Research Paper **Open Access**

Peter Dahlin* and Ossi Pesämaa

Drivers of cost and time overruns: A client and contractor perspective

DOI 10.2478/otmcj-2021-0006
Received: May 06, 2020; Accepted: January 12, 2021

Abstract: Large infrastructure investments are expected to be of sustained value to society for a long time. Such investment projects include, for instance, hospitals, tunnels, sport arenas, power plants, roads, railways, and bridges. They involve a complex organization of contracts and agreements. The client is expected to plan, procure, and determine the critical steps of a project, while the contractor should solve issues raised by the client. Many of these agreements are path-dependent and reflect past routines, experiences, and contacts. As such, many investments tend to return to similar sources instead of replacing routines and collaborations that did not work. This can cause change orders that furthermore reflect consequences such as cost and time overruns. While much is known about these effects in construction projects, this paper sheds light on the drivers of change orders. We build upon a sample of 234 observations responding to a survey on investment planning. The results show that project assumptions are often wrong and inadequate in large investments. Such wrong assumptions are caused by interpersonal and leadership issues, poor planning, or sometimes even intentional profit-seeking. Our results show that clients and contractors have different perceptions and enter contractual obligations differently. The implication is, therefore, that better routines of documentation, more frequent feedback, and more accurate or precise standards may close the gap between planning and what is actually achieved. More precise contractual agreements may also create a better process to procure, manage projects, and allocate resources.

Keywords: investment projects, change orders, cost and time overrun, client–contractor differences

***Corresponding author: Peter Dahlin,** Mälardalen University, School of Business, Society and Engineering, P.O. Box 883, SE-721 23, Västerås, Sweden.
E-mail: peter.dahlin@mdh.se
Ossi Pesämaa, Luleå University of Technology, Department of Business Administration, Technology and Social Sciences, SE-971 87 Luleå, Sweden

1 Introduction

Large infrastructure projects last and deliver value to society for decades or more (Lehtinen et al. 2019). Such projects include, for instance, hospitals, tunnels, sports arenas, nuclear power plants, wind power farms, roads, railways, and bridges. A properly planned and executed project has potentially multiple positive societal effects, which sustain over a long period of time. On the other hand, poorly designed and built projects tend to have higher operational costs and result in numerous negative sustainable consequences (Liu et al. 2013). In addition, poorly planned investments are more likely to cause significant cost and time overruns, often because of conflicting stakeholder goals, interests, and time perspectives (Qiu et al. 2019). The latter is often highlighted in the public media, but less studied in research. A recent overview of empirical studies on larger infrastructure projects states that many planning issues arise from conflicting goals (Themsen 2019; Flyvbjerg et al. 2002). Thus, stakeholders have conflicting views on how to address and integrate investment goals with operational goals (Qiu et al. 2019).

The issues mentioned above receive frequent attention in the public media in Sweden. For example, a hospital project in Stockholm, "Nya Karolinska," has resulted in at least 110 major change orders and high cost and time overruns. Each change order accounts for a fee of an additional €600,000, causing a total cost-overrun of €66 million. While the hospital was expected to be ready in 2018, the procurement of operations and maintenance will continue until 2040 (Gustafsson 2016). Another known Swedish example of cost and time overruns is the construction of the national sports arena (Friends Arena), in which the original budgeted cost of the arena accounted for €200 million (Swedbank 2013), but the final cost was €300 million (idrottensaffären.se) – a cost overrun of 47% in local currency.

Cost overruns occur worldwide and to varying degrees in different projects (Cantarelli et al. 2012; Shehu et al. 2014; Park and Papadopoulou 2012). In a

study of 258 infrastructure projects, over 70 years, and across different geographical regions, Flyvbjerg et al. (2002) found that almost 90% of the projects exceed the budgeted costs, on average by 28%. In another study, 50% of the construction projects in Asia were found to result in cost overruns (Shehu et al. 2014). There is no indication that this would be less in the rest of the world. On average, the Netherlands has the lowest percentage (11%) of cost overruns, while the north-western European countries show a significantly higher figure (27%), and the remaining European countries exceed the budgeted costs by an even higher percentage equivalent (44%) (Cantarelli et al. 2010; Cantarelli et al. 2012). Cost overruns for infrastructure projects in Asia range from 2% to 98% (Park and Papadopoulou 2012). In Norway, the average cost overrun is 8% for infrastructure projects and it varies between –59% and +183% (Odeck 2004). In absolute terms, this corresponds to around €50 million (Odeck 2004). Cost overruns are directly linked to the project size (Makovšek et al. 2012). A known project failure from a time and cost perspective is the 50 km long tunnel under the English Channel. The planned budget was massively exceeded, from £2,600 million to £4,650 million, based on the monetary value of 1985. This corresponds to a cost overrun of 80% of the projected budget (Flyvbjerg et al. 2003). Yet, cost overruns are more common in smaller projects than in larger ones (Odeck 2004). The 8.7 km long Swedish Hallandsås tunnel was finished in 2015, thereby taking 23 years instead of the planned 3 years. The cost of the project was ten times more than the estimated budget, as costs soared from €100 million to around €1.1 billion (Littorin 2015). However, there are no clear explanations about why small projects have more cost overruns than larger ones. In Sweden, cost overruns are expected to correspond to 60–70% of the initial price in construction projects. Time and place are known factors for cost overruns (Odeck 2004). In addition, procurement that tends to be inconsistent with the actual outcome is more likely to exceed the cost budget. Thus, time and cost are associated.

While the extant literature has a clear view of time and cost overruns being common and significant in large projects, less is known about the drivers of cost and time overruns (Zhang et al. 2019). Difficulties in time and cost overruns remain unsolved (Themsen 2019), and the effects of poorly planned projects are still present. Therefore, we aim to contribute to this understanding and suggest a testable model of where and why (i.e., drivers) cost and time overruns take place. This aim assumes that when uncertainty in the agreements exists, it also leaves room for interpretation of change orders. A perfectly designed and planned agreement gives little room for change orders. A contract's performance is thus a function of the room a contract leaves for additional work, i.e., change orders, in addition to the critical components of time, price, and quality.

To address the gap in contracts, but also cooperation in broader terms, we examine the client and contractor perspectives in infrastructure projects in Sweden. We examine contractual and leadership issues related to change orders. More specifically, we look for attitudes and behavior that can influence the drivers of change orders, and we compare the client and contractor perspectives on this.

2 Theory

A construction project is a complex process that follows several loops (Senescu et al. 2013). Theoretically, this paper is based on project life-cycle loops (Tsai et al. 2011). A project is assumed to follow several loops starting with planning and construction, and moving on to a post-process involving maintenance and learning. During these various loops, project managers meet to solve complex issues within and between the client and the contractor.

Earlier research shows that many different factors can explain project cost overruns (Segelod 2017). Various interests and perspectives may, to some extent, explain why projects cause overruns (Ruoslahti 2018). Besides the unavoidable risk and uncertainty, cost and time overruns can be vastly influenced by contractual difficulties, lack of communication, and even the opportunistic behavior of one or both parts. These factors are investigated in this paper, in relation to drivers of change orders, i.e., alterations causing time and cost addition.

2.1 Change orders

The negative sides of change orders in construction projects are often recognized in the current literature (Khanzadi et al. 2018). Change orders conceptually refer to a bargaining process in which clients (i.e., owners) and contractors (i.e., builders) meet to adjust the original scope of construction of the project after signing the contract (Ahmed et al. 2016). Such a process can be lengthy and involve substantial additions to the original plan that the client expects (Keane et al. 2010) or on-site

conditional (Wu et al. 2005). As some of the change orders impact delays in time, and subsequently, cost overruns, they may also cause vivid discussions about whether these were in the contract implicitly and to what extent the client or the contractor caused the additional changes due to shortcomings in fulfilling their part of the contract. These processes of bargaining are frequently cited as a relevant project management issue in the construction industry (Johnson and Babu 2020). Following Pesämaa et al. (2018), we define interactions that occur due to bargaining as tensions. According to Pesämaa et al. (2018), these tensions imply a lack of agreed terms and that the negotiating part emphasizes their own interest. Furthermore, we assume that clients and contractors may have different expectations, which further affect drivers to change orders differently (Pesämaa et al. 2018).

2.2 Leadership drivers to change orders

Ghoddousi and Hosseini (2012) argue that insufficient quality of leadership is the key cause of non-productivity in construction projects. Adequate leadership should recognize quality issues and identify overall production issues (Durdyev and Mbachu 2018). According to Pesämaa et al. (2018), leadership issues also cause tensions that directly depend on the counterpart's lack in leadership skills. Such lack of leadership caused by non-productive and meaningful interaction causes productivity issues and, subsequently, drivers to change orders. We argue that many of the leadership issues directly refer to issues related to weak interaction, which is defined as the effects of opportunism (Wathne and Heide 2000), competence cost, and bargaining costs (Dahlstrom and Nygaard (1999). We, therefore, hypothesize as follows:

H1a: Opportunism is related to leadership drivers to change orders.

H2a: Competence cost is related to leadership drivers to change orders.

H3a: Bargaining cost is related to leadership drivers to change orders.

2.3 Contractual drivers to change orders

Kamminga (2015) frames contractual issues as the main issue for project management. Lack of specified contracts in agreement among negotiating partners hamper the overall performance (Heravi and Charkhakan 2014). Many of the drivers to change orders are directly related to the perception that the counterpart lacks contractual skills (Ahmed et al. 2016). Such an implicit assumption not only causes tensions, but in the long run also issues of agreed contracts (Pesämaa et al. 2018). Contractual drivers to change orders thus stem from poor interaction between negotiating partners. We argue that many of the contracting issues can be deduced to the effects of opportunism (Wathne and Heide 2000), competence cost, and bargaining costs (Dahlstrom and Nygaard (1999). We, therefore, hypothesize as follows:

H1b: Opportunism is related to contractual drivers to change orders.

H2b: Competence cost is related to contractual drivers to change orders.

H3b: Bargaining cost is related to contractual drivers to change orders.

2.4 Research design

The method for this research paper is designed to explain and describe the roles of change orders. We conducted a survey in 2017 in which both clients and contractors offered their perception of change orders. The survey was sent to client project managers that prepare proposals for infrastructure projects in Sweden and contractor project managers with previous experience from infrastructure projects. The respondents, on average, have 21.9 years (SD 11.4) of work experience.

The measurements are included in full in the Appendix. Two dependent variables are used: leadership drivers to change orders, i.e., factors related to project organization and management, and contractual drivers to change orders, i.e., factors related to the specification, planning, and agreement of the project. Explanatory factors are Opportunism, i.e., action for own short-term gains, Bargaining cost, i.e., the effort of reaching agreements, and Communication cost, i.e., the effort of understanding each other. The study highlights the potential differences between the client and contractor perspectives. Each respondent is identified as being either a client or a contractor, and the analysis can thus distinguish between the two perspectives.

3 Results

A total of 234 complete responses were received (see Table 1). The responses were distributed among 95 clients and 139 contractors.

Tab. 1: Mean differences between clients and contractors

Question	Role	N	Mean	SD	F-value	*p*-value
OPP1: The counterpart presents misleading information to protect their interests.	Client	95	3.58	1.05		
	Contractor	139	3.66	0.93	0.41	0.525
	Total	234	3.63	0.98		
OPP2: The counterpart promises to do things without actually doing them later.	Client	95	3.55	1.01		
	Contractor	139	3.69	0.87	1.35	0.247
	Total	234	3.63	0.93		
OPP3: The counterpart does not always act in accordance with our contract.	Client	95	3.69	0.84		
	Contractor	139	3.85	0.76	2.13	0.146
	Total	234	3.79	0.80		
OPP4: The contractual partner sometimes breaks informal agreements to maximize their own benefit.	Client	95	3.18	1.01		
	Contractor	139	3.24	1.00	0.19	0.663
	Total	234	3.21	1.00		
BC1: Negotiations of financial aspects of the contract are typically difficult and lengthy.	Client	95	3.40	0.97		
	Contractor	139	3.45	0.93	0.13	0.715
	Total	234	3.43	0.94		
BC2: When unexpected changes arise, at least one party was dissatisfied with negotiated outcomes.	Client	95	3.24	0.91		
	Contractor	139	3.24	0.91	0.00	0.969
	Total	234	3.24	0.91		
BC3: Our negotiations with this contracting partner are usually difficult.	Client	95	3.34	0.96		
	Contractor	139	3.14	0.96	2.43	0.120
	Total	234	3.22	0.97		
BC4: Neither party is willing to lower their demands at their own cost.	Client	95	3.44	0.73		
	Contractor	139	3.49	0.72	0.24	0.623
	Total	234	3.47	0.72		
CC1: Information from the contractual partner is poorly formulated and difficult to understand.	Client	95	3.27	0.93		
	Contractor	139	3.15	0.92	1.00	0.318
	Total	234	3.20	0.92		
CC2: Important information from the contractual partner seldom comes at the right time.	Client	95	3.38	0.99		
	Contractor	139	3.46	0.92	0.42	0.520
	Total	234	3.43	0.95		
CC3: Information from the contractual partner is either incomplete or too voluminous to understand.	Client	95	3.27	0.99		
	Contractor	139	3.29	0.96	0.01	0.913
	Total	234	3.28	0.97		
LDCO1: The counterpart's (lack of) interpersonal skills causes change orders.	Client	95	3.13	1.08		
	Contractor	139	2.71	0.98	9.24	0.003
	Total	234	2.88	1.04		
LDCO2: The counterpart's (lack of) leadership skills causes change orders.	Client	95	3.18	1.03		
	Contractor	139	2.87	1.03	5.03	0.026
	Total	234	3.00	1.04		
LDCO3: The counterpart's lack of competence causes change orders.	Client	95	3.34	1.01		
	Contractor	139	3.49	1.14	1.11	0.293
	Total	234	3.43	1.09		

(*Continued*)

Tab. 1: Continued.

Question	Role	N	Mean	SD	F-value	*p*-value
CDCO1: Imprecise projecting of on-site conditions causes change orders.	Client	95	3.23	1.26		
	Contractor	139	4.20	0.91	46.78	0.000
	Total	234	3.81	1.17		
CDCO2: Incomplete early-stage planning causes change orders.	Client	95	3.12	1.14		
	Contractor	139	3.63	0.97	13.50	0.000
	Total	234	3.42	1.07		
CDCO3: Incomplete contracts cause change orders.	Client	95	2.97	1.13		
	Contractor	139	3.99	0.87	60.82	0.000
	Total	234	3.58	1.11		
CDCO4: Poor follow-up of similar projects causes change orders.	Client	95	2.77	1.02		
	Contractor	139	3.51	0.99	31.15	0.000
	Total	234	3.21	1.06		

SD, standard deviation.

Tab. 2: Correlation between composite scores

Composite score	Mean	SD	N	(1)	(2)	(3)	(4)	(5)
1. Opportunism	3.57	0.73	234	0.79				
2. Bargaining cost	3.34	0.67	234	0.39**	0.75			
3. Communication cost	3.30	0.81	234	0.41**	0.48**	0.82		
4. Leadership drivers to change orders	3.10	0.86	234	0.26**	0.02	0.22**	0.82	
5. Contractual drivers to change orders	3.50	0.90	234	0.10	0.17**	0.16*	–0.19**	0.83

*$p < 0.05$, **$p < 0.01$. Diagonal values are Cronbach's alpha.

SD denotes standard deviation.

The decision criterion was that we look for differences between clients and contractors. If the *p*-value is <0.05, it is an indication that the difference in mean values is significant. For most items, there are only minor differences in the comparison of client and contractor perspectives. However, we did find differences in the items related to the drivers of change orders. The differences were prevalent for drivers related to leadership as well as contractual issues. For attitudes and behaviors, there were no significant differences. This indicates that clients and contractors, in general, do not have different views of the investment projects and the interaction therein. Yet, they do have different views on the causes of change orders. This could indicate a tendency to point fingers at the other part, and it inevitably means that the difference in perspective is fundamental for the understanding of what drives change orders and causes project time and cost overruns.

The second test was that we calculated five composite scores (i.e., summated means). These are opportunism (four variables), bargaining cost (four variables), communication cost (three variables), leadership drivers to change orders (three variables), and contractual drivers to change orders (four variables). We did a Cronbach's alpha test to check whether the proposed measures measured the same thing. Our Cronbach's alpha test showed that all the proposed composite scores exceeded the recommended 0.70 level, and we could thus assume sufficient reliability of these measures. The subsequent tests are thus performed on the composite scores.

The correlation table indicates that several of the proposed measures are correlated (Table 2). We can thus assume that the two types of change orders that we wanted to explain can be modeled with linear regression.

We further assumed that leadership drivers to change orders depend on opportunism (H1a), bargaining cost (H2a), and communication cost (H3a). We notice that opportunism and communication costs are significant and robust for the whole sample, but only communication costs remain significant for clients (Table 3). We further see that both opportunism and communication costs

Tab 3: Regression on leadership drivers to change orders

	Dependent variable: Leadership drivers to change orders		
	All	Client	Contractor
H1a: Opportunism	0.24***	0.18	0.24***
H2a: Bargaining cost	−0.17*	−0.07	−0.17*
H3a: Communication cost	0.21**	0.31**	0.21**
R-square	10.40%	18.10%	11.10%
Adj. *R*-square	9.20%	15.40%	9.10%

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Beta-values reported.

Tab 4: Regression on contractual drivers to change orders

	Dependent variable: Contractual drivers to change orders		
	All	Client	Contractor
H1b: Opportunism	0.01	−0.09	0.04
H2b: Bargaining cost	0.12	0.37***	−0.07
H3b: Communication cost	0.09	−0.10	0.27**
R-square	4.00%	11.60%	6.40%
Adj. *R*-square	2.40%	8.70%	4.30%

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Beta-values reported.

are positive and significant for contractors, whereas bargaining cost is negatively related to leadership drivers to change orders. There are thus two different explanations for clients and contractors.

Subsequently, we argued that contractual drivers to change orders depend on opportunism (H1b), bargaining cost (H2b), and communication cost (H3b). Here we notice that the overall sample reports insignificant results for all the three hypotheses (Table 4). However, turning to the two separate samples, we see that clients' explanations of contractual change orders mainly emphasize bargaining costs. Conversely, contractors' explanations of contractual drivers mainly rely on communication costs. The explanations are thus different for the two groups and may also explain why the *R*-squares for both models tend to be relatively low. It further shows how different the two perspectives are, and the risk of conflicts emerging around change orders.

4 Discussion and implications

This paper is based on an issue of contractual change orders. Such change orders are defined as additional work and are intended to show who to blame when contracts result in time and cost overruns. The results show that there are significant differences between client and contractor perceptions of drivers to change orders. While earlier research has shown the impact of change orders (Zhang et al. 2019), this research is attempted to explain such change orders.

Change orders are ultimately a critical situation (Johnson et al. 2020) in which the negotiating partners meet to discuss specific and tangible unperformed agreed tasks. To this end, the literature posits that these issues stem from poor leadership (Ghoddousi and Hosseini 2012) or contractual issues (Kamminga 2015). Based on a framework to analyze tensions (Pesämaa et al. 2018), we deduced three major determinants that may affect drivers to change orders. We argue that opportunism (Rokkan, Heide, and Wathne 2003), competence cost, and bargaining costs (Dahlstrom and Nygaard 1999) affect both drivers to leadership and contractual change orders. Furthermore, and based on earlier research (Pesämaa et al. 2018), we assume that client and contractor expectations differ in construction projects. This study confirms client and contractor differences by testing these perspectives separately in a regression model.

Through analysis of the mean differences, we found that clients and contractors do not differ in the general assessment of opportunism, bargaining costs, and communication costs. There were, however, differences in both leadership and contractual drivers to change orders. When it comes to leadership drivers to change orders, we found that clients tend to perceive these to come from competence costs, while contractors rather see this as a result of opportunistic behavior in combination with competence costs. Yet, when analyzing contractual drivers to change orders, we found that clients tend to see this as an effect of bargaining costs, while contractors rather perceive this as a result of competence costs.

The significant differences that were found indicate that although clients and contractors may have a similar understanding of the attitudes and behavior in the project interaction, the drivers of change orders are seen very differently. This difference could, potentially, itself lead to miscommunication and misconceptions, leading to further time and cost overruns.

5 Conclusions

While the earlier literature has identified how much time and cost overruns various projects cause (Zhang et al. 2019), this paper has tested some tentative theoretical and empirical explanations to drivers of leadership – and contractual change orders. We postulated that these types of change orders are the effects of tensions that evolve from opportunism, bargaining costs, and competence costs. Furthermore, we found that depending on the type of explanation (i.e., leadership-driven or contractual-driven change order), clients and contractors have different explanations. We believe that these tentative results could inspire further research to explore the nuances of these negotiating processes in more detail. As clients and contractors have different roles, their expectations on leadership and contracts also differ. We suggest that such a mismatch of expectations may also result in extensive blaming, which is harmful to the project.

References

Ahmed, M. O., El-Adaway, I. H., Coatney, K. T., & Eid, M. S. (2016). Construction bidding and the winner's curse: Game theory approach. *Journal of Construction Engineering and Management, 142*(2), pp. 04015076.

Cantarelli, C. C., Flyvbjerg, B., & Buhl, S. L. (2012). Geographical variation in project cost performance: The Netherlands versus worldwide. *Journal of Transport Geography, 24*, pp. 324-331.

Cantarelli, C. C., Flyvbjerg, B., Molin, E. J. E., & Wee, B. (2010). Cost overruns in large-scale transportation infrastructure projects: Explanations and their theoretical embeddedness. *European Journal of Transport and Infrastructure, 10*(1), pp. 30-41.

Cantarelli, C., van Wee, B., Molina, E. J. E., & Flyvbjerg, B. (2012). Different cost performance: Different determinants? The case of cost overruns in Dutch transport infrastructure projects. *Transport Policy, 22*, pp. 88-95.

Flyvbjerg, B., Holm, M. S., & Buhl, S. (2002). Underestimating costs in public works projects: Error or lie? *Journal of the American Planning Association, 68*(3), pp. 279-295.

Flyvbjerg, B., Skamris Holm, M. K., & Buhl, S. L. (2003). How common and how large are cost overruns in transport infrastructure projects? *Transport Reviews*, *23*(1), pp. 71-88.

Ghoddousi, P., Hosseini, M. R. (2012). A survey of the factors affecting the productivity of construction projects in Iran. *Technological and Economic Development of Economy, 18*(1), pp. 99-116.

Gustafsson, A. (2016, 14 November). Notan för Nya Karolinska skulle räcka till två Slussen. *Dagens Nyheter*. Available at https://www.dn.se/sthlm/notan-for-nya-karolinska-skulle-racka-till-tva-slussen/

Heravi, G., & Charkhakan, M. H. (2014). Predicting and tracing change-formation scenarios in construction projects using the DEMATEL technique. *Journal of Management in Engineering, 30*(6), pp. 04014028.

Idrottens Affärer. (2013, 25 December). *Arenakostnaderna uppe i 8 miljarder.* Available at www.idrottensaffarer.se

Johnson, R. M., & Babu, R. I. I. (2020). Time and cost overruns in the UAE construction industry: A critical analysis. *International Journal of Construction Management, 20*(5), pp. 402-411.

Kamminga, P. (2015). Rethinking contract design: Why incorporating non-legal drivers of contractual behavior in contracts may lead to better results in complex defense systems procurement. *Journal of Public Procurement, 15*(2), pp. 208-235.

Keane, P., Sertyesilisik, B., & Ross, A. D. (2010). Variations and change orders on construction projects. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 2*(2), pp. 89-96.

Khanzadi, M., Nasirzadeh, F., & Dashti, M. S. (2018). Fuzzy cognitive map approach to analyze causes of change orders in construction projects. *Journal of Construction Engineering and Management, 144*(2), pp. 04017111.

Lehtinen, J., Peltokorpi, A., & Artto, K. (2019). Megaprojects as organizational platforms and technology platforms for value creation. *International Journal of Project Management*, *37*(1), pp. 43-58.

Littorin, J. (2015). Hallandsåstunneln öppnar – 18 år försenat. *Dagens Nyheter.* 8 December. Available at http://dn.se

Liu, J., Zuo, J., Sun, Z., Zillante, G., & Chen, X. (2013). Sustainability in hydropower development—A case study. *Renewable and Sustainable Energy Reviews*, *19*, pp. 230-237.

Makovšek, D., Tominc, P., & Logožar, K. (2012). A cost performance analysis of transport infrastructure construction in Slovenia. *Transportation*, *39*(1), pp. 197-214.

Odeck, J. (2004). Cost overruns in road construction—What are their sizes and determinants? *Transport Policy*, *11*(1), pp. 43-53.

Park, Y., & Papadopoulou, T. (2012). Causes of cost overruns in transport infrastructure projects in Asia: Their significance and relationship with project size. *Built Environment Project and Asset Management, 2*(2), pp. 195-216.

Pesämaa, O., Dahlin, P., & Öberg, C. (2018). Reduction of tension effects on partner evaluation. *Marketing Intelligence & Planning, 36*(4), pp. 425-439.

Pesämaa, O., Larsson, J., & Eriksson, P. E. (2018). Role of performance feedback on process performance in construction projects: Client and contractor perspectives. *Journal of Management in Engineering, 34*(4), pp. 04018023.

Qiu, Y., Chen, H., Sheng, Z., & Cheng, S. (2019). Governance of institutional complexity in megaproject organizations. *International Journal of Project Management, 37*(3), pp. 425-443.

Rokkan, A. I., Heide, J. B., & Wathne, K. H. (2003). Specific investments in marketing relationships: Expropriation and bonding effects. *Journal of Marketing Research, 40*(2), pp. 210-224.

Ruoslahti, H. (2018). Co-creation of knowledge for innovation requires multi-stakeholder public relations. *Public Relations and the Power of Creativity, Advances in Public Relations and Communication Management*, *3*, pp. 115-133.

Segelod, E. (2017). *Project Cost Overrun: Causes, Consequences, and Investment Decisions*. Cambridge University Press, Cambridge. doi: 10.1017/9781316779675.009

Senescu, R. R., Aranda-Mena, G., & Haymaker, J. R. (2013). Relationships between project complexity and communication. *Journal of Management in Engineering*, *29*(2), pp. 183-197.

Shehu, Z., Endut, I. R., Akintoye, A., & Holt, G. D. (2014). Cost overrun in the Malaysian construction industry projects: A deeper insight. *International Journal of Project Management*, *32*(8), pp. 1471-1480.

Swedbank. (2013). Ny Nationalarena i Solna AB: Swedbank Arena. Stockholm. Available at https://www.swedbank.se/idc/groups/public/@i/@sbg/@gs/@com/documents/article/fm_478566.pdf

Themsen, T. N. (2019). The processes of public megaproject cost estimation: The inaccuracy of reference class forecasting. *Financial Accountability & Management*, *35*(4), pp. 337-352.

Tsai, W. H., Lin, S. J., Liu, J. Y., Lin, W. R., & Lee, K. C. (2011). Incorporating life cycle assessments into building project decision-making: An energy consumption and CO2 emission perspective. *Energy*, *36*(5), pp. 3022-3029.

Wathne, K. H., & Heide, J. B. (2000). Opportunism in interfirm relationships: Forms, outcomes, and solutions. *Journal of Marketing, 64*(4), pp. 36-51. doi: 10.1509/jmkg.64.4.36.18070.

Wu, C. H., Hsieh, T. Y., & Cheng, W. L. (2005). Statistical analysis of causes for design change in highway construction on Taiwan. *International Journal of Project Management, 23*(7), pp. 554-563.

Zhang, J., Li, H., Olanipekun, A. O., & Bai, L. (2019). A successful delivery process of green buildings: The project owners' view, motivation and commitment. *Renewable Energy*, *138*, pp. 651-658.

Appendix – Measurement items

Opportunism (Adapted from Rokkan et al. 2003)
Definition: Self-centred behavior in contractual situations.
Reliability, Cronbach's alpha: 0.79
5-Point Likert Scale: *completely inaccurate description/completely accurate description*
OPP1: The counterpart presents misleading information to protect their interests.
OPP 2: The counterpart promises to do things without actually doing them later.
OPP 3: The counterpart does not always act in accordance with our contract.
OPP 4: The counterpart sometimes breaks informal agreements to maximize their own benefit.
Bargaining costs (Adapted from Dahlstrom and Nygaard 1999)
Definition: Degree of skills under and during contractual situations.
Reliability, Cronbach's alpha: 0.75
5-Point Likert Scale: *strongly disagree/strongly agree*
BC1: Negotiations of financial aspects of the contract are typically difficult and lengthy.
BC 2: When unexpected changes arise, at least one party was dissatisfied with negotiated outcomes.
BC 3: Our negotiations with this contracting partner are usually difficult.
BC4: Neither party is willing to lower their demands at their own cost.

Communication cost

Definition: Cost of lacking communication in contracting situations.
Reliability, Cronbach's alpha: 0.82
5-Point Likert Scale: *strongly disagree/strongly agree*
CC1: Information from the counterpart is poorly formulated and difficult to understand.
CC2: Important information from the counterpart seldom comes at the right time.
CC3: Information from the counterpart is either incomplete or too voluminous to understand.

Leadership drivers to change orders

Definition: Perception of counterparts lacking leadership skills.
Reliability, Cronbach's alpha: 0.82
5-Point Likert Scale: "strongly disagree/strongly agree"
LDCO1: The counterpart's (lack of) interpersonal skills causes change orders.
LDCO2: The counterpart's (lack of) leadership skills causes change orders.
LDCO3: The counterpart's lack of competence causes change orders.

Contractual drivers to change orders

Definition: Perception of counterparts lacking contractual skills.
Reliability, Cronbach's alpha: 0.83
5-Point Likert Scale: *strongly disagree/strongly agree*
LDCO1: Imprecise projecting of on-site conditions causes change orders.
LDCO2: Incomplete early-stage planning causes change orders.
LDCO3: Incomplete contracts cause change orders.
LDCO4: Poor follow-up of similar projects causes change orders.