Room to Manoeuvre: Governing the Project Provisions

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Abstract

Purpose – The purpose of the paper is 1) to address the importance of contingency at the right level when defining project control baseline, including cost reserves / "room to manoeuvre" and 2) present proactive uncertainty management as a regime to ensure cost effective management of project reserves and contribute to project success.

Design/Methodology/Approach – The paper is a combination of literature study and quantitative research on how contingency develops during the lifetime of a case project. The investigation into the case project includes document study into quantitative material from the case project. The combination of empirical material and theory makes the discussion robust.

Findings – Unrealistic low cost uncertainty will lead to unrealistic low contingency. The case study from a Norwegian mega project shows a contingency of 15 per cent in addition to expected costs. The case study shows that by continuous opportunity management and risk reduction, the needs for management reserves are systematically reduced and the contingency is controlled.

Research Limitations/Implications – This research is limited to one case study. A higher number of cases are necessary to generalise the findings. However, the authors would claim that the systematic mapping of need for management reserve towards the project contingency, and a continuous uncertainty management system will help to obtain cost effective management. The findings from the case study could be applied on similar cases.

Practical Implications – The case study shows a way of setting contingencies and managing contingencies through systematic uncertainty management.

Originality/Value – Improved management of project provisions will increase the value of future projects.

Keywords Project governance, Project management, Cost management, Contingency, Management reserves, Uncertainty management, Project success

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1. Introduction

Patrascu (1988) observed nearly two decades ago that "contingency is probably the most misunderstood, misinterpreted, and misapplied word in project execution". Since that time, there has been little empirical research into project people's understanding of the concept of project cost contingency (Zhao 2006). Zhao (2006) reports the results of a survey of 78 project practitioners' comprehension of issues pertaining to project cost contingency. While there is a consensus that cost contingency is a reserve of money which should be used for scope changes, a key finding is that there is a lack of appreciation that project cost contingency is a risk management notion.

Uncertainties, risks and opportunities are a fact in every project, big or small, and thus a challenge to all project governors and project managers. Successful projects rely on creating the expected benefits and value for users and owners. Finishing the project within given limits of time and cost – even for complex projects under uncertainty is an important issue. When the project delivers the intended effect too late and/or over budget, this obviously is a potential threat to its value for investors, owners and users. Project budgets normally include contingency for handling the uncertainty. Zhao (2006) found that the majority of practitioners (77 per cent) use a deterministic percentage approach for estimating project cost contingency. Furthermore, 46 per cent of respondents work in organisations that do not have a policy on contingency and 36 per cent do not manage the use of contingency.

The owner provides a contingency on top of the project base estimates to cover for unexpected cost (or buffers to cover extra time). This is already common knowledge and established practice in the Nordics and most industrial countries. Different approaches could be applied by the governors to decide the size of the contingency (Love *et al.* [2015]); among them, we can find deterministic percentage or probabilistic distributed risk contingency, typically calculated by a Monte Carlo-simulation method.

Project managers need realistic level of contingencies and to manage and control these contingencies to secure project success. There will always be nonconformity and surprises, owing to mistakes, changes in the situation or decisions, variability in nature or other reasons. Sometimes investors and owners desire changes to add value to the project and, thus, increase the risk of overspending the budget or delaying the project delivery. Having a contingency is important to handle surprises and change but controlling this use of allowance is hard. It is tempting to spend allowances too quick to gain increased value, quality or progress. While there is still a long way to go, it is easy to think that there are plenty left. This, however, is a risky strategy. Decision-makers on all levels need help to understand what the optimal use of contingency is at any time during project development and execution. Overall, this suggests there is significant room for improvement in the understanding, estimation and management of project cost contingency.

This paper looks at the potential for securing successful projects by establishing realistic contingency provisions at the beginning and follows up by governing these provisions carefully to create and maintain a room to manoeuvre for project governors and project managers. The purpose of the paper is to reveal how contingency needs to be defined, managed and maintained to secure project success. The following research questions will be answered in the paper:

(1) How should contingency be set?

(2) How should contingencies be managed and maintained through the management reserves on different organisational levels to secure project success?

The reason for choosing to focus this issue is recurring discussions, not so much on establishing a realistic budget and contingency anymore, but on how it should be used to steer the project once established. This is not a trivial matter, as the paper will illustrate.

2. Method

To answer the research questions, this paper apply a literature review and a case study (Yin, 2017). When it comes to the literature review, we searched for literature around contingency in construction projects in databases such as Oria and Google Scholar. Relevant literature findings are included in the section describing previous research. The investigation into the case project includes a desk study of company documents, including quantitative material concerning the size of the contingency and how the size of the need for management reserves and the use of management reserves have developed over time in the case project. The combination of empirical material and theory makes the discussion robust.

The theoretical part is important to understand necessary concepts and to map current knowledge on the matter. The empirical part represents updated, practical knowledge from an ongoing complex project in Norway, and it is worth noticing that the authors have intimate knowledge into the case-project and many years of experience as practitioners in the field of uncertainty analysis and management. Two of the authors have been actively involved in cost analysis and cost uncertainty management for the case project over several years; one author works in the project as uncertainty management responsible. The unit of analysis here is the project's cost contingency and the use of management reserves. Data from the development of the project's cost contingency and management reserves over a period of four years are collected, and the development over time is analysed when it comes to the prognoses for the project costs and the size of the management reserves compared to the contingency.

As stated in the introduction, there is already an established knowledge (theory) and "best practice" standard in this field. The experience from this case and observations in other practical projects prompted the authors to develop initial theories of how the contingency best would be managed. We started to address and challenge the research questions as part of practical discussions with the project organisation. This lead to new ideas for further development, forming a new theory, which is pursued here. Thus, the research follows a stepwise inductive–deductive logic (Tjora, 2017).

This research is limited to describing the reality in one single case and thus not transferable to other situations (limited external validity). However, the concepts and principles used in this case are useful contributions to inform choices in other situations and projects. Following Yin (2017, p 45) the research has high degree of construct validity, combining different sources of data. It has high internal validity owing to use of direct internal first-hand deep knowledge and challenging rival explanations in the discussion section.

3. Previous research

Love *et al.* (2015) state that a base estimate plus the contingency figure typically form a project's estimated costs. Contingency can be defined as "the amount of funds, budget, or time needed above the estimate to reduce the risk of overruns of project objectives to a level acceptable for the organization" (PMI 2012). Two fundamental types of contingency exists: 1) Design contingency, which is allocated for changes during design, and 2) Construction contingency, in which any unresolved design issues, at the time of contract reward, are incorporated into the estimate/contract price (Gunhan and Arditi 2007).

A brief literature review tells us that the questions discussed here have been on the agenda before. Flyvbjerg (2016) points back to Parkinson (1958) and claims that a contingency is highly likely to be used. The debate on realistic budgeting, including how to dimension contingencies, and how to control them was on the agenda in the late 1980s and 1990s (Patrascu, 1988; Lorance, 1992; Chen, 1994) and during the 2000s. (Baccarini, 2005; Noor *et al.*, 2005; Zhao, 2006; Hollman, 2007; Lukas, 2008; Jergeas, 2008; Noor and Tichacek, 2009; Franklin 2009). The debate was particularly intense in the American Association of Cost Engineers (AACE). The focus in these contributions was methods and tools for cost estimation under uncertainty, the decisions on realistic budgets and control of these during execution. The obvious choice was introducing some form of probabilistic method and tool for cost estimation, instead of, or in addition to deterministic methods. This has later become a widely accepted standard requirement in project cost estimation.

One aspect of specific interest in this paper is the use of various methods for Contingency Drawdown. Parkinson predicted this would become a problem. If you set aside a contingency for future changes and emerging risks, the money (or time) will be used before the project is finished. The same argument was used against the introduction of the Norwegian governance scheme in 2000 (Samset *et al.*, 2006). History and empirical evidence has proven this to be wrong in this particular context (Samset and Volden, 2013; Welde, 2017).

Three sets of best practice guides indicates what is by most practitioners considered best practice: The AACE International Recommended Practice No. 44R-08 (AACE 2009), the PMI Practice Standard for Project Estimating (PMI 2011)/PMI Practice Standard for Project Risk Management (PMI 2009) and Prince2 (TSO 2009). Interestingly enough, AACE is the only recommendation to explicitly tell not only how to establish a cost estimate with contingencies but also explains how to control it. PMI explains how to establish cost estimates and follow up risks – but not how to control contingencies – the two issues seems little connected at all. Prince2 takes a different position in that they say (p. 149 Glossary):

> Contingency: Something that is held in reserve typically to handle time and cost variances, or risks. Prince2 does not advocate the use of contingency because estimating variances are managed by setting tolerances, and risks are managed through appropriate risk responses (including the fall-back response that is contingent on the risk occurring).

The discussions has taken another round later, introducing new methodologies (Moselhi and Salah, 2012; Flyvbjerg *et al.*, 2016; White, 2017; Moulidiana 2017) but never worked up the same heat again as earlier. Theoretically, the field may seem established in terms of methodology. Best practice standards, although very different in their approaches, was established and became widely implemented.

Most of these contributions were theoretical but not only. Some, including Jergeas (2008) and Moselhi and Salah (2012), Salah (2012) did report on real life case projects. These case-stories illustrate the dynamic nature of the projects, the complexity of the management challenge and the struggle managers have to get control with contingencies and total cost. Merrow (2011) has gone deep into empirical material to find evidence that the dominating risk management methodology; Monte Carlo Simulation does not work, but probabilistic schedule assessment does work (p. 324-328). These authors do not agree to this conclusion, and based on our own experience, we believe the problem in Merrow's database was unrealistically low degree of uncertainty expressed in the cost risk analyses.

How to realistically estimate contingencies even in extremely large, complex and long-lasting projects is discussed in Torp and Klakegg (2016). Inside view should be combined with the outside view to secure realism in cost estimates, and this has actually given budget control in Norway and Denmark (Klakegg and Lichtenberg, 2016). Governance regimes that aspire to keep budget control over time needs to be regularly changed and improved (Klakegg *et al.*, 2015). Project management and cost control needs to excess established best practice (Jordanger and Klakegg, 2013). Overall, the authors claim that on this basis, it is time to take another look at project governance and cost control.

4. Uncertainty Management in Statsbygg's PNN Project

Development of the new National museum in Oslo (PNN) was initiated in 2009. The Norwegian Directorate of Public Construction and Property Management (Statsbygg) is the builder. The size of the project is 54,600 m^2 gross floor area, divided into 1,100 rooms. The new museum is built in the city centre of Oslo. The architecture and technical design is challenging and so is the interface to existing infrastructure and intensive traffic situation related to the project's construction and logistic processes.

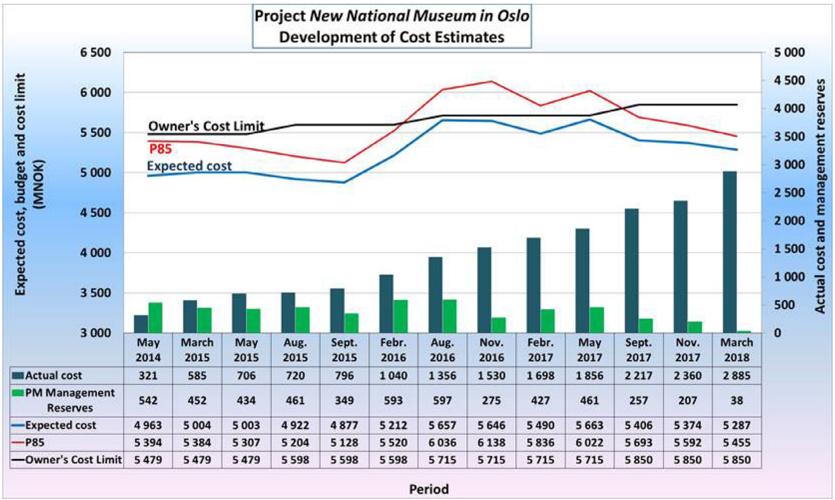
In 2013, the consultancy WSP was assigned to assist the PNN project in uncertainty cost analysis and uncertainty management. The project's uncertainty management concept was developed over time in an evolutionary process. The central approach in this concept is to manage the uncertainty-time dimension of the project, i.e. how to proactively manage opportunities and risks by dynamic navigation in the uncertainty-time space. In practice, this means identification of all relevant uncertainties, definition and execution of actions to reduce risk exposure and to harvest opportunities/upside potentials. The uncertainty register is an important tool for the project, both at project level and at contract level. Project success is, as always, measured against initial baselines, i.e. project budget at the level of expected costs and owner's cost limit at the P85 level, forming the Project Owner's Management Reserve between P85 and expected costs.

The development of the project means that the initial knowledge base related to the project's baseline soon will be obsolete, but the project cost limit and budget is fixed. Uncertainties are gradually transformed into historical facts, and the remaining uncertainties are gradually reduced. The ambition in the management concept is to, at any time, be able to produce updated prognosis of final cost, including estimates for the impact from uncertainties at all contracts. In practice, this means periodic and extraordinary updating of uncertainty analysis, which periodically gives key values such as expected cost and P85-values (85 per cent probability to hold). The update is done every quarter of a year, where once a year, external consultants run the analysis, and three times a year, an internal analysis is done. Necessary management reserves to fulfil the project within given cost limits are compared to the initial Project Management Reserve given by the Contingency, and the Project Owner Management Reserve.

Traditional uncertainty analysis is concentrated on identification and management of the project risk exposure. In modern uncertainty analysis, equal focus is on (negative) risk and (positive) opportunities. If management have minor focus on opportunities, opportunities will, in fact, be lost.

Figure 1 shows the development of project costs and the results of the uncertainty analysis as function of time. This cost uncertainty development profile shows how prognosis of final cost relates to initial budget (initial expected costs) and owner's cost limits (initial P85).

As can be seen from Figure 1, the project had to take extraordinary actions in 2016. Analysis showed potentially considerable cost overrun. Project owner managed to regain control by organisational changes and project management reinforced focus on opportunity management and reduction of risk exposure.



	May 2014	March 2015	May 2015	Aug. 2015	Sept. 2015	Febr. 2016	Aug. 2016	Nov. 2016	Febr. 2017	May 2017	Sept. 2017	Nov. 2017	March 2018
Actual cost	321	585	706	720	796	1 040	1 356	1 530	1 698	1 856	2 217	2 360	2 885
PM Management Reserves	542	452	434	461	349	593	597	275	427	461	257	207	38
Expected cost	4 963	5 004	5 003	4 922	4 877	5 212	5 657	5 646	5 490	5 663	5 406	5 374	5 287
P85	5 394	5 384	5 307	5 204	5 128	5 520	6 036	6 138	5 836	6 022	5 693	5 592	5 455
Owner's Cost Limit	5 479	5 479	5 479	5 598	5 598	5 598	5 715	5 715	5 715	5 715	5 850	5 850	5 850

Figure 1.
Project Cost Estimate, March 2018.

Cost estimate in March 2018 shows that the prognosis of final cost is approx. 400 MNOK below owner's cost limit. Further, project management is also in a well-controlled position related to expected cost being below given budget.

The Project Owner's Management Reserve was set at the baseline level and defined through the difference between the upper cost frame (P85 at time of baseline) and the expected costs (baseline budget). The analysis shows that the owner's reserves needed are far below the available PO's Management Reserve. The actual need of reserves is gradually reduced as function of the project degree of completion and remaining uncertainties. Project Management Reserve was initially set at the level of Contingency from the initial Uncertainty Analysis. The analysis shows that the project management reserves are significantly reduced but still sufficient to complete the project within the given project management budget.

5. Discussion

This paper aims to answer the research questions. How should the room to manoeuvre be defined through cost contingencies? How should the room to manoeuvre be managed and maintained on different organisational levels to secure project success?

Zhao (2006) found that the majority of practitioners use a deterministic percentage approach for estimating project cost contingency. Lately, methods for cost estimation under uncertainty, such as the Monte Carlo Simulation, have become a widely used approach. To achieve realistic size of the contingency forming the Project Management Reserve, and of the Project Owner's Management Reserve, it is important that the results from the cost estimation and uncertainty analysis describe the right level of uncertainty. Unrealistic low cost uncertainty will lead to unrealistic low Reserves for project owner and project manager. The case study from this Norwegian mega project shows a PO's reserve on 15 per cent of the PM budget. This gives room to manoeuvre for the project management and the project owner.

Authors' state that contingencies tend to be used before the project finishes (e.g. Flyvbjerg 2016). This would imply that the 15 per cent Reserve in the case project will be spent. Results from the Norwegian governance scheme do not support this (Samset and Volden, 2013; Welde, 2017).

From the case study, we can see that the needs for management reserves are reduced during the project progress. By periodical uncertainty analyses, the project management and the project owner can follow the project cost development, and they are able to compare the situation at any time with project owner's cost limit and project manager's budget. This made them able to track the use of reserves all the way. In 2016, uncertainty analyses results showed possibility for considerable cost overrun, in which prognosis for expected costs were slightly below project owners cost limit, and P85 prognosis exceeds project owners cost limit. Focus on risk reduction and opportunity management combined with implementing organisational changes, resulted in regained cost control. The latest uncertainty analysis update in 2018 shows expected costs below PM budget, and P85 to be far below the project's cost limit. Without the continuous focus on uncertainty analyses and management of opportunities and risks, our opinion is that the project would get out of control and that the needs for cost reserves probably would increase rather than decrease during the project execution phase.

6. Conclusion

The paper aims to reveal how Project Owner's and Project Management's reserves needs to be defined, managed and maintained at different organisational levels to secure project success. One challenge during the cost estimation process is deciding the size of these reserves. This is best done through an uncertainty analysis, producing realistic estimates and level of uncertainty. Realistic level of contingency and the right level of uncertainty is important basis for cost management of the project.

Performing updated uncertainty analysis periodically makes it possible to map prognosis of the management reserves needed against owner's cost limit (P85) and PM budget (P50). A continuous evaluation of the need of management reserves against the baseline project contingency makes it possible to control costs and to do necessary actions. The case study shows that continuous focus on opportunity management and risk reduction, i.e. proactive uncertainty management ensured robust and cost effective project execution.

The general conclusion is that the PNN project, a complex megaproject, is well controlled and probably at the end in about eight months, will show final cost within given cost budget. In the opinion of the authors, important reasons for this are professional project management including the implemented uncertainty management regime.

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