goes on to give megaprojects a bad name.

5. Proposed solution

As can be seen above there are many problems associated with megaprojects starting from how they are planned, to how they are executed and what is expected of them. The problems are multifaceted and require prompt addressing given the over reliance that governments all over the world have come to rely on megaprojects as the choice model for delivering goods and services to their populace. One of the most promising of the solutions to the problems posed by megaprojects is the use of prediction markets. According to Berg and others [13] prediction markets have the primary purpose of using the information content in the market

to make predictions about specific future events. Examples of prediction markets include The Iowa electronics market (IEM) established in 1998 and the Hollywood Stock Exchange (HXE) that provides markets that trade on movies. According to O'Leary [14] internal decision markets depend on the wisdom of the crowd by gathering knowledge from a "broad range of information sources and embedding that knowledge in a stock price". This "stock price" can be broadly defined as an expected future outcome and the stock being traded is the forecast of the event.

Prediction markets work by gathering what is called the wisdom of the crowds and many firms including internet giant's Google and Microsoft are make use of them to forecast the outcomes of events related to the company such as launch dates and new office openings [14].

Multiple theoretical bases for the use of prediction markets have been proposed over the years by a number of scholars. In their 1982 paper Forsythe and others [15] suggested both rational expectations and efficient markets as reasons why prediction markets work. Rational expectations theory has to do with specifying a direct relationship between expectations and market price behavior. On the other hand the efficient market theory is based on the premise that "prices at any time reflect all available information" and that thus that markets are as reliable as is the quality of information that flows within them.

Prediction markets are very effective at arriving at the valuation or expected outcome of an event and have for this reason found a number of applications especially as internal control mechanisms and it's for this reason that they are suited as measures of solving some of the many problems associated with megaprojects. Remidez and Jolin [16] for instance found out that prediction markets can be used to facilitate forecasting project management events. A study by the authors found out that a prediction market correctly predicted 24 out of 26 milestones set for a project.

Hewlett- Packard (HP) also found out that predictive markets were more accurate than custom made forecasting tools 75% of the time[17]. O'Leary [14] identified several reasons why prediction markets are effective tools of internal control. First they provide broad information access. With the market, firms and projects get access to information that they would previously not have access to. This is because as O'Leary [14] points out, they involve a broad range of participants thereby opening new communication channels and create a medium for interacting with the said information sources. Prediction markets extend in time and thus provide continuous feedback and real time information about projects as a result timely adjustments can be made before things such as cost overruns and time-lapses happen[18].

Another advantage of predictive markets is that they involve anonymity. This provides a very safe way for information to that would otherwise be sanctioned reach the market and exert its influence. For megaprojects this possibility is very welcome given that there is the likelihood of the misinterpretation of costs and benefits to suit certain agendas some of which are political. Anonymity also increases the chances of truth telling and on this Abramowitz and Henderson [19] note thus "Prediction markets can increase the flow of information, encourage truth telling by internal and external firm monitors, and create incentives for agents to act in the interest of their principals."

Another advantage of predictive markets is that by involving all stakeholders they contribute to better performance of the said stakeholders. Wooldridge and Floyd [20] for instance argue that the extent to which market participants are involved often leads to broader bases of information compared to other types of forecasting tools.

6. Conclusion

Predictive markets work by relying on information sourced broadly and are therefore inclusive. Further they are free from any of the political manipulations that go on to build a case for one project over another or one cost value over another [21]. Not to mention, predictive markets continue well into the future thus providing a constant stream of information that can be relied upon throughout the course of a project's life span. The final price arrived at in these markets is that which has been evened out by considering as many information sources as are available. In sum, the use of predictive markets holds the best promise for ending the cycle of wastage that is unleashed for every 9 of 10 megaprojects anywhere on the planet.

Finally, it may be added that the objective of this study was to propose a theoretical solution to known issues of megaproject management. As a consequence, this study lacks of a comprehensive perspective evaluating different approaches through academic literature. Therefore, follow-up studies should compare the prediction market solution to already existing concepts. With the theoretical analysis complete, it may be the most recommended choice to evaluate the prediction market solution in a real world application.

References

- [1] J. Böttcher and P. Blattner, *Projektfinanzierung*. München: Oldenbourg Wissenschaftsverlag Verlag, 2013.
- [2] B. Flyvbjerg, "What You Should Know About Megaprojects and Why: An Overview," *Project Management Journal*, vol. 45, no. 2, pp. 6–19, Apr. 2014.
- [3] R. Dobbs, *Infrastructure productivity: how to save \$1 trillion a year*. 2013.
- [4] N. Malkoutzis, "How the 2004 Olympics Triggered Greece's Decline," 03-Aug-2012. [Online]. Available: <http://www.bloomberg.com/news/articles/2012-08-02/how-the-2004-olympics-triggered-greeces-decline>. [Accessed: 15-Mar-2016].
- [5] B. Flyvbjerg, "Policy and Planning for Large Infrastructure Projects: Problems, Causes, Cures," *SSRN Electronic Journal*, 2005.
- [6] R. Anguera, "The Channel Tunnel—an ex post economic evaluation," *Transportation Research Part A: Policy and Practice*, vol. 40, no. 4, pp. 291–315, May 2006.
- [7] B. Flyvbjerg and A. Budzier, "Why Your IT Project May Be Riskier than You Think," *SSRN*

Electronic Journal, 2011.

- [8] B. Flyvbjerg, M. K. SKAMRIS HOLM, and S. L. BUHL, "What Causes Cost Overrun in Transport Infrastructure Projects?," *Transport Reviews*, vol. 24, no. 1, pp. 3–18, Jan. 2004.
- [9] B. Flyvbjerg, "Megaproject Policy and Planning: Problems, Causes, Cures," Feb. 2007.
- [10] D. Kahneman and A. Tversky, "Prospect Theory: An Analysis of Decision under Risk," *Econometrica*, vol. 47, no. 2, p. 263, Mar. 1979.
- [11] B. Flyvbjerg, N. Bruzelius, and W. Rothengatter, *Megaprojects and Risk*. Cambridge University Press, 2003.
- [12] W. Brown, "When Warriors travel to China, Ed Lee will follow," 27-Jul-2013. [Online]. Available: www.sfgate.com/bayarea/williesworld/article/When-Warriors-travel-to-China-Ed-Lee-will-follow-4691101.php. [Accessed: 15-Mar-2016].
- [13] J. E. Berg, F. D. Nelson, and T. A. Rietz, "Prediction market accuracy in the long run," *International Journal of Forecasting*, vol. 24, no. 2, pp. 285–300, Apr. 2008.
- [14] D. E. O'Leary, "Prediction Markets as a Forecasting Tool," in *Advances in Business and Management Forecasting*, vol. 8, Emerald Group Publishing Limited, 2011, pp. 169–184.
- [15] R. Forsythe, T. R. Palfrey, and C. R. Plott, "Asset Valuation in an Experimental Market," *Econometrica*, vol. 50, no. 3, p. 537, May 1982.
- [16] H. Remidez Jr and C. Joslin, "Using Prediction Markets to Support IT Project Management," *eProceedings of the 2nd International Research ...*, 2007.
- [17] P. F. Yeh, *Using prediction markets to enhance US intelligence capabilities*. Studies in Intelligence, 2006.
- [18] A. Borison and G. Hamm, "Prediction Markets: A New Tool for Strategic Decision Making," *California Management Review*, vol. 52, no. 4, pp. 125–141, Aug. 2010.
- [19] M. Abramowicz and M. Henderson, "Prediction markets for corporate governance," *Notre Dame Law Review*, vol. 82, no. 4, pp. 1344–1368, 2007.
- [20] B. Wooldridge and S. W. Floyd, "The strategy process, middle management involvement, and organizational performance," *Strat. Mgmt. J.*, vol. 11, no. 3, pp. 231–241, Mar. 1990.
- [21] L. Page and R. T. Clemen, "Do Prediction Markets Produce Well-Calibrated Probability Forecasts? *," *Econ J*, vol. 123, no. 568, pp. 491–513, Dec. 2012.