Road-Testing the ITA Contractual Practices Checklist

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1. INTRODUCTION

Do contractual practices affect project outcome? Can better contractual practices improve the likelihood of project success? The consensus amongst experts is that better contractual practices really do improve project outcomes. With this in mind the members of the International Tunnelling Association (ITA) Working Group 3 on Contractual Practices (WG3) pooled their collective knowledge to publish in 2011 the document entitled The ITA Contractual Framework Checklist for Subsurface Construction Contracts (ITA Working Group 3, 2011).

Written for projects involving significant subsurface works, e.g. tunnels and caverns, the ITA Framework Checklist explains the major contractual issues that must be considered to ensure a successful project. Its goal is not to specify how each issue should be resolved, but rather to highlight the issues and give recommendations on how they should be addressed. The Checklist is compatible with, and provides guidance for reviewing, standard contracts such as FIDIC and NEC. One of the authors is a co-author of the Checklist and has contributed to previous papers describing the Checklist and its applicability to hydropower projects (Hodgkinson & Wilson 2014, Hodgkinson & Wilson 2015).

The Checklist identifies a series of issues that should be contractually defined, which can be summarised as follows:

- Methods for dealing with geotechnical uncertainties should be defined in the contract
- There should be an appropriate level of geotechnical/geological investigation
- Sufficient mobilization periods should be allowed
- Sufficient time should be allowed for testing and commissioning
- Procedures for timely dispute resolution should clearly defined
- Quality and performance requirements should be clearly defined and measurable
- Provision should exist for cost consequences of unforeseen circumstances
- Dispute resolution processes should be clearly defined

- Payment processes should be fair and clearly defined
- Risk should be clearly allocated and parties should be able to bear the risks they carry
- There should be a mechanism for adjusting payments according to conditions
- The risk management approach should be clearly defined
- Admeasurement or unit price approaches are recommended
- The responsibilities of each party must be clearly defined
- The consequences of non-performance should be clearly defined
- The Construction Programme (Schedule) should be realistic.

The Checklist was updated in 2015 with minor clarifications and the inclusion of a discussion of the issue of sovereign risk.

This paper presents the methodology and results of a study which was undertaken to determine whether adhering with the Checklist's recommendations correlates positively to successful project outcomes. The study was performed using an online survey that selected industry practitioners were invited to take. The respondents were requested to report on the contractual practices and project outcome of a single project with a significant subsurface component.

2. METHODOLOGY

An online survey was developed to test the Checklist's recommendations. The survey questions were grouped into twelve categories:

1. Project Information
2. Studies
3. Risk Factors
4. Risk Allocation
5. Forms of Contract
6. Defects and Dispute Resolution
7. Procurement
8. Change Management
9. Project Close-out
10. Unfairness
11. Project Outcome
12. Thank You

The final, optional, "Thank You" section allowed respondents to enter their contact details if they wanted to receive results, feedback and further information. The full text of the questionnaire can be found at Hodgkinson et al. (2015a).

There were 60 questions in total, which included 57 multiple choice questions. Over half the questions (31 in number) requested a "level of agreement" to a provided statement, based on a six-point scale. The six-point scale was selected in order to offer an ample grading of impact. The even number of choices ensured that respondents were unable to select a middle or average opinion (as often happens when using an odd-number choice scale).

Using statements rather than questions allows a finer level of detail to be captured. The statements were intended to get the respondents own views on what elements were used or followed and to what

degree that element (as a subset of the recommendations) was applied. For example in the Change Management section the first statement says:

"Procedures for changing scope were clearly defined in the contract."

The respondent is then requested to choose from the six-point scale of:

1. Strongly disagree
2. Disagree
3. Slightly disagree
4. Slightly agree
5. Agree
6. Strongly agree

Wherever possible we sought to choose this statement/graded opinion method to collect data. However, not all sections fitted the graded statement approach. In the Risk Allocation section there were Yes/No questions asking whether a standardized risk management approach was used and whether the ITIG (International Tunnelling Insurance Group) Joint Code of Practice was followed. Other Yes/No questions were used to ask about the use of incentive/penalty systems, whether there was a Differing Site Conditions (DSC) or similar clause and whether a Disputes Resolution Board (DRB) or other Alternative Dispute Resolution (ADR) clause existed.

In the Procurement section several simple Yes/No questions asked whether a (pre-) qualification process was adopted, how the tenders (bids) were evaluated and what types of bonds, if any, were required.

In the Project Close-out section there were Yes/No/Not Applicable (three choice) questions to ask whether disputes arose in completed projects and if so how they were resolved and whether bonds or guarantees were called.

In the Project Information section multiple choice (choosing from a list) questions were asked to find out the project size (by cost), the respondent's years of experience and the types of studies undertaken for the project. There was also a multiple choice question seeking to find the level of bonding required as a percentage of bid value.

Finally, in the Project Outcome section there were three "free text" type questions aimed at collecting statements on "Success Factors", "Lessons Learned" and "Recommendations". Respondents were asked to enter text statements describing their own experience and recommendations.

To encourage openness, the survey did not require the participant's name or any information that might allow them or the project to be identified.

It was intended to only include participants who had sufficient contract and project knowledge to form opinions. Our list of contact names included the authors' own contact lists and lists of delegates of ITA tunnelling conferences from the ITA's database. All names were sent invitation e-mails describing the survey and its purpose and a link to the web-site that administered the survey. Two follow-up reminders were sent, two and four weeks after the original e-mail, to encourage additional responses.

3. RESULTS

The initial mailing resulted in a surge of survey responses, followed by smaller surges after each of the two reminder e-mails. As is common with surveys, many people started but did not finish the survey. Figure 1 shows the histogram of the number of questions answered by all participants.

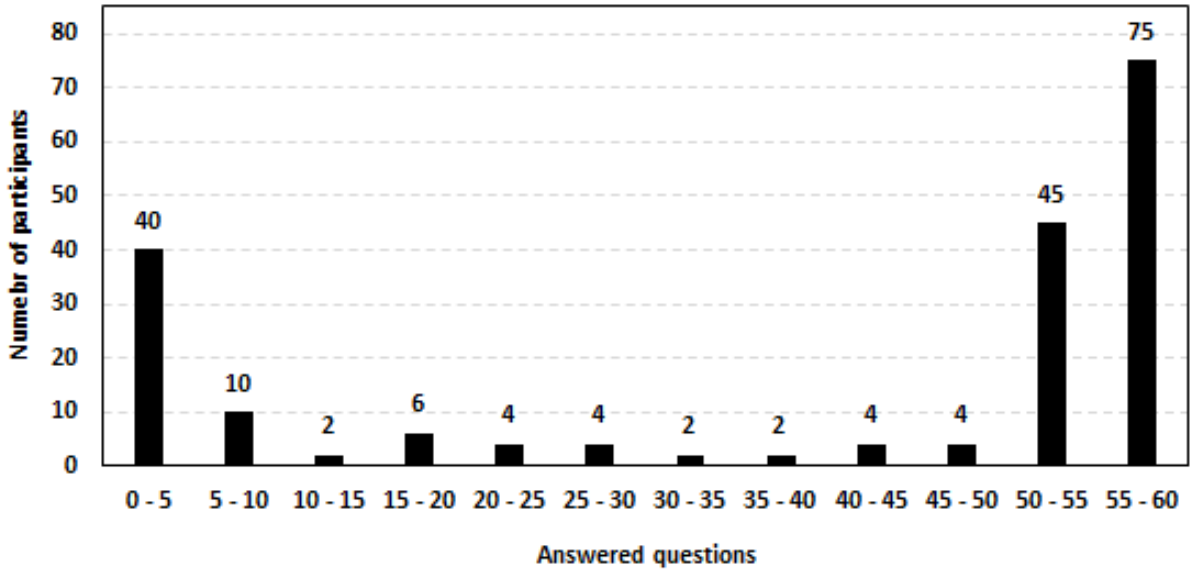

Figure 1. Number of questions answered per participant.

Three weeks after the final email reminder the final number of participants was 198. This included all participants who answered at least one question. From the histogram the authors decided to only include responses from participants who answered a minimum of 50 of the 60 questions, to ensure that the responses covered all survey topics, and specifically included the response to the question asking about the project outcome. This left a total of 120 participants whose responses became the dataset that was analyzed.

The final dataset was loaded into an Excel spreadsheet. The spreadsheet was then programmed to calculate and display:

- The descriptive statistics parameters of all the questions
- Uni-variable histograms to investigate the distribution of the answers in each question, considering also a secondary criterion; e.g. the distribution of the answers in question X only for the participants that have selected “Agree” in question Y
- The development of multi-variable diagrams to graphically illustrate the correlation between the answers of two questions
- The calculation of the correlation matrix for all the possible pairs of parameters providing an integrated approach for the correlation between the responses of all the questions.

Additional fields were included in the database to allow specific participants to be excluded or included in the data evaluations, which was typically used for plausibility testing.

The main characteristics of the final sample (geographical distribution of the projects and size of the projects) are shown in Figures 2 and 3 and a typical histogram for the answers to a single question is presented in Figure 4.

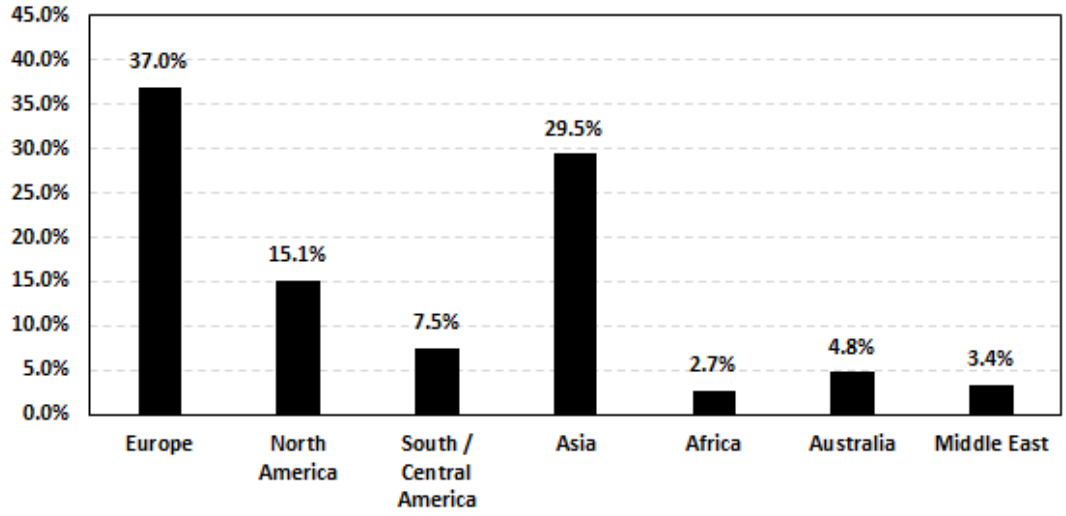

Figure 2. Geographical distributions of projects.

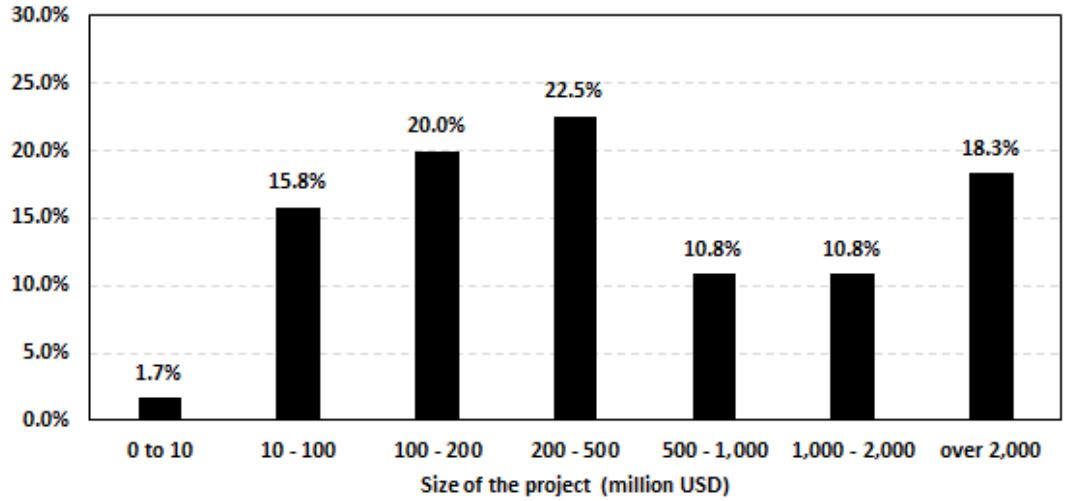

Figure 3. Project sizes.

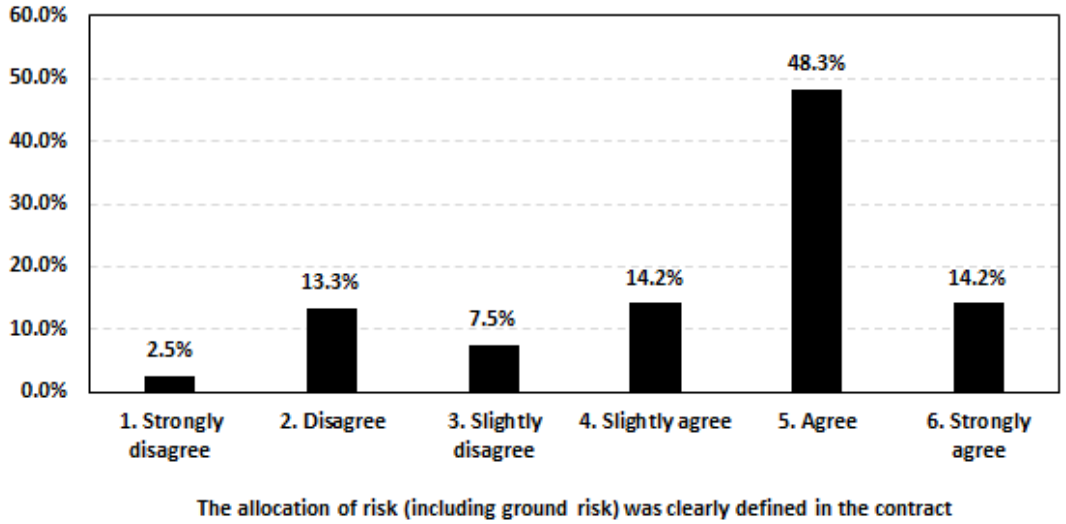

Figure 4. Allocation of risk.

The correlation matrix was calculated by assigning numeric values to each answer. The values were set using a linear scale, with “Strongly disagree” to “Strongly agree” responses set to one through six and “No” and “Yes” set to one and two, such that positive answers always had higher values. “N/A” responses and all questions that were not responded to by participants were excluded from the correlations.

The key result is the set of correlations of all questions against the final survey statement “The project had a completely successful outcome”. The absolute values of the correlations are less important than their sign and relative rankings. That is, the correlation rankings give an indication of the relative importance of a given factor to the project outcome. The full list of correlations of the survey questions to the project outcome can be found in Hodgkinson et al. (2015b). The largest positive correlations to project outcome are shown in Table 1 and the largest negative correlations in Table 2.

Table 1. Largest positive correlations to project outcome.

#	Survey Section	Statement	Corr.
P1	Defect Resolution	Defect resolution procedures worked well	0.447
P2	Risk Allocation	Contract(s) provided risk allocation was shared between parties	0.354
P3	Risk Factors	All parties were familiar with the relevant legal environment(s)	0.332
P4	Risk Factors	Project team’s experience level was high and appropriate	0.327
P5	Procurement	A points or technical merit score was used for selection process	0.267
P6	Studies	Extensive studies and surveys were carried out	0.263
P7	Project Close-out	Disputes were resolved through a DRB	0.260
P8	Defect Resolution	Dispute resolution procedures were clearly defined	0.254
P9	Change Mgt.	Procedures for changing scope were clearly defined	0.246
P10	Risk Allocation	The allocation of risk (including ground risk) was clearly defined	0.240
P11	Forms of Contract	The payment mechanisms were clearly specified	0.206
P12	Risk Factors	Risks to existing buildings often dictated working methods	0.199
P13	Risk Factors	Many of the parties involved had worked together previously	0.190
P14	Procurement	Qualification or prequalification was required	0.190
P15	Defect Resolution	Claims resolution procedures were clearly defined	0.185
P16	Risk Factors	There is good experience of this type of project in the region	0.173
P17	Forms of Contract	There was a pain/gain or penalty/incentive payment system	0.173
P18	Risk Allocation	Differing ground conditions risk was carried by the Client/Owner	0.143

Table 2 - Largest negative correlations to project outcome.

#	Survey Section	Statement	Corr.
N1	Project Close-out	Did/will disputes result in proceedings at a court of law?	-0.592
N2	Procurement	Was the selection process based on price alone?	-0.369
N3	Project Close-out	Did disputes arise on the project?	-0.333
N4	Unfairness	Unfairness issues had an adverse effect on the project outcome	-0.325
N5	Unfairness	There were other unfairness issues on this project	-0.314
N6	Unfairness	There were unfairness issues on this project	-0.274
N7	Risk Allocation	A standardized risk management approach was used	-0.205
N8	Forms of Contract	Were standard forms of contract used?	-0.159

The lack of very high and low correlation values suggest that there is no single contractual issue that can be 'fixed' to ensure a positive project outcome, and that successful projects most likely result from doing many things right.

The final three questions in the survey asked respondents for statements of the "*Success Factors*" and "*Lessons Learned*" from the project and their "*Recommendations*" for future projects. A total of 236 statements were entered. Approximately two-thirds of the respondents entered values for one or more of the final three questions.

All the statements in the text responses were analyzed and assigned to one or more categories. The list of categories and the number of statements in each one is shown in the Table 3. The percentages sum to greater than 100% due to rounding.

Table 3. Text response categories.

#	Category	N	%
S1	Technical and managerial skills and experience	77	33%
S2	Clear definition of contractual procedures	56	24%
S3	Teamwork, cooperation and open communication	48	20%
S4	Site investigations, studies, GBR, etc.	31	13%
S5	Fair and clear allocation of risk and risk management	15	6%
S6	Sufficient funds for realization	8	3%
S7	Procurement and pre-qualification	7	3%
S8	Incentives, penalties and flexible payment systems	5	2%
	Total number of statements	**236**	**100%**

4. DISCUSSION

There were no correlations in the opposite direction to that expected from the Checklist. There were also no cases where "Success Factors", "Recommendations" (expressed as positive statements) or "Lessons Learned" (expressed as negatives) contradicted each other. Nor did any of the statements contradict the Checklist recommendations. This is confirmation that the Checklist's recommendations are borne out in practice.

According to Table 3, the three most important factors in the respondent statements, which were explicitly mentioned by more than half of all respondents, were:

- Technical and managerial skills and experience (S1), or the lack of them, is likely the key factor to project success. This includes having familiarity with the relevant legal environment (P3), sufficient and appropriate skills (P4), experience working together previously (P13), and experience with the particular type of project (P16)
- Clear definition of contractual procedures (S2), including those for resolving disputes (P8), changing scope (P9), payment mechanisms (P11), and resolving claims (P15)
- Teamwork and cooperation (S3).

These three factors are also emphasized by the recommendations in the Checklist, namely that subsurface works require experienced specialists, and that contracts should clearly describe the duties and responsibilities of all parties and define procedures for resolving differences, in a manner that fosters cooperation.

The Defect and Dispute Resolution and Project Close-out sections indicate the importance of having defect resolution procedures that actually work (P1). Projects should try to avoid disputes (N3), but if they do develop, resolution procedures should be clearly defined in the contract (P8) and use of a DRB (P7) is recommended. The largest negative correlation (N1) serves as a warning, echoed by the Checklist, that resorting to courts of law to resolve disputes leads to poor project outcomes.

The Risk Allocation section indicates the importance of clearly and fairly allocating risk (P2, S5), including the ground risk (P10). Modern contracts are trending towards having the Client or Employer carry the ground risk (P18) which is in line with the Checklist's recommendations.

Respondents also indicated the importance of site investigations (P6, S4), and procurement that required (pre-)qualification (P14, S7), based on a points or technical merit system (P5) rather than on price alone (N2).

Use of a standardized risk management system (N7) and standard forms of contract (N8) had moderate negative correlations to project outcomes, perhaps indicating that naive application of standardized systems can lead to worse outcomes. Unfairness was negatively correlated with project outcomes (N4, N5, N6).

Interestingly, higher risks and more challenging projects do not correlate strongly with project outcome. This might be because good recognition of risks leads to plans and procedures that appropriately deal with them.

5. CONCLUSIONS

The survey results, which represent experience from a wide range of projects and geographical areas, show that following the Checklist's recommendations does correlate positively to project outcomes. The fact that none of the correlations and statements about project experiences and recommendations from the survey respondents conflict with anything in the Checklist adds confidence that the Checklist recommendations are really correct and useful.

Further significant, but unsurprising, findings are that skill, experience, teamwork and cooperation were felt to be a significant indicator of project success. A challenge to contract writers is to consider how to write contracts that foster teamwork and cooperation, and ensure selection of personnel with appropriate skills and experience.

The ITA and its Working Groups have produced publications on a broad range of topics related to underground excavation, which can be accessed through the ITA website (http://www.ita-aites.org). Many of these publications are useful reference documents for projects that require extensive surface and subsurface excavation. The Contractual Framework Checklist is a useful reference when formulating contract documents for projects with substantial underground work.

6. REFERENCES

ITA Working Group 3. 2011. *The ITA Contractual Framework Checklist for Subsurface Construction Contracts*, Report No. 006, ISBN: 978-2-9700624-7-9, http://www.ita-aites.org/en/publications/wg-publications/download/82_ca1e25b526079aa7b0d24474b29143c9

Hodgkinson, A., Wilson, A. 2014. The ITA Contractual Practices Checklist of Subsurface Construction Contracts, *Hydro 2014 Conference Proceedings - Building on Recent Development Progress*. Cernobbio, Italy, 2014, http://www.softxs.ch/papers

Hodgkinson, A., Wilson, A. 2015. Effective Allocation of Excavation Risk in Hydropower Projects. *ICOLD 2015 25th Congress / 83rd Annual Meeting, Conference Proceedings*. Stavanger, Norway, 2014. http://www.softxs.ch/papers.

Hodgkinson, A., Caiden, D., Fortsakis, P. 2015a. *ITA WG3 Contractual Practices Checklist Survey Text*, http://www.softxs.ch/info/ita-wg3-survey/ab52015

Hodgkinson, A., Caiden, D., Fortsakis, P. 2015b. *ITA WG3 Contractual Practices Checklist Survey Project Outcome Correlations*, http://www.softxs.ch/info/ita-wg3-survey/cb52015

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