

Reference class forecasting – What, why and how?

Ásthildur Lára Stefánsdóttir

asthildurs@ru.is



Agenda today

- Introduction
- Purpose
- State of the art
- What is Reference class forecasting
- Next steps





Introduction

Ásthildur Lára Stefánsdóttir

- Management engineer M.Sc.
- Ph.D. student in engineering and applied science
- Supervisors Dr. Helgi Þór Ingason and Dr. Þórður Víkingur Friðgeirsson

Scope

- Project governance
- Forecasting methods – Reference class forecasting
- Risk assessment of large investment projects in Iceland



Purpose of my studies

Improve the methodology for the planning of large investment projects in Iceland that should:

- ensure better decision-making and risk assessment.
- be able to bypass forecasting bias.
- use quantitative risk assessment based on empirical evidence.

The outcome should be a forecasting model that uses the reference class forecasting method and empirical data to predict aspects of future investment projects in Iceland.



State of the art

Public projects tend to suffer from benefit shortfalls and inaccurate cost forecasts.

- Forecasting of these projects remarkably inaccurate for decades (Flybjerg, B. 2008)
- 1 out of 1000 megaprojects meets all three – time, cost and benefit (Flybjerg, B. 2014)
- Iceland is no exception. Overspend was identified in 2/3 projects in a study of 70 Icelandic projects (Friðgeirsson. 2009)

Vaðlaheiðargöng langt fram úr áætlun

Áætlaður kostnaður við gerð Vaðlaheiðarganga nemur nú tæpum 12,5 milljörðum króna.



Kostnaður rúmum 16 milljörðum meiri en áætlað var

Heildarkostnaður við byggingu nýs Landspítala við Hringbraut hefur aukist um ríflega sextán milljarða króna. Húsnaðið verður eitt það stærsta sem byggt hefur verið hér á landi og mun kosta hartnær áttatíu milljarða króna.

1087 13. júlí 2021 18:33 01:57 FRÉTTIR



Fréttir Sjónvarp Útvarp Dagskrá KrakkaRÚV Íþróttir Menning Um RÚV

Kostnaður við bragga langt umfram áætlun

02.09.2018 - 19:53 Innlent · Arkitektúr · Bragginn · Höfuðborgarsvæðið · Reykjavíkurborg · Skipulagsmál



Fréttir Sjónvarp Útvarp Dagskrá KrakkaRÚV Íþróttir Menning Um RÚV

Kostnaðaráætlun hækkað um þrjá milljarða frá 2019

14.09.2022 - 19:04 Heilbrigðismál · Innlent · heilbrigðisráðuneytið · Hjúkrunarhelmilli · Norðurland · Norðurþing



mbl.is

Forsíða Viðskipti 200 málur Íþróttir Enski Fólkið Smartland Matur Börn Ferðalög

Innlent | mbl | 14.6.2022 | 13:13

Kostnaður við dýpkun þrefalt meiri á næstu árum

kjarninn

Fréttir Skýringar Skoðun Fólk Styrkja

Innlent

Stjórnsmál

Kostnaður við framkvæmd leiðréttingarinnar 40 prósent meiri en áætlað var

Kostnaður við framkvæmd leiðréttingarinnar verður 325 milljónir. Upphaflega var áætlað að hann yrði 233 milljónir.

Þórður Snær Júlíusson 9. nóvember 2015



State of the art

‘Inside view’ forecasting is one of the reasons behind these inaccurate forecasts and the inside view is based on a human judgment that is biased.

- PMs focus on the specifics of the project at hand while trying to estimate uncertain events that could influence the future of the project (Batselier and Vanhoucke 2016)

Kahneman and Tversky found out that human judgment is biased (1979).

- We are generally too optimistic because of overconfidence and lack of regard for actual previous experience – **Optimism bias**



State of the art

Kahneman and Tversky, and later Kahneman and Lovallo (2004) introduced a new forecasting method called reference class forecasting (RCF)

- Takes an ‘outside view’ on planned actions of a project by using distributional data from other projects that are similar to the one being forecasted.
- Ignores the project at hand and bypasses optimism bias.



State of the art

Based on a study by Friðgeirsson and frequent news of cost overruns there is a clear need for a methodology that aims to reduce governance risk and inaccurate forecasts of public investment projects in Iceland

Furthermore, there is no database available in Iceland that has empirical data of all Icelandic public investment projects.



State of the art

The Concept research program in Norway

- They develop knowledge and expertise in front-end governance
- The focus is on major public investment projects under the Norwegian quality assurance scheme
- They save and store the data of projects in a database called **Trailbase**.

Norway is one of the leading countries in the world when it comes to project governance and we could benefit by looking into their research and Trailbase.



What is Reference class forecasting?

Reference class forecasting (RCF) is a forecasting method for systematically taking an outside view of planned actions. It requires three steps:

STEP 1: Identification of a relevant reference class of past, similar projects.

- Road tunnels, suspension bridges, concert halls, etc.



Jökulsá á Fjöllum, Grímsstaðir



Ölfusá

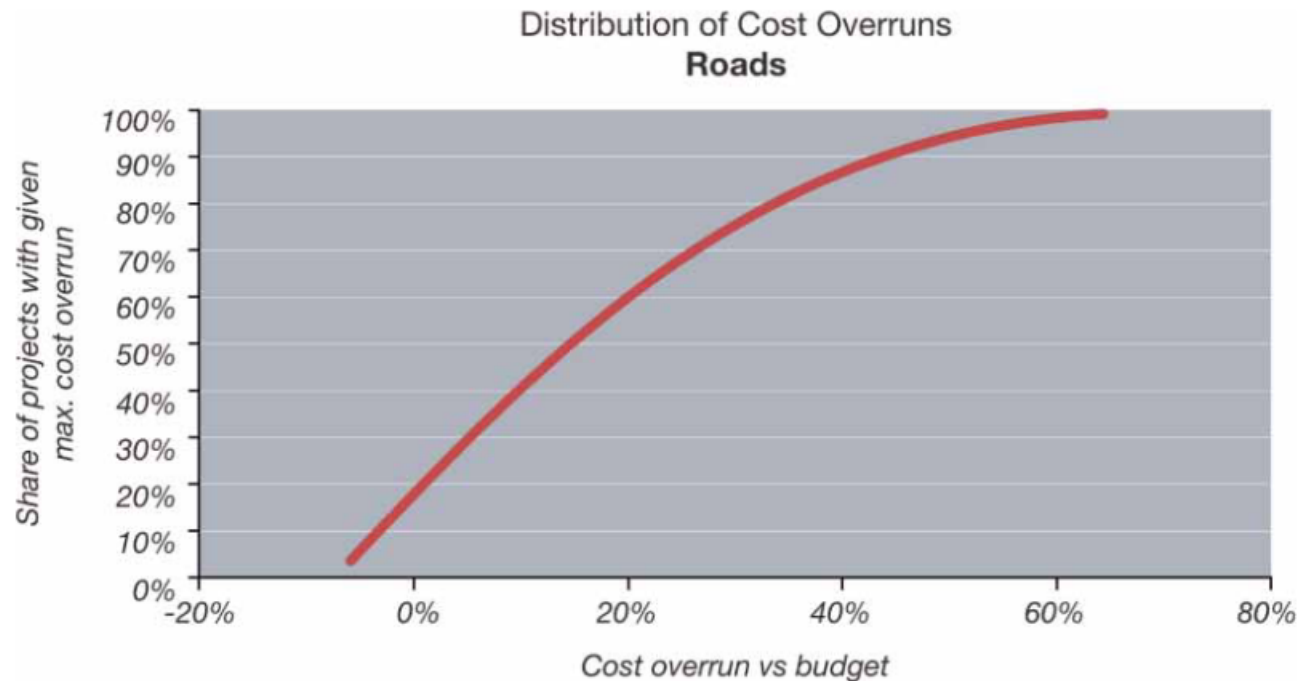


Jökulsá á Breiðamerkusandi



What is Reference class forecasting?

STEP 2: Is to establish a probability distribution for the selected reference class.



Probability distribution of cost overrun for roads, constant prices ($N = 172$).

Source: Flyvbjerg database on large-scale infrastructure projects



What is Reference class forecasting?

STEP 3: Compare the project at hand with the reference class distribution, to establish the most likely outcome for the specific project.

So RCF does not try to forecast the specific uncertain events that can affect the project at hand but places the project in a statistical distribution of outcomes from the class of reference projects.



What is Reference class forecasting?

Part of step 3 – adding an optimism bias uplift

- The amount of additional funding that is needed to raise the cost estimate so that there is an equal chance of the outturn cost being above or below the planned cost
- Possible to determine after a probability distribution for cost overrun has been found for each reference class
- Established as a function of the level of risk one is willing to take. A lower level of acceptable risk leads to higher uplift.



What is Reference class forecasting?

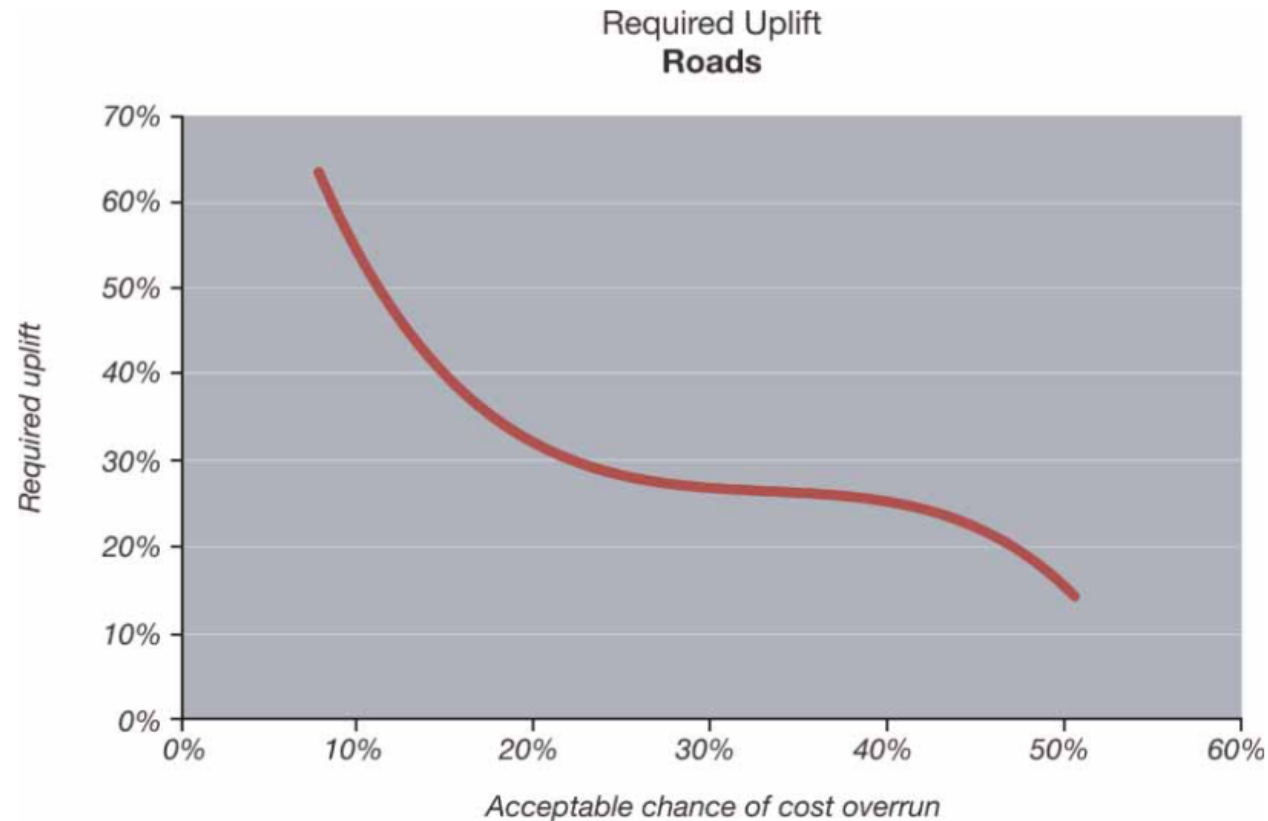


Figure 5. Required uplift for roads as a function of the maximum acceptable level of risk for cost overrun, constant prices ($N = 172$).

Source: Flyvbjerg database on large-scale infrastructure projects



What is Reference class forecasting?

- Research has shown that using RCF results in a more accurate forecast than using methods that use the inside view (Flyvbjerg et al. 2002)
- RCF performed better in both cost and time forecasting than the Monte-Carlo simulation and Earned Value management in a study from 2016 using real-life data (Batselier and Vanhoucke 2016.)
- **However, the real challenge of RCF is assembling a valid dataset that will give a reliable forecast.**



My Ph.D.

Develop the requirements for the National project database (NPD).

- Empirical data from past public investment projects in Iceland.
- Sort into reference classes.
- Define the most important attributes – such as planned vs actual cost, benefits, and, time of the project, etc.
- Build a reference class forecasting model that can be used with the NPD to evaluate the risk of cost overruns for large public investment projects in Iceland.



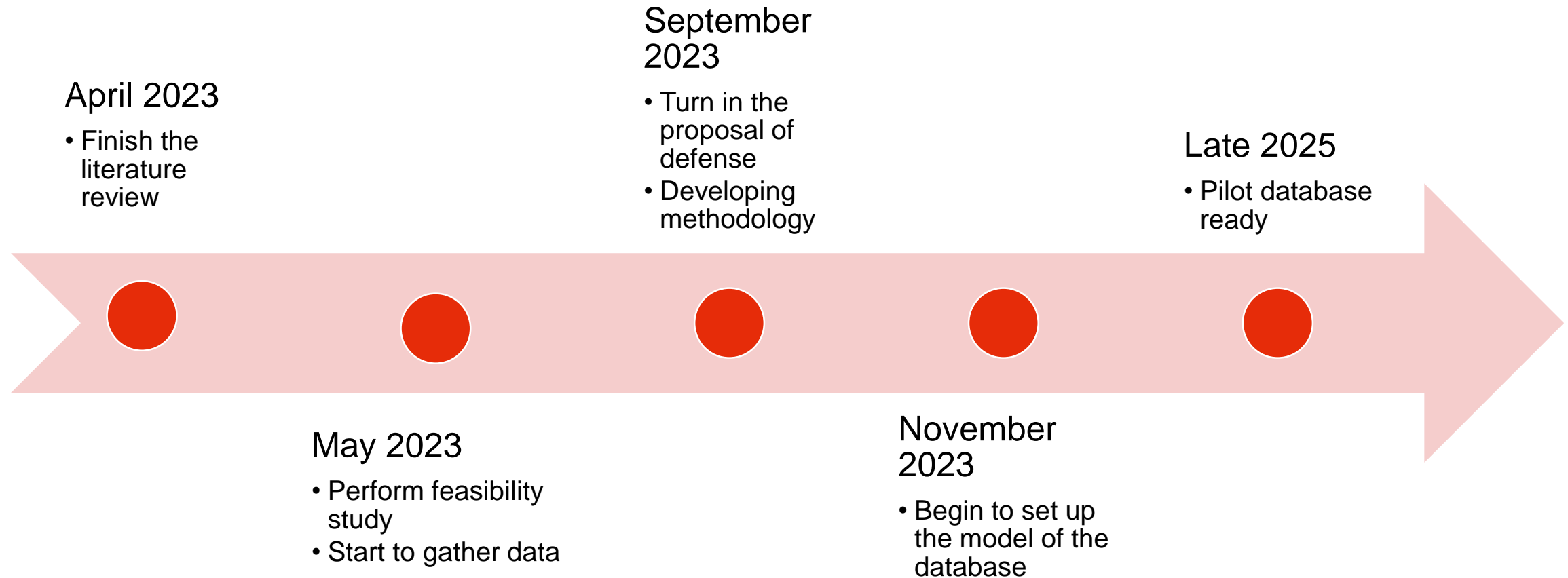
My Ph.D.

Benefits

- Improved decision-making within the project governance framework.
- Reduce chances of cost overrun and late schedules in investment projects.
- Increased risk awareness.
- Etc.



Next steps



Thank you for listening



- [1] B. Flyvbjerg, “Curbing Optimism Bias and Strategic Misrepresentation in Planning: Reference Class Forecasting in Practice,” *Eur. Plan. Stud.*, vol. 16, pp. 3–21, Jan. 2008, doi: 10.1080/09654310701747936.
- [2] B. Flyvbjerg, “What You Should Know About Megaprojects and Why: An Overview.” Rochester, NY, Apr. 07, 2014. Accessed: Oct. 10, 2022. [Online]. Available: <https://papers.ssrn.com/abstract=2424835>
- [3] T. V. Fridgeirsson, “The use of reference classes to forecast risk and uncertainty in Icelandic projects,” in *Proceedings of the 5th Nordic Conference on Construction Economics and Organisation*, 2009, pp. 117–124.
- [4] J. Batselier and M. Vanhoucke, “Practical Application and Empirical Evaluation of Reference Class Forecasting for Project Management,” *Proj. Manag. J.*, vol. 47, no. 5, pp. 36–51, Oct. 2016, doi: 10.1177/875697281604700504.
- [5] D. Kahneman and A. Twersky, “Intuitive prediction: Biases and corrective procedures,” *Makridakis Wheel. Eds Stud. Manag. Sci. Forecast. P 12 Amst. Neth. North Holl.*, 1979a.
- [6] D. Kahneman and A. Tversky, “Prospect Theory: An Analysis of Decision under Risk,” *Econometrica*, vol. 47, no. 2, pp. 263–291, 1979, doi: 10.2307/1914185.
- [7] Þ. V. Friðgeirsson, “Reference class forecasting in Icelandic transport infrastructure projects,” Jun. 2016, doi: 10.20858/tp.2016.11.2.10.
- [8] B. Flyvbjerg, “From Nobel Prize to Project Management: Getting Risks Right,” *Proj. Manag. J.*, vol. 37, no. 3, pp. 5–15, Aug. 2006, doi: 10.1177/875697280603700302.
- [9] T. Servranckx, M. Vanhoucke, and T. Aouam, “Practical application of reference class forecasting for cost and time estimations: Identifying the properties of similarity,” *Eur. J. Oper. Res.*, vol. 295, no. 3, pp. 1161–1179, Dec. 2021, doi: 10.1016/j.ejor.2021.03.063.
- [10] B. Flyvbjerg, M. Skamris, and S. Buhl, “Underestimating Costs in Public Works Projects: Error or Lie?,” *J. Am. Plann. Assoc.*, vol. 68, pp. 279–295, Jun. 2002, doi: 10.1080/01944360208976269.

