2014-10-07

Industry Perceptions of Lump Sum Contracting is Alberta Oil and Gas Projects

O'Toole, Jacqueline

Appendix 5: Detailed Statistical Analysis

1 Primary Survey Data Analysis

1.1 Alberta Industry Willingness for Lump Sum Contracting

This section uses Chi Square and Fisher Exact tests to find significant correlations between the survey questions on industry's willingness to use lump sum and the demographic and company specific factors that may influence these opinions.

1.1.1 Company Interest in Lump Sum (Q12)

- *Opinion on Company Interest in Lump Sum Payment Structures versus Organizational Type (Q12 * Q1)*

The hypothesized relationship between Q12 (Company Interest in Lump Sum) and Q1 (Organizational Type) was:

Hypothesis 1: Company Type will be highly correlated with Interest in Lump Sum

Operators (principal) and contractors (agents) are two groups with very divergent interests. One group desires utility maximization (principal) and the other desires profit maximization (agents). Based on the preliminary interviews conducted in this study, Operators were expected to feel more favourable toward Lump Sum (LS) payment structures because LS may offer better perceived cost control/certainty and transfer of risk to the agent company. Both Engineers and Constructors were expected to have less interest in LS because of the increased risk absorbed by the contractor. From the pre-interviews, many Engineers stated that they were unlikely to accept Full EPC lump sum contract when required to partner with a Constructor. The reason given was that the Constructors they currently conduct business with had no interest in accepting LS payment structure work.

Q12 and Q1 were found to be highly correlated (χ^2 =18.92, *df*=2, P<0.001). As expected, Operators showed more interest in using LS than contractor companies; there was found to be a 41.1% difference in interest between Operators and Engineers and an 11.8% difference in

interest between Operators and Constructors. Constructors showed a 29.3% greater interest in LS than the Engineers. Somewhat surprisingly, Constructors were more aligned with the Operators than with the Engineers, with respect to interest in using LS, despite both Contructors and Engineers being on the contractor side of the industry. Engineers saw more sources of risk than the other two organizational types. Engineers were concerned about labour risk, risk of fast tracking, desire for involvement by local clients, and poor scope definition. Operators and Constructors listed far more advantages to using LS than Engineers, perhaps indicating that they feel, for their particular groups, the advantages to using LS outweigh the risks.

- *Opinion on Company Interest in Lump Sum Payment Structures versus Years Working Experience (Q12 * Q3)*

The hypothesized relationship between Q12 (Company Interest in Lump Sum) and Q3 (Years Working Experience) was:

Hypothesis 3: Years working experience will be highly correlated with Interest in Lump Sum

Years working experience was expected to influence company interest in LS as years of experience may imply a higher level position within a company. Having a higher position may result in an individual possessing more knowledge and understanding of company business strategies and risk tolerance levels. More years' working experience may also indicate more knowledge of payment structure strategies and may influence perceptions of the value to using a LS payment structure. Whether the response would be positively or negatively correlated was not speculated.

Q12 and Q3 were found to be highly positively correlated through the Fisher Exact Test ($P<0.001$). Respondents having less than 15 years' working experience were very interested in LS (100%). For respondents with intermediate years' working experience, above 15 years and below 25 years, there was declining interest in LS, with 57.7% of the 16-20 year group showing interest and 42.9% of the 21-25 year group showing interest. Above 25 years' experience, there is a sharp increase in the interest level for LS, with 82.4% of the sample showing company interest.

- *Opinion on Company Interest in Lump Sum Payment Structures versus Current Company Operates Internationally (Q12 * Q4)*

The hypothesized relationship between Q12 (Company Interest in Lump Sum) and Q4 (Company Operates Internationally) was:

Hypothesis 4: Company international experience will be highly correlated with Interest in Lump Sum

Company international experience was expected to influence company interest in LS. Feedback from the pre-interviews indicated that many projects in oil and gas outside of North America are done using LS payment structures. International experience may increase a company's willingness to implement LS due to previous experience with LS and knowledge of how to mitigate the risk factors associated with LS, thereby leading to positive project outcomes.

Through the Fisher Exact Test, Q12 and Q4 were found to be highly positively correlated ($P<0.001$). Of 111 respondents whose companies had international experience, 79.3% indicated an interest in LS. Of the nine respondents whose companies did not work internationally, only 11.1% indicated an interest in LS. These results suggest that operating internationally does seem to influence the willingness to execute projects in a LS environment. Many contractors with international experience mentioned the opportunity for higher profits in a LS model, if the contract is well administered as a driver. For operator companies that had worked internationally, the main reason for interest in LS proposed by Operator respondents was the opportunity for greater cost certainty.

- *Opinion on Company Interest in Lump Sum Payment Structures versus Lump Sum Construction: Alberta Oil and Gas (Q12 * c_Q3)*

The hypothesized relationship between Q12 (Company Interest in Lump Sum) and c_Q3 (Performed Lump Sum Construction: Alberta Oil and Gas Sector) was:

Hypothesis 13: Constructors having performed Lump Sum Payment Structures in Alberta oil and gas will positively influence their company Interest in Lump Sum.

This question was posed to Constructors because during the pre-interview research stage, Engineers indicated a lack of interest in using LS on the construction phase of projects because they perceived there to be a lack of interest on the part of Constructors in partnering on LS projects. It was speculated that having performed LS in oil and gas in the past would be a determining factor for interest in repeating the endeavour.

Through a Fisher Exact Test C_Q3 and Q12 were found to be highly positively correlated ($P<0.001$). Of 35 respondents whose companies had used LS previously, 94.3% indicated an interest in LS. Only six respondents had not used LS in oil and gas in Alberta, and all six respondents had no interest in using LS. The reason provided by respondents who were not interested in LS was their perception that significant risk existed in the Alberta oil and gas industry and that, without proper risk division, too much risk would be placed on the contractor to manage.

- *Opinion on Company Interest in Lump Sum Payment Structures versus Company Engages in Lump Sum Payment Structures (Q12 * Q5.1)*

Question Q5 was asked in such a way that participants could mark off each type of payment structure their company used, rather than having to select the type which their company most commonly uses in their business. As a result, a respondent whose company uses lump sum may also use cost reimbursable or unit rate as part of their business strategy.

The hypothesized relationship between Q12 (Company Interest in Lump Sum) and Q5.1 (Company Engages in Lump Sum Payment Structures) was:

Hypothesis 5: Companies that have engaged in lump sum payment structures will be more likely to have interest in Lump Sum

The basis for this hypothesis was that companies that have past experience with a particular payment structure type would be more likely to engage in this payment type again. Companies with relevant experience may have greater awareness of the requirements and risks associated with a particular payment type than companies that have no experience with that same payment type.

Q12 and Q5.1 were found to have a positive, medium correlation (χ^2 =4.97, *df*=1, P=0.026), with 82.1% of respondents whose companies had used LS previously, believed their companies would be interested in using LS contracts again. Fewer respondents (64.2%), from companies that had not used LS previously indicated their companies may be interested in using LS.

- *Opinion on Company Interest in Lump Sum Payment Structures versus Company Engages in Unit Rate Payment Structures (Q12 * Q5.3)*

The hypothesized relationship between Q12 (Company Interest in Lump Sum) and Q5.3 (Company Engages in Unit Rate Payment Structures) was:

Hypothesis 7: Companies that have engaged in Unit Rate payment structures will be more likely to have interest in Lump Sum.

It was speculated that companies that have previously engaged in unit rate payment structures may be more likely to have interest in LS because the two payment structures, unit rate and lump sum, are more closely related to each other than are cost reimbursable and lump sum, as unit rate is a LS cost for a unit of work.

Q12 and Q5.3 were found to have a negative, medium correlation (χ^2 =6.22, *df*=1, P=0.013). Of the respondents whose companies engaged in unit rate, 65.2% were interested in LS. 85.2% of respondents whose companies did not engage in unit rate were interested in LS. Participant responses suggest that companies that engaged in unit rate payment structures are less likely to want to engage in LS, which is the opposite of the proposed hypothesis.

- *Opinion on Company Interest in Lump Sum Payment Structures versus Company use of Lump Sum on Past Projects: Alberta (Q12 * Q8)*

The hypothesized relationship between Q12 (Company Interest in Lump Sum) and Q8 (Company used Lump Sum on Past Projects: Alberta) was:

Hypothesis 8: Company Interest in Lump Sum will be positively correlated with use of Lump Sum on past projects in Alberta.

Companies that have engaged in LS in Alberta previously would likely be more experienced at using LS in the Alberta environment and would be more willing to engage in LS again.

Q12 and Q8 were found to have a positive, medium correlation (χ^2 =5.59, *df*=1, P=0.018). Companies that had worked with the LS payment structure in Alberta previously were more interested in working with LS again, with 79.2% expressing interest. The companies that had not used LS in the past expressed a 56.0% interest in engaging in LS.

1.1.2 Lump Sum Effect on Project Cost (Q13)

- *Lump Sum Effect on Project Cost versus Organizational Type (Q13*Q1)*

The hypothesized relationship between Q13 (Lump Sum effect on Project Cost) and Q1 (Organizational Type) was:

Hypothesis 15: Type of organization will be highly correlated with perceived effect on project cost.

As discussed previously, Operators and contractors have divergent interests of utility maximization and profit maximization. Based on results from the pre-interviews, Operators may expect LS to reduce costs, as they feel much of the risk is transferred to contractors. Contractors may think costs will increase as a result of the risk premium added to balance out the transfer of risk.

Q1 and Q13 were found to be highly correlated (χ^2 =22.83, *df*=4, P<0.001). 87.8% of Engineers perceived that LS would increase project cost, as was anticipated. The perceptions of Engineers differed from the perceptions of Operators and Constructors, with 52.5% of Operators and 39.0% of Constructors believing LS would increase project cost. A significant percentage of Operators and Constructors felt LS would decrease project cost, 32.5% and 39.0%, respectively, while only 12.0% of Engineers felt LS would decrease cost. None of the Engineers felt that costs would stay the same with LS, while a proportion of Operators and Constructors, 15.0% and 22.0%, respectively, did feel that costs would stay the same with LS. Operators were expected to have a better perception of LS effect on cost than the Engineers, but the Constructor opinion

was unexpected. It is another example where the Constructors are aligned more with the Operators than are the Engineers group, despite both, the Contructors and the Engineers, being on the contractor side of the industry. The Constructors who viewed the cost impact favourably believed LS would lead to more efficient planning, execution, and management of projects; Constructors also believed they could get better supplier pricing under a LS arrangement.

- *Lump Sum Effect on Project Cost versus Role in Organization (Q13 * Q2)*

The hypothesized relationship between Q13 (Lump Sum effect on Project Cost) and Q2 (Role in Organization) was:

Hypothesis 16: A respondent's role in their organization will be highly correlated with perceived effect on project cost.

This hypothesis was based around the speculation that an individual with a higher level role within an organization may have more insight into a their company's position on LS than an individual in a less senior role. Greater years' working experience and more responsibility within a company may influence the desire for LS and its perceived impact on projects. A higher level individual may have greater understanding of the risks faced with using LS in the Alberta environment. No speculation was made on whether a higher level role would result in a favourable or unfavourable view of LS cost impact.

Through the Fisher Exact Test, role in organization and effect on cost was found to have a medium correlation (P=0.043). All four 'role in organization' groups deemed that costs were most likely to increase. For the rest of this analysis, the group 'Other' was left out. Since 'Other' is made up of a mixture of commercial leads, project controls leads, and discipline engineers, there is no clear seniority pattern. This would skew the results.

The other three categories are grouped by increasing level of seniority and responsibility: Project Manager, Senior Manager, and Executive. As seniority increased, so did the perception that cost would increase with LS use. Although Project Managers are less senior in role than executives or senior managers, they may be more familiar with daily project and construction

execution. It is interesting to note that this group had the highest percentage of respondents who viewed LS cost favourably, with 47.4% expecting costs to decrease or stay the same.

- *Lump Sum Effect on Project Cost versus Company Operates Internationally (Q13 * Q4)*

The hypothesized relationship between Q13 (Lump Sum effect on Project Cost) and Q4 (Company Operates Internationally) was:

Hypothesis 18: Company international experience will be highly correlated with perceived effect on project cost.

From interview feedback, it appears many international oil and gas projects are executed on a LS basis. Therefore, international experience could increase how many LS payment situations participants had been exposed to. This may influence how well they feel their company could perform within a LS environment and may influence what they thought would happen to cost. As well, they may have firsthand knowledge of the effect risks associated with LS have on cost.

Q13 and Q4 were found to be highly correlated through the Fisher Exact test (P=0.006). Respondents whose companies operate internationally were more likely to think that LS increases cost, with 62.5% choosing increases cost and only 37.5% choosing decreases cost or does not affect cost. Although a very small number of participants had companies that did not operate internationally, it is still an interesting result that they were more likely to choose LS decreases cost, with 77% choosing decrease cost over increase cost (22.2%). Between the various respondent groups, there were no differences observed in the reasons they provided.

- *Lump Sum Effect on Project Cost versus Payment Structure Strategies: Cost Reimbursable (Q13*Q5.2)*

The hypothesized relationship between Q13 (Lump Sum effect on Project Cost) and Q5.2 (Company Engages in Cost Reimbursable Payment Structures) was:

Hypothesis 20: A respondent's opinion of lump sum impact on cost will be highly correlated with their company's typical payment structure strategy: Cost reimbursable.

A company which typically engages in cost reimbursable work may be more likely to think LS will increase cost. Companies using cost reimbursable may have a company culture based

around cost reimbursable project delivery and be unfamiliar with LS project management. They could be expected to see higher levels of risk in moving to an unfamiliar payment structure model.

Q13 and Q5.2 were found to be highly correlated (χ^2 =24.00, *df*=2, P<0.001), validating the hypothesis. Respondents whose companies engaged in cost reimbursable payment structures were much more likely to expect LS to raise project cost (70.5%), when compared with respondents whose companies did not employ cost reimbursable (23.1%). Respondents in companies not employing cost reimbursable were much more likely to expect decreased project cost (65.4%) for LS when compared with respondents in companies that regularly used cost reimbursable (17.9%). There was very little difference in the percentages of respondents who thought LS would not affect cost. The reasons for the increased cost with LS, given by respondents whose companies regularly used cost reimbursable, were aligned. They all stated that increased risk exposure being built into a risk premium, and client interference and oversight causing changes and delays were the main reasons for cost increase with LS.

- *Lump Sum Effect on Project Cost versus Payment Structure Strategies: Unit Rate (Q13 * Q5.3)*

The hypothesized relationship between Q13 (Lump Sum effect on Project Cost) and Q5.3 (Company Engages in Unit Rate Payment Structures) was:

Hypothesis 21: A respondent's opinion of lump sum impact on cost will be highly correlated with their company's typical payment structure strategy: Unit Rate.

A company which typically engages in unit rate work may be less likely to think LS increases cost than one that regularly uses cost reimbursable. The companies that typically engage in unit rate work may have greater experience functioning in a fixed price environment because in a unit rate structure fixed prices for units of work are estimated. Quantity risk is removed, but all other factors and mark-ups must be included. There may be more transferable skills between unit rate and LS than between cost reimbursable and LS.

As expected, Q13 and Q5.3 were found to have a medium correlation (χ^2 =6.33, *df*=2, P=.042). Respondents in companies that used unit rate were less likely than respondents in companies that used cost reimbursable to believe that LS increases costs: 52.2% versus 70.5%, respectively. A higher percentage of respondents felt LS increased project cost compared with respondents who did not believe LS increased project cost. Also, respondents whose companies did not use unit rate were more likely than respondents whose companies did use unit rate, to think LS would increase cost, 70.4% and 52.2%, respectively.

- *Lump Sum Effect on Project Cost versus Years' Working Experience (Q13*Q3)*

The hypothesized relationship between Q13 (Lump Sum effect on Project Cost) and Q3 (Years Working Experience) was:

Hypothesis 17: Years' Working Experience will be highly correlated with perceived effect on project cost.

Years' working experience would likely increase the number of projects an individual had been involved with in their career. More experienced individuals may have been exposed to more examples of payment structure affecting contract cost, which would likely result in them having a different opinion about LS effect on cost than individuals with less working experience. The subjects of the interview phase were all highly experienced and senior industry members.

Q13 and Q3 were found to be highly correlated through the Fisher Exact Test (16.78, P=0.006). Results indicate that as years' working experience increased, so did the perception that LS would increase project cost. As years' experience increased, the percentage of respondents who felt LS would decrease project cost, decreased. Of the respondents with 16-20 years' experience, 34.6% felt project cost would increase and 50% felt project cost would decrease, in the LS environment. Of the respondents having greater than 25 years' working experience, 58% felt project cost would increase and 26.1% felt project cost would decrease, with LS .

- *Lump Sum Effect on Project Cost versus Maximum Lump Sum Project Dollar Value in Alberta (Q13*Q9)*

The hypothesized relationship between Q13 (Lump Sum effect on Project Cost) and Q9 (Maximum Lump Sum Project Dollar Value in Alberta) was:

Hypothesis 23: The lower the dollar value of the largest LS project the company has performed in Alberta, the more likely they will be to believe LS increases cost.

In analyzing the responses to the first survey, results indicated participants had raised some concern about the risks increasing with project size and complexity when using LS in Alberta oil and gas. It is possible that companies that have chosen to perform LS on smaller value projects believe the risks associated with LS in Alberta are too large to take on higher dollar value projects.

Through the Fisher Exact Test, Q13 and Q9 were found to be highly correlated (P=0.001). The results did not quite match the hypothesis. Respondents from companies that had performed LS projects in the $5MM - $100MM range, were almost unanimous in believing that LS increased project cost (90.5%). This group of respondents were 43.7% more likely to believe LS increased project costs than respondents whose companies had performed LS projects between the $100MM - $1B range, of which 46.8% of this group believed LS increased costs. When comparing these two groups, respondents from companies that had performed a smaller dollar value LS projects were more likely to believe LS increased project costs. However, respondents from companies that had performed very small LS projects were even less likely to believe LS increased project costs (31.8%), and 68.2% of this group believed LS would favourably decrease costs or that cost would remain unaffected.

- *Lump Sum Effect on Project Cost versus Company Used Lump Sum on Past Projects: Internationally (Q13*Q10)*

The hypothesized relationship between Q13 (Lump Sum Effect on Project Cost) and Q10 (Company Used Lump Sum on Past Projects: Internationally) was:

Hypothesis 24: A company having performed lump sum internationally will be highly correlated with a respondent's perception of lump sum effect on project cost.

From analyzing the answers for Q8 - Q10, many respondents from companies that had performed LS projects internationally provided reasons why they felt the Alberta oil and gas environment was less conducive to using LS payment structures compared to the international environment. From these responses, it may be expected that respondents from companies that have done LS work internationally would believe the risks in the Alberta environment would cause LS project costs to increase.

Q13 and Q10 were found to be highly correlated (χ^2 =20.26, *df*=2, P<0.001). Respondents for companies that had performed LS internationally were more likely to think LS increases project cost (68.0%) rather than decreases cost (14.7%) or does not affect cost (17.3%). Compared with respondents from companies that had performed LS projects internationally, respondents for companies that had not performed LS internationally were less likely to believe in a project cost increase (47.8%) with LS , with much of the group selecting 'decrease' (50%) for LS effect on project cost. This result may suggest that companies with international LS experience have a perception of higher risk being associated with the Alberta oil and gas industry.

- *Lump Sum Effect on Project Cost versus Maximum Lump Sum Project Dollar Value: International (Q13*Q11)*

The hypothesized relationship between Q13 (Lump Sum Effect on Project Cost) and Q10 (Maximum Lump Sum Project Dollar Value: International) was:

Hypothesis 25: A company having performed large lump sum projects internationally will be highly correlated with a respondent's perception of lump sum effect on project cost.

From the interview phase, participants reported that they regarded the Alberta oil and gas industry to be riskier than the international oil and gas industry. Based on this perception of risk, participants from companies that have performed larger dollar value LS projects internationally may perceive that lump sum use in Alberta would increase project cost.

Q13 and Q11 were found to be highly correlated through the Fisher Exact Test (25.6, P<0.001). What can be extracted from the analysis is that respondents whose companies have performed international LS projects greater than $5MM are more likely to think that LS use in Alberta oil

and gas will increase project costs. Respondents whose companies have performed international LS projects below $5MM are more likely to think that LS will not affect project cost. Respondents whose companies have performed higher dollar value international LS projects have a more negative view of the effect of using LS in the current Alberta oil and gas environment.

1.1.3 Project Management Experience in Lump Sum Contracting (Q20)

- *Effect of Industry Lump Sum Management Experience on feasibility of Lump Sum versus Organizational Type (Q20*Q1)*

The hypothesized relationship between Q20 (Effect of Industry Lump Sum Management Experience on feasibility of Lump Sum) and Q1 (Organizational Type) was:

Hypothesis 89: A respondent's organizational type will be highly correlated with a respondent's perception of effect of industry lump sum management experience on the feasibility of lump sum.

A topic discussed during the interview research phase was the lack of industry experience in Alberta with LS management practices, behaviours, and roles. Most interviewees felt that lack of LS management experience existed. Engineers seemed the most adamant that their peers and Operators lack the experience required to make LS feasible. It may be expected for Engineers to feel the most strongly negative about the LS experience levels.

Q20 and Q1 were found to have a medium correlation ($\chi^2 = 6.37$, $df=2$, P = 0.41), with all organizational types most likely to believe industry experience with LS was lacking. Engineers were the most confident in industry lack of experience, as expected, with 90% feeling there was a deficiency in the industry. Constructors (70.7%) were the least negative about industry experience with ~20% fewer than Engineers seeing this deficiency.

- *Effect of Industry Lump Sum Management Experience on Feasibility of Lump Sum versus Role in Organization (Q20*Q2)*

The hypothesized relationship between Q20 (Effect of Industry Lump Sum Management Experience on feasibility of Lump Sum) and Q2 (Role in Organization) was:

Hypothesis 90: A respondent's role in their organization will be highly correlated with a respondent's perception of effect of industry lump sum management experience on the feasibility of lump sum.

Based on the interviews with senior industry members, most participants saw a lack of industry LS experience. The individuals in senior roles within an organization may have more industry experience to draw from and may be expected to see a larger source of inexperience than individuals in less senior roles.

Q20 and Q2 were found to be highly correlated (χ^2 =32.16, *df*=3, P<0.001), but the opposite of what was hypothesized. The majority of respondents in all role categories, except for the 'Other' category, believed there to be a lack of industry experience with LS. With decreasing level of seniority, there was an increasing lack of confidence in industry LS experience with Executives: 86.7%, Senior Managers: 90.3%, and Project Managers: 97.4%. It is possible that project managers feel so strongly about this topic because they see the day to day risks to project execution that lack of knowledge surrounding a contracting strategy may present.

- *Effect of Industry Lump Sum Management Experience on Feasibility of Lump Sum versus Current Company Operates Internationally (Q20*Q4)*

The hypothesized relationship between Q20 (Effect of Industry Lump Sum Management Experience on feasibility of Lump Sum) and Q4 (Current Company Operates Internationally) was:

Hypothesis 92: A respondent's company operating internationally will be highly correlated with a respondent's perception of the effect of industry lump sum management experience on the feasibility of lump sum.

From interviews, the majority of respondents reported reasons why they consider Alberta oil and gas to be riskier than international oil and gas. For this reason, respondents from companies with international experience were expected to be more likely to feel there was a lack of LS experience than respondents whose companies did not operate internationally.

Through Fishers Exact Test, Q20 and Q4 were found to be highly correlated (P=0.001). From the data, if a company worked internationally, this group of respondents were much more likely to believe there was a lack of experience with LS, locally (86.8%). Respondents whose companies had not worked internationally held the opposite opinion; 66.7% felt there was sufficient LS experience, locally.

- *Effect of Industry Lump Sum Management Experience on Feasibility of Lump Sum versus Company Engages in Lump Sum Payment Structures (Q20*Q5.1)*

The hypothesized relationship between Q20 (Effect of Industry Lump Sum Management Experience on feasibility of Lump Sum) and Q5.1 (Currently Engages in Lump Sum) was:

Hypothesis 93: A respondent's company engaging in lump sum will be highly correlated with a respondent's perception of effect of industry lump sum management experience on the feasibility of lump sum.

Q20 and Q5.1 were found to be highly correlated (χ^2 =7.39, *df*=1, P=0.007). More members of both respondent groups, respondents from companies that engaged in LS and respondents from companies did not engage in LS, were more likely to believe there exists a lack of experience with LS in the industry. Companies that engaged in LS were more likely than companies that did not engage in LS to consider there to be a lack of experience with LS in the industry, 91.0% and 72.2% respectively.

- *Effect of Industry Lump Sum Management Experience on Feasibility of Lump Sum versus Company Engages in Cost Reimbursable Payment Structures (Q20*Q5.2)*

The hypothesized relationship between Q20 (Effect of Industry Lump Sum Management Experience on feasibility of Lump Sum) and Q5.2 (Currently Engages in Cost Reimbursable) was:

Hypothesis 94: A respondent's company engaging in Cost Reimbursable will be highly correlated with a respondent's perception of effect of industry lump sum management experience on the feasibility of lump sum.

Respondents from companies that regularly use cost reimbursable may feel there is a lack of industry experience with lump sum, because the primary contract form used, locally, is cost reimbursable.

Through Fishers Exact Test, Q20 and Q5.2 were found to be highly correlated (P=0.001). More members of both respondent groups, respondents from companies that engaged in cost reimbursable and respondents from companies that did not engage in cost reimbursable, were more likely to believe there exists a lack of experience with LS in the industry. However, companies that engaged in cost reimbursable were more likely than companies that did not engage in cost reimbursable to consider there to be a lack of experience with LS in the industry, 89.5% and 57.7% respectively.

- *Effect of Industry Lump Sum Management Experience on Feasibility of Lump Sum versus Maximum Lump Sum Project Dollar Value: Alberta (Q20*Q9)*

The hypothesized relationship between Q20 (Effect of Industry Lump Sum Management Experience on feasibility of Lump Sum) and Q9 (Maximum LS Project Value: Alberta) was:

Hypothesis 97: Maximum lump sum project value will be highly correlated with a respondent's perception of effect of industry lump sum management experience on the feasibility of lump sum.

The higher lump sum project dollar value that a respondent's company has performed, the less likely that company may view local lump sum experience level as a problem.

Through Fishers Exact Test, Q20 and Q9 were found to be highly correlated (P=0.005). No companies had performed LS projects in Alberta above $1B. Respondents from all other financial range groups were more likely to believe there is a lack of experience with LS in Alberta oil and gas. Respondents from companies that had performed LS on projects of less than $5MM were almost evenly split in their opinion, with 54.5% of respondents selecting 'Yes', to lack of LS experience and 45.5% of respondents selecting 'No'. Respondents whose companies had performed LS projects between $5MM and $100MM were much more likely to believe there is a lack of LS experience in Alberta oil and gas, with 90.5% of respondents

selecting 'Yes'. Respondents from companies that had performed LS projects in the $100MM - $1B range represented a sample group double the size of the other financial ranges, and were slightly less likely to believe there is a lack of LS experience, with 87.2% selecting 'Yes' to the question.

- *Effect of Industry Lump Sum Management Experience on Feasibility of Lump Sum versus Company Used Lump Sum on Past Projects: Internationally (Q20*Q10)*

The hypothesized relationship between Q20 (Effect of Industry Lump Sum Management Experience on feasibility of Lump Sum) and Q10 (*Company Used Lump Sum on Past Projects: Internationally*) was:

Hypothesis 98: International lump sum use will be highly correlated with a respondent's perception of effect of industry lump sum management experience on the feasibility of lump sum.

Given that interview respondents perceived the local Alberta oil and gas environment to be riskier than the international oil and gas environment and mentioned lack of local LS experience as an issue, international experience may be an indicator of lack of confidence in the local lump sum experience level.

Through Fishers Exact Test, Q20 and Q10 were found to be highly correlated (P=0.006). Both respondent groups, respondents from companies that had used LS on past international projects and respondents from companies that had not used LS on past international projects, considered there to be a lack of industry experience with LS in Alberta. However, respondents whose companies had used LS on international projects were much more likely to indicate a lack of confidence in the local LS experience level (90.7%) than respondents whose companies had not used LS on international projects (69.6%).

1.1.4 Local Operating Company Interference Compared to International Operators (Q21)

- *Level of Local Operating Company Interference versus Organizational Type (Q21*Q1)*

The hypothesized relationship between Q21 (*Level of Local Operating Company Interference*) and Q1 (*Organizational Type)* was:

Hypothesis 103: Organizational Type will be highly correlated with view of level of local operating company interference compared to international clients.

Q21 and Q1 were found to be highly correlated (χ^2 =24.16, *df*=2, P<0.001). Operators and Engineers were aligned in their responses with 84.6% and 87.8%, respectively, believing that local clients desired a higher degree of input on projects than did international clients. Constructors expressed the opposite opinion by a slight margin, with 56.1% feeling clients did not want greater input on projects locally versus internationally.

- *Level of Local Operating Company Interference versus Role in Organization (Q21*Q2)*

The hypothesized relationship between Q21 (*Level of Local Operating Company Interference*) and Q2 (*Role in Organization)* was:

Hypothesis 104: Role in Organization will be highly correlated with view of level of local operating company interference compared to international.

Project managers may feel that local operating companies interfere more than international companies because they are more involved in the day to day project execution activities and are thus more aware of the level of expected input.

Q21 and Q2 were found to be highly correlated (χ^2 =11.57, *df*=3, P=0.009). In all categories, the highest percentage of respondents felt that local clients wanted greater input on projects than did international clients. As seniority of role within a company increased, the data showed a trend of decreasing perception of higher local client input, as expected. 53.3% of Executives, 80.6% of Senior Managers, and 86.5% of Project Managers selected 'more client input locally'. Since no seniority pattern could be determined for the category, 'Other', it was omitted from the study for this question.

- *Level of Local Operating Company Interference versus Company Engages in Cost Reimbursable Payment Structures) (Q21*Q5.2)*

The hypothesized relationship between Q21 (*Level of Local Operating Company Interference*) and Q5.2 (*Company Engages in Cost Reimbursable Payment Structures)* was:

Hypothesis 107: Engaging in cost reimbursable will be highly correlated with view of level of local operating company interference compared to international.

Respondents from companies that regularly use cost reimbursable payment structures may perceive a higher level of desired client interference. This client interference may be the reason for the use of cost reimbursable.

Through Fishers Exact Test, Q21 and Q5.2 were found to be highly correlated (P<0.001). The data indicates that companies that engaged in cost reimbursable and companies that did not engage in cost reimbursable had opposite views concerning local client input requirements. Of the respondents from companies that engaged in cost reimbursable, 80.0% believed local clients wanted more project input than international clients, as was expected. Of the respondents from companies that did not engage in cost reimbursable, 60.0% believed local clients did not want more project input than international clients.

- *Level of Local Operating Company Interference versus Company Used Lump Sum on Past Projects: Locally (Q21*Q8)*

The hypothesized relationship between Q21 (Level of Local Operating Company Interference) and Q8 (*Company Used Lump Sum on Past Projects: Locally*) was:

Hypothesis 110: Using lump sum locally will be highly correlated with view of level of local operating company interference compared to level of international client interference.

Through Fishers Exact Test, Q21 and Q8 were found to be highly correlated (P=0.002). Both respondent groups, respondents whose companies had used LS on past projects in Alberta and respondents whose companies had not used LS on past projects in Alberta, were more likely to feel that local clients wanted more project input than international clients. Respondents whose companies had used LS on past Alberta projects were less likely than respondents whose companies had not previously used LS in Alberta, to believe that local clients want more project input, at 66.0% and 95.8%, respectively.

- *Level of Local Operating Company Interference versus Maximum Lump Sum Project Dollar Value: Alberta (Q21*Q9)*

The hypothesized relationship between Q21 (Level of Local Operating Company Interference) and Q9 (*Maximum Lump Sum Project Dollar Value: Alberta*) was:

Hypothesis 111: Lump sum project dollar value locally will be highly correlated with view of level of local operating company interference compared to level of international client interference.

Q21 and Q9 were found to be highly correlated (χ^2 =9.14, *df*=2, P=0.01). Respondents from companies that had performed LS projects under $5MM in Alberta, were the most likely to believe local clients wanted more project input than international clients, with 81.8% of respondents holding that opinion. Respondents from companies that had performed LS projects in the $100MM - $1B range in Alberta, were also likely to believe local clients wanted more project input than international clients, with 66.0% of respondents believing this to be the case. Respondents from companies that had performed LS projects in the $5MM - $100MM range, held the opposite opinion; they were more likely to believe clients did not want more project input locally than internationally, with 61.9% of respondents choosing the 'No' option.

1.1.5 Sufficient Companies Capable of Preparing Lump Sum Proposals (Q22)

- *Sufficient Companies Capable of Lump Sum Proposals versus Organizational Type (Q22*Q1)*

The hypothesized relationship between Q22 (Sufficient companies capable of Lump Sum proposals) and Q1 (Organizational Type) was:

Hypothesis 117: Organizational Type will be highly correlated with perception of Alberta having sufficient companies capable of developing proper Lump Sum proposals.

Q22 and Q1 were found to be highly correlated (χ^2 =9.27, *df*=2, P=0.01). Operators and Constructors felt strongly that there were sufficient companies in Alberta capable of preparing LS proposals in the industry, with 84.6% and 82.9% , respectively, responding 'Yes' to the question. This result was unexpected due to the fact that operating and construction companies are on opposite sides of the industry: principle/agent. Data from engineer

responders indicated that Engineers had less confidence that there were sufficient companies in Alberta capable of preparing LS proposals, with only 58.5% responding 'Yes' to the question. This result is significant because, most likely, Engineers would be the parties preparing the bid proposals. Engineers seem the least confident that their companies or their competitor companies have the skills required to create accurate LS proposals.

- *Sufficient Companies Capable of Lump Sum Proposals versus Role in Organization (Q22*Q2)*

The hypothesized relationship between Q22 (Sufficient companies capable of Lump Sum proposals) and Q2 (Role in Organization) was:

Hypothesis 118: Role in organization will be highly correlated with perception of Alberta having sufficient companies capable of developing proper Lump Sum proposals.

It was hypothesized that senior leadership (Executives and Senior Managers) from operational organizations would believe there are sufficient companies in Alberta capable of developing lump proposals because they may desire LS contracting as a means to assist in obtaining project cost certainty. Based on the interviews, Engineer and Constructor leadership was expected to believe there are insufficient companies in Alberta capable of developing lump proposals because of their perceived lack of interest during interview sessions.

Q22 and Q2 were found to be highly correlated (χ^2 =15.37, *df*=3, P=0.002). Senior Managers and Project Managers from all three types of companies strongly believe there are sufficient companies in Alberta capable of developing lump sum proposals; enough to create an adequate pool of LS bidders. The views of respondents from the Executives group, however, were not aligned. Upon further analysis of the data, the lack of confidence that there are sufficient companies capable of developing LS proposals, is being expressed by the Engineer executive leaders. Of the 17 Engineer executives who responded, 13 respondents felt there are insufficient companies in Alberta with LS bidding capabilities, which accounts for most of the 15 'No' responses that were returned by this category. Of the five Senior Managers who answered

'No' to the question, three were Engineers. Operators and Constructors were consistent in their perception that there are sufficient companies in Alberta capable of developing LS proposals.

- *Sufficient Companies Capable of Lump Sum Proposals versus Years' Working Experience(Q22 * Q3)*

The hypothesized relationship between Q22 (Sufficient companies capable of Lump Sum proposals) and Q3 (Years' Working Experience) was:

Hypothesis 119: Years' Working Experience will be highly correlated with perception of Alberta having sufficient companies capable of developing proper Lump Sum proposals.

The Fisher Exact test run showed that Q22 was highly correlated with Q3 (P=0.001). Every category for 'years working experience' was more likely to believe that there are sufficient companies in Alberta capable of developing lump sum proposals. However, above 15 years' experience, as experience increased, the belief that there are sufficient companies capable of developing lump sum proposals, decreased. This can be accounted for by the Engineers. Of the 22 'No' respondents with above 25 years' working experience, 17 are from the Engineers group.

- *Sufficient Companies Capable of Lump Sum Proposals versus Maximum Lump Sum Project Dollar Value: Alberta (Q22 * Q9)*

The hypothesized relationship between Q22 (Sufficient companies capable of Lump Sum proposals) and Q9 (Lump Sum Project Dollar Value in Alberta) was:

Hypothesis 125: Maximum Project Dollar Value – Alberta will be highly correlated with perception of Alberta having sufficient companies capable of developing proper Lump Sum proposals.

Respondents from companies that have performed higher dollar value LS projects in Alberta may be more likely to believe there are sufficient companies in Alberta capable of preparing LS proposals. Executing larger projects under a LS payment structure could indicate a company has more confidence in the Alberta industry for this type of work than the confidence level of companies that are only willing to perform low dollar value LS projects.

From the Fisher Exact Test, Q22 and Q9 were found to be highly correlated (P=0.008). There were no respondents who said their companies had performed LS projects in Alberta greater than $1B. Participants in all other project dollar value ranges were more likely to believe that there are sufficient companies in Alberta capable of preparing LS proposals. However, respondents whose company's maximum LS project dollar value was less than $5MM were the most confident that Alberta has sufficient companies capable of preparing LS proposals, with 95.5% answering 'Yes'. The less than $5MM group included no Engineers, as they were either not willing to answer or had performed larger LS contracts. In the $5MM - $100MM project group, of the eight respondents who answered 'No' to sufficient companies in Alberta capable of preparing LS proposals, six were Constructors. In this category, Constructor opinion was split almost evenly between 'Yes' and 'No'. There were no Constructors in the large project dollar value group who said they doubted there are sufficient number of companies capable of preparing LS bids. For some reason the Constructors whose companies have performed mid-size LS projects lack confidence in the industry's capability with LS bidding.

- *Sufficient Companies Capable of Lump Sum Proposals versus Company Used Lump Sum on past projects - Internationally(Q22 * Q10)*

The hypothesized relationship between Q22 (Sufficient companies capable of Lump Sum proposals) and Q10 (Company used Lump Sum on past projects - Internationally) was:

Hypothesis 126: Lump Sum use on past international projects will be highly correlated with perception of Alberta having sufficient companies capable of developing proper lump sum proposals.

Companies that have used LS internationally on past projects may be more likely to think that Alberta has few companies capable of preparing LS proposals because they have more experience with LS structures. The companies with LS experience may know what expertise and proficiency is required for successful LS bidding and may perceive the Alberta industry to be lacking this skill set.

Q22 and Q10 were found to be highly correlated (χ^2 =9.97, *df*=1, P=0.002). Participants from companies that had used LS on past international projects were less likely to believe there were

sufficient companies in Alberta capable of LS bidding. Only 65.3% of respondents from companies that had used LS on past international projects believed the skills required for preparing LS proposals existed locally, compared with 91.1% of respondents from companies that had not used LS on past international projects. Again, the majority of respondents in of the 'No' group, from companies that had used LS internationally, were Engineers, with Engineers responsible for 17 out of the 26 'No' responses to the question.

- *Sufficient Companies Capable of Lump Sum Proposals versus Maximum Lump Sum Project Dollar Value Internationally (Q22 * Q11)*

The hypothesized relationship between Q22 (Sufficient companies capable of Lump Sum proposals) and Q11 (Maximum Lump Sum Project Dollar Value Internationally) was:

Hypothesis 127: The maximum project dollar value used on past international projects will be highly correlated with perception of Alberta having sufficient companies capable of developing proper lump sum proposals.

The Fisher Exact test was run and Q22 and Q10 were found to be highly correlated, ($P<0.001$). The two groups with highest participant numbers were respondents from companies with maximum LS project dollar values of the $5MM - $100MM range and of the $100MM - $1B range, with 18 and 17 respondents, respectively, willing to comment on past project dollar value. These two groups of respondents held very different opinions; the $5MM - $100MM respondent group lacked confidence in the industry's LS bid proposal development capability, with only 44.4% answering 'Yes' to the question; whereas the $100MM - $1B respondent group had full confidence in the industry's capabilities for developing LS bid proposals, with 100% answering 'Yes'. The Organizational Type make-up for the $5MM - $100MM group was 50% Constructors, 28% Engineers, and 22% Operators. All operator respondents in the group answered 'Yes' to sufficient companies capable of developing proper LS proposals in Alberta , and all Engineers answered 'No'. Constructors response was split, with 44% answering 'Yes' and 56% answering 'No' to the question. In the $100MM - $1B project size group, there were no Constructors, and Engineer and Operator respondents were basically of equal numbers. The

other two groups were difficult to properly analyze given the small response numbers. The group having international LS projects with maximum project dollar values greater than $1B was comprised entirely of Engineers, with the exception of one Operator. The Engineer response was split 50% for 'Yes' and 50% for 'No', regarding suffcient companies in Alberta capable of developing LS bid proposals. There were no Engineers in the less than $5MM project size category, which included six Operators and four Constructors, where the only 'No' respondent was a Constructor. What can be extracted from this data is that Engineers have the most experience with projects of greater than $1B and have performed projects of all sizes greater than $5MM. The Constructors have not performed LS projects internationally of greater than $100MM. Constructors have a lack of confidence in the industry's LS structure skills above $100MM. Operators are consistently optimistic about the industry's LS bidding skills across project dollar values and have little experience with LS above $1B.

1.1.6 Financial Ranges Companies Willing to Lump sum (Q24)

- *Financial Ranges Companies Willing to Lump sum versus Organizational Type (Q24 * Q1)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and Q1 (Organizational Type) was:

Hypothesis 131: The respondent's Organizational Type will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

Operators may be more interested in using LS for larger project sizes as they may be interested in cost certainty and transfer of risk for larger projects. Engineers and Constructors may be less interested in LS for larger dollar value projects since more of the risk, including labour and productivity risk, is transferred to them.

Both the Pearson Chi-squared and Fisher Exact Test were run on this data, although the criteria stated above was met for Pearson only. The two tests disagreed on the statistical significance, with Pearson validating the H_0 hypothesis and Fisher validating the H_a hypothesis. According to the Fisher exact test, Q24 and Q1 were found to have a medium correlation, (P=0.044). As expected, Operators had the strongest desire to use LS for mega projects, with 24.3% choosing

a financial range willing to lump sum of greater than $1B. Only 16.7% of Engineers and 0% of Constructors indicated a willingness to use LS for projects >$1B. Percentage interest for operating companies in all different financial ranges was very consistent, indicating that there is a market for LS projects of all sizes throughout the industry. Constructor interest was fairly consistent in the remaining three financial ranges, with a slight preference for LS on projects of $100MM - $1B financial range. Engineers indicated a preference for LS on projects in the $100MM - $1B financial range.

- *Financial Ranges Companies Willing to Lump sum versus Role in Organization (Q24 * Q2)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and Q2 (The respondent's role in their organization) was:

Hypothesis 132: The respondent's role in their organization will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

Respondents in positions of more authority within a company may have a clearer understanding of and more influence in setting the strategic direction of their organizations. Of the three organizational types, the responses of individuals in higher positions within the organization, may be more accurate to use to generalize the corporate mandate. However, the Project Managers would be basing their opinion on greater firsthand understanding of and experience with directly executing those projects. Executives and Senior Managers may prefer to LS higher dollar value projects while Project Managers may be reluctant to undertake LS projects, knowing how difficult it could be to execute lump sum locally.

A Fisher Exact test should have been run for this correlation, but there was insufficient memory to perform the correlation. A Pearson Chi-Square was run instead to approximate the probability of correlation. Q24 and Q2 were found to be highly correlated (χ^2 =29.68, *df*=9, P<0.001).

Executives and Senior Managers were the organizational roles most interested in high dollar value LS projects, with 19.0% and 19.4%, respectively, expressing interest in LS projects greater

than $1B. Project Managers expressed less interest in LS mega projects with only 6.1% conveying interest in using LS on large projects. Executives had the greatest interest in LS projects of $100MM - $1B financial range. Senior Managers had the greatest interest in LS projects of <$5MM size and the $100MM - $1B range. All groups, except Executives, expressed significant levels of interest in using LS on very small dollar value projects.

Further analysis was conducted on the company-type demographic of each role category, as indicated below:

- Executives:
    - $5MM - $100MM: Engineers
    - $100MM - $1B: Constructors except one Operator
    - >$1B: 50% Engineers, 50% Operators
- Senior Manager:
    - <$5MM: 33.33% of each Engineers, Constructors, Operators
    - $5MM - $100MM: 67% Operators, 33% Constructors
    - $100MM - $1B: 78% Engineers, 22% Operators
    - >$1B: 67% Operators, 33% Engineers
- Project Manager;
    - <$5MM: 44% Engineers, 56% Operators
    - $5MM - $100MM: 80% Operators, 20% Engineers
    - $100MM - $1B: 41% Constructors, 18% Engineers, 41% Operators
    - >$1B: 50% Operators, 50% Engineers

From this data sample, Constructor Executives prefer the $100MM - $1B financial range for LS projects, as do Constructor Project Managers. Constructor Senior Managers prefer LS projects of less than $100MM, with the majority preferring projects less than $5MM. Operator Executives prefer LS for projects greater than $100MM. Operator Senior Managers are open to using LS on all different sizes of projects. Operator Project Managers are also open to using LS on projects of any size, with the majority preferring projects under $1B. The majority of Engineer Executives prefer using LS for projects of the $5MM - $100MM range. Engineer Senior

Managers are receptive to LS projects of greater than $1B and less than $1B. Engineer Project Managers are open to LS projects of all sizes, with the largest percentage preferring projects less than $5MM.

- *Financial Ranges Companies Willing to Lump sum versus Years Working Experience (Q24 * Q3)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and Q3 (Years' Working Experience) was:

Hypothesis 133: The respondent's years' working experience will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

It was speculated that years' working experience would alter a respondent's perception of risks associated with LS contracts. Depending on international experience, projects already performed under LS, previous project success, etc., an individual may be more or less inclined to support executing larger projects on a LS basis.

With the Fisher Exact Test, Q24 and Q3 were found to be highly correlated ($P<0.001$), with greater than 25 years' working experience being the largest sample size to respond, three times the sample size of the other groups. The preference of respondents with 25 years' experience was to perform LS projects of $100MM - $1B financial range (49.2%), which matched the preference of respondents with 21-25 years' experience, of whom 41.7% chose the $100MM - $1B range for LS projects. The majority of the group having 16-20 years' working experience (54.5%) chose projects of less than $5MM size, while respondents with less than 15 years' experience chose the $5MM - $100MM range for LS projects. What can be understood from this data is that individuals with more years of industry experience prefer using LS on projects of the $100MM - $1B financial range.

- *Financial Ranges Companies Willing to Lump sum versus Company Operates Internationally (Q24 * Q4)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and Q4 (Company Operates Internationally) was:

Hypothesis 134: If the company Operates internationally will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

Form literature, most oil and gas projects outside of North America are performed on a LS basis. Companies that had participated in the international sector of the industry may have more experience in performing LS work, may have performed larger projects using the LS payment structure, and may have a greater understanding of how to successfully execute larger LS projects and the risks involved.

Through Fisher Exact Test, Q24 and Q4 were found to have a medium correlation (P=0.25). There were much larger numbers of participants whose companies did work internationally than participants whose companies did not work internationally, who responded to this question. The responses between the two groups were dramatically different. Of respondents whose companies did not work internationally, 75% were willing to LS projects of less than $5MM. Companies with international experience were much more willing to perform larger project sizes on a LS basis than companies without international experience. The responses from participants whose companies did work internationally were more distributed, with companies willing to LS projects in each financial range. The two financial ranges preferred were $100MM - $1B (34.7%) and $5MM - $100MM (29.6%).

- *Financial Ranges Companies Willing to Lump sum versus Company Engages in Lump Sum Payment Structures(Q24 * Q5.1)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and Q5.1 (Company Engages in Lump Sum Payment Structures) was:

Hypothesis 135: A company currently engaging in lump sum payment structures will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

If a company currently includes the use of LS payment structures in its business model, it will likely be more receptive to performing larger LS project dollar values than a company that does not currently use LS, due to the company's experience with performing this type of work. Q24

and Q5.1 were found to be highly correlated (χ^2 =19.29, *df*=3, P<0.001), with companies that were unfamiliar with LS being much less willing to perform higher dollar value LS projects. 58.1% of companies familiar with employing LS were willing to perform LS work of greater than $100MM compared with only 27.3% of companies unfamiliar with employing lump sum payment structures.

- *Financial Ranges Companies Willing to Lump sum versus Company Engages in Cost Reimbursable Payment Structures (Q24 * Q5.2)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and Q5.2 (Company Engages Cost Reimbursable Payment Structures) was:

Hypothesis 136: A company currently engaging in cost reimbursable payment structures will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

If a company engages in cost reimbursable payment structures, it may do so because it finds cost reimbursable less risky than other types of payment structures, including LS. This may result in a company being less willing to perform high dollar value LS contracts due to the company's perception of higher levels of risk exposure with the LS payment structure.

Q24 and Q5.2 were found to be highly correlated (χ^2 =18.34, *df*=3, P<0.001). The result was surprising as companies that engaged in cost reimbursable were more interested in higher dollar value LS projects (40.3% for $100MM - $1B range) than companies that did not engage in cost reimbursable (52% for less than $5MM projects).

- *Financial Ranges Companies Willing to Lump sum versus Company Used Lump Sum on Past Projects: Alberta (Q24 * Q8)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and Q8 (Company Used Lump Sum on Past Projects: Alberta) was:

Hypothesis 138: Company use of lump sum on past projects in Alberta will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

If a company has performed projects with a LS payment strategy in the past, it may be more willing to perform projects with LS again, and it may be more willing to perform higher dollar value LS projects than companies that have not engaged in LS payment structures.

Q24 and Q8 were found to have a medium correlation (χ^2 =7.96, *df*=3, P=0.047). Participants whose companies had performed LS projects in Alberta in the past were more likely than participants whose companies had not employed LS, to be willing to perform mega projects (greater than $1B) using a LS payment structure, 14.9% and 5.0%, respectively. However, the rest of the results were actually the reverse of what was expected. Respondents whose companies had used LS in the past were more interested in projects of less than $5MM (29%) than respondents whose companies had no past experience with LS in Alberta (10%). Of the respondents whose companies had not used LS in the past, 85% were interested in LS projects greater than $5MM but < $1B, whereas, only 55% of respondents from companies with past LS experience were interested in projects greater than $5MM but $<1B . The profile of the experienced group is much more varied in the financial ranges they are willing to LS compared to the inexperienced group, because the experienced group had more respondents willing to do LS projects in the two extreme financial ranges of only <$5MM and >$1B.

- *Financial Ranges Companies Willing to Lump sum versus Project Dollar Value: Alberta (Q24 * Q9)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and Q9 (LS Project Dollar Value: Alberta) was:

Hypothesis 139: Dollar value of LS projects used in Alberta will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

If a company has executed higher dollar value LS projects in the past, in Alberta, it may be more likely to be comfortable executing high dollar value projects again. Q24 and Q9 were found to be highly correlated with the Fisher Exact Test (70.43, P<0.001). Respondents whose companies had performed LS projects in Alberta of a maximum dollar value of less than $5MM were only comfortable performing that dollar range in the future. Of the respondents from companies that had performed LS projects in Alberta between $5MM - $100MM, 40% were comfortable

performing LS projects above $100MM. Of the respondents whose companies had performed LS projects in Alberta between $100MM - $1B, 69.8% were comfortable performing LS projects above $100MM, with 15.9% more respondents than the previous group being comfortable with LS projects of greater than $1B. Unexpectedly, of the companies that had performed LS projects in the $100MM - $1B range, 11.6% of respondents were only comfortable with LS projects less than $5MM in the future. This unexpected result could perhaps be the result of past experience with an unsuccessful LS project that was of a greater dollar value.

- *Financial Ranges Companies Willing to Lump sum versus Company Used Lump Sum on Past Projects: Internationally (Q24 * Q10)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and Q10 (Company Used Lump Sum on Past Projects: Internationally) was:

Hypothesis 140: Company use of lump sum on past projects internationally will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

If a company has performed projects with a LS payment strategy internationally, in the past, it may be more willing to perform projects with LS again, and may be more willing to perform higher dollar value projects than companies that have not. Conversely, it may have the opposite effect. Companies that have operated internationally and have LS experience, may have a better understanding of the risks that may be encountered by using LS in Alberta and may be less inclined to do larger LS projects there.

Q24 and Q10 were found to be highly correlated (χ^2 =12.94, *df*=3, P=0.005). Companies that had not performed LS projects internationally were more interested than companies that had executed international LS projects, in larger dollar value LS projects in Alberta. Of the respondents from companies that had no international LS experience, 58.1% were interested in Alberta LS projects greater than $100MM, while only 36.5% of respondents whose companies had international LS experience were interested in projects of the same dollar range. Respondents from companies that had not used LS internationally were most interested in LS projects of the $100MM - $1B range (41.9%), while respondents from companies with

international LS experience were most interested in Alberta LS projects of the $5MM-$100MM range (41.3%).

- *Financial Ranges Companies Willing to Lump sum versus Project Dollar Value: Internationally (Q24 * Q11)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and Q11 (Project Dollar Value: International) was:

Hypothesis 141: Dollar value of Lump Sum projects used internationally will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

The higher the dollar value of the LS projects a company had performed internationally, in the past, may be reflected in the dollar value it would be willing to LS, locally. Q24 and Q11 were found to be highly correlated through the Fisher Exact Test (47.63, $P<0.001$). Survey results indicated that respondents of each past international LS project dollar value category, were most comfortable with performing LS projects in Alberta, of the same size as projects they had previously performed. The respondents from $100MM - $1B past LS project group were interested in both the $5MM - $100MM (30.8%) and $100MM - $1B (38.5%) financial ranges for LS projects.

- *Financial Ranges Companies Willing to Lump sum versus Company has Internal Construction Division (Q24 * b_Q5)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and b_ Q5 (Company has Internal Construction Division) was:

Hypothesis 142: Company has an internal construction division will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

This question was asked only of Engineers. If an Engineer company has an internal construction division, it may be willing to LS higher contract values. An external company would not have to be partnered with and relied on for the construction portion of the job, thus potentially reducing some risk. This hypothesis was derived from interviews carried out with Engineer

leaders during the initial interview stage. A common theme that surfaced during these interviews was a perceived lack of desire by Constructors to partner on LS payment structure work. Some Engineers had been left in the position of having to accept cost reimbursable agreements with Constructors for the construction portion of LS jobs.

Q24 and b_Q5 were found to be highly correlated through the Fisher Exact Test (9.75, P=0.001). Most Engineers who chose to answer this question did have internal construction divisions. The majority of respondents whose organizations did have internal construction divisions were willing to LS higher contract values than respondents from organizations without internal construction divisions. Companies that did not have construction divisions were only willing to LS projects of less than $5MM, while 88.5% of companies with internal construction divisions were willing to perform projects of greater than $5MM dollar value. There were respondents from the group that did have an internal construction division who were willing to LS all different sizes of LS projects. The most popular were $5MM - $100MM (30.8%) and $100MM - $1B (38.5%). It is interesting to note that more respondents from this group were interested in contracts greater than $1B (19.2%) than respondents who were interested in small projects of less than $5MM (11.5%).

- *Financial Ranges Companies Willing to Lump Sum versus Performed Lump Sum in Alberta Oil and Gas (Q24 * c_Q3)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and c_Q3 (Performed Lump Sum in Alberta Oil and Gas) was:

Hypothesis 143: Having performed lump sum previously in oil and gas will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

Those Constructors who have performed LS in oil and gas before may be more likely to lump sum larger scale projects in Alberta than those who have not. Q24 and c_Q3 were found to be highly correlated through the Fisher Exact Test (11.80, P=0.001). The data showed that companies that had performed LS in Alberta oil and gas previously were much more interested in higher dollar value LS projects. Those who had not used LS in oil and gas previously were not interested in projects any higher than $5MM. For those who had performed LS in Alberta

before, none were interested in contracts over $1B, but interest seemed to increase with contract value up to $1B: 20.6% (<$5MM), 35.3% (<$100MM), 44.1% (<$1B).

- *Financial Ranges Companies Willing to Lump Sum versus Performed Lump Sum in Alberta Outside Oil and Gas (Q24 * c_Q4)*

The hypothesized relationship between Q24 (Financial Ranges the respondent's company is willing to lump sum) and c_Q4 (Performed LS in Alberta Outside Oil and Gas) was:

Hypothesis 144: Having performed lump sum previously outside oil and gas will be highly correlated with the maximum financial ranges the respondent's company is willing to lump sum.

Those Constructors whose companies have performed LS projects outside oil and gas, may be less likely to want to LS larger scale projects in Alberta than companies that have performed LS within oil and gas. Q24 and c_Q3 were found to have a medium correlation with the Fisher Exact Test (P=0.42). As with those respondents who had used LS in oil and gas, the most preferred financial range for those respondents that had used LS outside oil and gas, was $100MM - $1B (46.7%). However, only 66.7% of the respondent group that had performed LS outside oil and gas were willing to LS projects greater than $5MM, compared with 79.4% of the respondent group that had used LS within oil and gas, which matches the expected result.

1.1.7 Project Phase at Which Operations Input Should be Limited (ab_Q2)

- *Project Phase at Which Operations Input Should be Limited versus Years' Working Experience (ab_Q2 * Q3)*

The hypothesized relationship between ab_Q2 (Project Phase at Which Operations Input Should Be Limited) and Q3 (Years' Working Experience) was:

Hypothesis 159: Years' Working Experience will be highly correlated with which project phase operations input should be limited.

Years' working experience would potentially increase the number of projects an individual had been involved in. A respondent with more years' experience may have a greater understanding of the impact on project outcome of operations involvement or lack of involvement at different project stages.

Through Fisher Exact Test ab_Q2 and Q3 were found to be highly correlated (P<0.001). The greatest numbers of respondents were in the greater than 25 years' working experience category, with the majority of those respondents selecting limited operational input at After FEED phase (58.3%) followed by After Detailed Design phase (39.6%). The responses of this category were more aligned than the other working experience categories. The majority of the 21-25 years' experience also chose After FEED phase, as well (58.3%), but this group's second most chosen category was After DBM phase (33.3%). In the less than 15 years'and the 16-20 years' experience groups, there were around 20% of respondents in each of the two respondent groups who believed operations should have unlimited input at all phases, an outcome that is much different from those with greater than 21 years'working experience. The less than 15 years' experience category had very few respondents (5) thus it is hard to assume their answers are reflective of their demographic, as a whole. The majority of respondents with 21+ years' experience believes operational input should be limited After FEED phase. 75% of 16-20 years' respondents believe operational input should be limited After Detailed Engineering or never, while only 35% of those with over 20 years' experience believed in limiting operational input after Detailed Engineering. Responses indicate that individuals with more years' working experience believe operational input should be limited at earlier phases of a project than do individuals with less years' working experience.

- *Project Phase at Which Operations Input Should be Limited versus Company Engages in Unit Rate Payment Structures (ab_Q2 * Q5.3)*

The hypothesized relationship between ab_Q2 (Project Phase at Which Operations Input Should Be Limited) and Q5.3 (Company Engages in Unit Rate Payment Structures) was:

Hypothesis 163: The payment structure type a company engages in (in this case, unit rate) will be highly correlated with which project phase operations input should be limited.

The payment structure type a company engages in may affect its perception of when operational input should be limited. If a company engages in cost reimbursable, it may be more agreeable to later phase operational input. If a company engages in LS or unit rate, it may want to see operational changes limited at earlier phases because of the fixed price elements of these payment structures.

Ab_Q2 and Q5.3 were found to be highly correlated with the Fisher Exact Test (P=0.006). The statistical results were different than expected, however. It appeared that respondents from companies that engaged in unit rate payment structures were actually more comfortable with operational input in later project stages than respondents from companies that did not use unit rate. 69% of those respondents would like to see operational input limited After FEED phase or before, compared to 42% of respondents who did engage in unit rate payment structures.

- *Project Phase at Which Operations Input Should be Limited versus Company Used Lump Sum on Past Projects: Alberta (ab_Q2 * Q8)*

The hypothesized relationship between ab_Q2 (Project Phase at Which Operations Input Should Be Limited) and Q8 (Company Used Lump Sum on Past Projects: Alberta) was:

Hypothesis 164: Company Use of Lump Sum on Past Projects in Alberta will be highly correlated with which project phase operations input should be limited.

Companies that have used LS for projects in Alberta in the past may have a different opinion of when operational input should be limited than the companies that have not used LS. They may wish input to be limited at earlier phases of the project as this may help freeze the scope and make fixed price execution easier. Ab_q2 and Q8 were found to be highly correlated with Fisher Exact Test (P=0.001). Respondents whose companies had not performed LS on past projects in Alberta were actually found to prefer earlier limiting of operations input than respondents from companies that had used LS on past projects. The most preferred project phase for limiting operations input by those who had not used LS was After FEED phase (76%), while the preference for those who had used LS in Alberta was After Detailed Engineering (50%). 80% of companies that had not used LS preferred limiting operations input After FEED phase or earlier, while only 46.4% of companies that had used LS preferred After FEED phase or earlier.

- *Project Phase at Which Operations Input Should be Limited versus Project Dollar Value: Alberta (ab_Q2 * Q9)*

The hypothesized relationship between ab_Q2 (Project Phase at Which Operations Input Should Be Limited) and Q9 (Project Dollar Value: Alberta) was:

Hypothesis 165: Dollar Value on past Projects in Alberta will be highly correlated with which project phase operations input should be limited.

Companies that have performed LS on higher dollar value projects may want operational input limited prior to construction (After Detailed Design) and may desire to have it limited even earlier (After FEED phase) to help achieve scope freeze. Ab_Q2 and Q9 were found to have a medium correlation through the Fisher Exact Test (P=0.044). Respondents from companies that had performed projects greater than $5MM were fairly consistent in their choices for which project phase operations input should be limited. After Detailed Engineering was preferred, with After FEED a close second. Respondents whose maximum project size was less than $5MM preferred limiting operations input After Detailed Engineering, as well, but with After DBM as the next most preferred project phase .

- *Project Phase at Which Operations Input Should be Limited versus Project Dollar Value: International (ab_Q2 * Q11)*

The hypothesized relationship between ab_Q2 (Project Phase at Which Operations Input Should Be Limited) and Q11 (Project Dollar Value: International) was:

Hypothesis 167: Dollar Value on past Projects internationally will be highly correlated with which project phase operations input should be limited.

Companies that have performed LS on higher dollar value projects may want operational input limited earlier in the project, to help achieve scope freeze. The Fishers Exact test was performed and ab_Q2 and Q11 were found to be highly correlated (P<0.001). All groups that had performed LS projects greater than $5MM preferred limiting operations input either After FEED phase or After Detailed Engineering. For companies that had engaged in LS projects below $5MM, 50% of respondents preferred limiting operations input After DBM phase and 50% preferred After Detailed Engineering phase.

1.1.8 Reason for Late Changes from Operating Company (a_Q1)

- *Reason for Late Changes from Operating Company versus Years' Experience (a_Q1 * Q3)*

The hypothesized relationship between a_Q1 (Reason for Late Changes from Operating Company) and Q3 (Years' Experience) was:

Hypothesis 171: Opinion of reason for operational late changes will be highly correlated with years of experience.

Greater years of experience might give more exposure to the most predominant factors that influence late changes. As a result, as years of experience increased, the opinion of the greatest influencing factors may change. There was no speculation as to which factor would be most important as years' experience increased.

A_Q1 and Q3 were found to be highly correlated by the Fisher Exact Test (P=0.002). As years' working experience increased, less emphasis was placed on changes resulting from the technical aspects of a project not being fully understood initially. 100% of respondents with 15 years' experience or less, chose the main reason for late changes to be technical aspects, with 71.4% of the 16-20 years' group, 42.0% of the 21-25 years' group, and 6.7% of the greater than 25 years' group chosing the same answer. As years of experience increased, the emphasis on changes in understanding of a company's internal business needs increased, with 28.6% of the 16-21 years' group, 57.1% of the 21-25 years' group, and 60% of the greater than 25 years' group, selecting this option. The respondents with the most years' working experience (greater than 25 years) were the only group to select changes in external market needs (33.3%). This may be because this group would contain the highest percentage of executives and senior managers. Senior leaders may be responsible for assessing the external business environment and setting the direction of the company more so than any of the respondents with fewer years' working experience. Senior leaders may be the only group taking external factors into consideration.

- *Reason for Late Changes from Operating Company versus Company Used Lump Sum on Past Projects: Alberta (a_Q1 * Q8)*

The hypothesized relationship between a_Q1 (Reason for Late Changes from Operating Company) and Q8 (Company Used Lump Sum on Past Projects: Alberta) was:

Hypothesis 176: Opinion of reason for operational late changes will be highly correlated with Company use of Lump Sum on Past Projects.

Company use of LS and reason for late changes within an Operator company may be related since the reason for late changes within a company may have influenced whether they have used LS in the past. Alternatively, companies that have used LS in the past may have experienced the reasons for late changes on a LS project, first hand.

A_Q1 and Q8 were found to be highly correlated with the Fisher Exact Test (P=0.006). Respondents from companies that had performed LS on past projects were most concerned by changes stemming from understanding of internal business needs (56%) and from the technical aspects not being fully understood prior to contract award (40%). Respondents whose companies had not performed LS on past projects in Alberta were also concerned about technical aspects (37.5%), as the reason for late changes but interestingly were more concerned about changes in external market needs (50%). Respondents from companies that had used LS on past projects were not concerned about changes due to external market needs whereas respondents from companies that had not used LS in Alberta, were. Since external market factors cannot be influenced, perhaps this concern is an influencing factor on whether a company will employ a LS payment structure or not.

1.1.9 Engineering Company Interest in Lump Sum by Phase: FEED (b_Q1)

- *Engineering Company Interest in Lump Sum by Phase: FEED versus Maximum Lump Sum Project Dollar Value Performed in Alberta (b_Q1 * Q9)*

The hypothesized relationship between b_Q1 (Engineering Company Interest in Lump Sum by Phase: FEED) and Q9 (Maximum Lump Sum Project Dollar Value Performed in Alberta) was:

Hypothesis 188: Company Interest in FEED phase lump sum will be highly correlated with maximum lump sum project dollar value performed in Alberta.

Entering the FEED phase of a project, scope is typically not fully defined, which makes LS bidding on this phase very difficult. The size of LS projects performed previously in Alberta may influence a respondent's willingness to attempt LS on different stages of a project.

B_q1 and Q9 were found to be highly correlated by the Fisher Exact Test (P<0.001). Only individuals from companies that had performed LS projects of $5MM - $100MM and $100MM - $1B ranges responded to both questions. Those respondents whose companies had performed LS on projects $5MM - $100MM were all interested in using LS for FEED phase of a project. All respondents from companies that had performed Alberta LS projects $100MM - $1B were not interested in using LS for FEED phase. What may be concluded is that the higher the LS project dollar value performed previously, the less interest there is in early phase LS work.

- *Engineering Company Interest in Lump Sum by Phase: FEED versus Company Used Lump Sum on past projects – Internationally (b_Q1 * Q10)*

The hypothesized relationship between b_Q1 (Engineering Company Interest in Lump Sum by Phase: FEED) and Q9 (Company Used Lump Sum on Past Projects – Internationally) was:

Hypothesis 189: Company Interest in lump sum for FEED phase will be highly correlated with company past use of lump sum on International projects.

If a company has performed LS contracts on past projects internationally, it may have a better understanding of the risks associated with performing LS on different phases of a project. This may make these companies less likely to have interest in LS for earlier project phases where the project scope is less well defined.

B_Q1 and Q10 were found to be highly correlated from the Fisher Exact Test (P=0.001). Respondents from companies that had performed LS internationally were less interested in employing LS for FEED phase of a project than respondents from companies that had not performed LS internationallyt, 9.4% and 66.7%, respectively. The reasons stated by the participants who had performed LS internationally and were not interested in FEED were aligned. There is substantial Operator involvement in the FEED phase of a project because it is very difficult for Operators to specify the scope of services at this phase. As a result, the

estimate of hours required for the Engineer to perform this work will not be accurate. The fact that there are many levels of approval within the Operator required at this phase was also mentioned as a reason for lack of interest in LS for FEED phase.

1.1.10 Company Interest in Lump Sum by Phase: Detailed Engineering (b_Q2)

- *Engineering Company Interest in Lump Sum by Phase: Detailed Engineering versus Company Engages in Unit Rate Payment Structures (b_Q2 * Q5.3)*

The hypothesized relationship between b_Q2 (Engineering Company Interest in Lump Sum by Phase: Detailed Engineering) and Q5.3 (Company Engages in Unit Rate Payment Structures) was:

Hypothesis 198: Company Interest in lump sum for Detailed Engineering phase will be highly correlated with company use of unit rate payment structures.

B_Q2 and Q5.3 were found to be highly correlated (χ^2 =14.60, *df*=1, P<0.001). Companies that did not engage in unit rate payment structures were much more interested in LS for Detailed Engineering phase(91.7%) than companies that did engage in unit rate contracts(35.3%). The reasons for lack of interest in using LS for Detailed Engineering phase provided by respondents from companies that did use unit rate were that the scope is still undefined and Operators still require large amounts of input at this stage. Some respondents stated they would accept LS after the 90% model review was complete. Respondents whose companies did not engage in unit rate were interested in LS for the Detailed Design phase because they felt the scope should be defined adequately from FEED phase.

- *Engineering Company Interest in Lump Sum by Phase: Detailed Engineering versus Company Used Lump Sum on past projects – Internationally (b_Q2 * Q10)*

The hypothesized relationship between b_Q2 (Engineering Company Interest in Lump Sum by Phase: Detailed Engineering) and Q10 (Company Used Lump Sum used on past projects – Internationally) was:

Hypothesis 201: Company Interest in lump sum for Detailed Engineering phase will be highly correlated with Company Used Lump Sum used on past projects – Internationally.

If a company has performed LS contracts on past projects internationally, they may have a better understanding of the risks associated with performing LS on different phases of a project. This may make them less likely to have interest in LS for phases prior to completion of Detailed Engineering.

B_Q2 and Q10 were found to have medium correlation through the Fisher Exact Test (P=0.038). Both groups of respondents, those that had and those that had not used LS internationally, were more interested in using LS for Detailed Engineering than they were interested in LS for FEED phase of a project: 59.4% and 100%, respectively, for Detailed Engineering phase; compared with 9.4% and 66.7%, respectively, for FEED phase. Previous users of LS on international projects were still less interested in using LS for Detailed Engineering than those who had not used LS internationally. The reason for lack of interest in LS for Detailed Engineering was lack of scope definition in the Detailed Engineering phase. Respondents believed that, internationally, scope is generally frozen by the Detailed Engineering point and the owner/operator role is characterized as "auditing", which is considerably different from the operator role in the Alberta environment.

- *Engineering Company Interest in Lump Sum by Phase: Detailed Engineering versus Maximum Lump Sum Project Dollar Value: Internationally (b_Q2 * Q11)*

The hypothesized relationship between b_Q2 (Engineering Company Interest in Lump Sum by Phase: Detailed Engineering) and Q11 (Maximum Lump Sum Project Dollar Value: Internationally) was:

Hypothesis 202: Company Interest in lump sum for Detailed Engineering phase will be highly correlated with Maximum Lump Sum Project Dollar Value: Internationally.

B_Q2 and Q11 were found to be highly positively correlated through the Fisher Exact Test (P=0.002). Interest in using LS for Detailed Engineering project phase increased with size of LS project performed internationally. Companies that had performed international LS projects of

less than $100MM had no interest in LS for Detailed Engineering, while all respondents from companies that had performed international LS projects greater than $1B were willing to LS for Detailed Engineering phase. Respondents with $100MM - $1B project size were split in level of interest, with 44.4% expressing an interest in LS for Detailed Engineering. These results likely mean that the smaller the maximum dollar value of LS project performed previously by a company, the lower the company's perception that it has the ability to control risk during the Detailed Engineering phase.

1.1.11 Company Interest in Lump Sum by Phase: Construction (b_Q3)

- *Engineering Company Interest in Lump Sum by Phase: Construction versus Company Engages in Unit Rate Payment Structures (b_Q3 * Q5.3)*

The hypothesized relationship between b_Q3 (Engineering Company Interest in Lump Sum by Phase: Construction) and Q5.3 (Company Engages in Unit Rate Payment Structures) was:

Hypothesis 210: Company Interest in lump sum for Construction phase will be highly correlated with company use of unit rate payment structures.

B_q3 and Q5.3 were found to have be highly correlated (χ^2 =7.41, *df*=1, P=0.006). Engaging in unit rate payment structures seemed to be an influencing factor for interest in LS for Construction phase of a project. The majority of respondents from companies that had engaged in unit rate payment structures expressed an interest in LS for Construction phase on future projects (76.5%), while the majority of those who did not engage in unit rate were not interested in using LS for Construction phase (66.7%). The reason given for the lack of interest in LS for Construction phase among respondents who did not engage in unit rate payment structures was high risk exposure. The major factors making up this risk exposure were:

- Labour performance unpredictability
    - Lack of skilled resources and supervision
    - Poor productivity
    - Rigid work organization
    - Weather conditions

- Lack of construction subcontractors willing to risk share
    - Must subcontract out field construction and construction subcontractors not willing to offer LS contracts.

Some unit rate respondents commented that they would be willing to LS small projects, but large projects were too risky. Perhaps respondents whose companies engage in unit rate payment structure work, primarily worked on smaller dollar value projects. There was not a large enough sample that had responded to the maximum project dollar value question to draw a conclusion.

- *Engineering Company Interest in Lump Sum by Phase: Construction versus Company Used Lump Sum used on past projects – Alberta (b_Q3 * Q8)*

The hypothesized relationship between b_Q3 (Engineering Company Interest in Lump Sum by Phase: Construction) and Q8 (Company Used Lump Sum used on past projects –Alberta) was:

Hypothesis 211: Company Interest in lump sum for Construction phase will be highly correlated with Company Used Lump Sum used on past projects – Alberta.

Those companies that had previously used LS on projects in Alberta may be more aware of the risks associated with executing a LS project locally. This awareness may make them either more or less interested in LS for Construction phase than companies that had not performed LS locally in the past, depending on whether the project had a good or bad outcome.

B_Q3 and Q8 were found to be highly correlated (χ^2 =7.41 *df*=1, P=0.006). Respondents whose companies had performed LS projects in Alberta previously, were much less interested in using LS for Construction phase of a project than respondents from companies that had no past experience with LS, locally, 33.3% and 76.5%, respectively.

- *Engineering Company Interest in Lump Sum by Phase: Construction versus Maximum Lump Sum Project Dollar Value Internationally (b_Q3 * Q11)*

The hypothesized relationship between b_Q3 (Engineering Company Interest in Lump Sum by Phase: Construction) and Q8 (Maximum Lump Sum Project Dollar Value Internationally) was:

Hypothesis 214: Company Interest in lump sum for Construction phase will be highly correlated with Maximum Lump Sum Project Dollar Value performed internationally.

The higher the LS project dollar value performed previously, the greater the comfort level a company may have performing LS again and the more knowledge of the risks associated with LS Construction the company may have acquired. This may lead to more willingness to perform LS for Construction phase of a project, as previous project dollar value increases.

B_Q3 and Q11 were found to be highly correlated through the Fisher Exact Test (P=0.007). Respondents from companies that had performed international LS projects of less than $100MM and projects of greater than $1B were all interested in performing LS for Construction phase of a project. Respondents whose companies had executed international LS projects in the $100MM - $1B range were less interested in using LS for Construction phase, with 33.3% responding positively. With such a small sample size, it is difficult to determine if this is reflective of the entire population that is the subject of this study. The respondents who were not willing to LS for Construction phase, who gave contextualizing answers, were not interested due to construction labour productivity risk, lack of availability of good construction supervision resources, and lack of availability of Constructors willing to accept LS work. Several participants commented that internationally there is flexible and wide access to low cost workforce and supervision and Constructors are familiar with LS and will accept LS or unit rate payment structures, sharing the productivity risk.

- *Engineering Company Interest in Lump Sum by Phase: Construction versus Company has an Internal Construction Division (b_Q3 * b_Q5)*

The hypothesized relationship between b_Q3 (Engineering Company Interest in Lump Sum by Phase: Construction) and b_Q5 (Company has an Internal Construction Division) was:

Hypothesis 215: Company Interest in lump sum for Construction phase will be highly correlated with whether a company has an internal construction division.

From the pre-interviews, a main source of risk as stated by Engineer interviewees was lack of desire for LS by the Constructors with which Engineers may have to partner on projects. It may

stand to reason that Engineers with internal construction divisions would not have to partner with Constructors and thus may be more interested in using LS for Construction phase than engineering companies without internal construction divisions.

B_Q3 and b_Q5 were found to have a medium correlation through the Fisher Exact Test (P=0.021). Respondents from companies with internal construction divisions (58.3%) were more interested than respondents whose companies did not have an internal construction division (0%) in LS for Construction phase. This result was consistent with what was expected, based on feedback from the pre-interviews.

1.1.12 Engineering Company Interest in Lump Sum for Full EPC (b_Q4)

- *Engineering Company Interest in Lump Sum for Full EPC versus Maximum Lump Sum Project Dollar Value Internationally (b_Q4 * Q11)*

The hypothesized relationship between b_Q3 (Engineering Company Interest in Lump Sum for Full EPC) and Q8 (Maximum Lump Sum Project Dollar Value Internationally) was:

Hypothesis 223: Company Interest in lump sum for Full EPC will be highly correlated with Maximum Lump Sum Project Dollar Value performed internationally.

The responses to this question were expected to be similar to company interest in LS for Construction phase because construction is the most capital intensive part of an EPC project and may expose a company to the largest financial risk on a LS project.

B_Q4 and Q11 were found to be highly correlated through the Fisher Exact Test (P<0.001). The results were different from b_Q3 (interest in LS for Construction phase), with all respondents from companies that have performed LS projects of less than $1B, internationally showing no interest in Full EPC LS contracts. All respondents from companies that had performed international LS contracts greater than $1B were interested in Full EPC LS contracts. It is difficult to consider the responses as being reflective of the entire population under study, due to the small sample size. Respondents who had no interest in Full EPC LS contracts stated two reasons for their opinion. Some were willing to LS after 90% model review, i.e. the bulk of engineering was complete and some were unwilling due to the risks associated with construction.

1.1.13 Construction Companies Lack Interest in Partnering on Lump Sum Projects (c_Q1)

The quantitative results were deemed invalid, thus this question was not analyzed.

1.1.14 Construction Company has Performed Lump Sum on Projects in Alberta Oil and Gas Industry (c_Q3)

The questions posed to construction companies regarding LS use within the oil and gas industry in Alberta and outside the oil and gas industry within Alberta were used to determine if there was less interest in using LS payment structures for oil and gas than for the other construction sectors. It was predicted that there would be differences in the prevalence and financial magnitude of LS usage in oil and gas vesrsus outside oil and gas.

- *Construction Company has Performed Lump Sum on Projects in Alberta Oil and Gas Industry versus Company Works Internationally (c_Q3*Q4)*

The hypothesized relationship between c_Q3 (Construction Company has Performed Lump Sum on Projects in Alberta oil and gas Industry) and Q4 (Company Works Internationally) was:

Hypothesis 231: A construction company having performed lump sum projects in Alberta oil and gas industry will be highly correlated with that company working internationally.

If a construction company has worked internationally, it may have used LS since the LS payment strategy is more frequently used internationally than locally. If a company has used LS for international projects, it may stand to reason that the company may use its experience with and knowledge of LS contracting to employ LS on projects locally, in the Alberta oil and gas industry.

C_Q3 and Q4 were found to be highly correlated through the Fisher Exact Test ($P<0.001$). From the data, if a company has worked internationally it is much more likely to use LS payment strategies locally, in the Alberta oil and gas industry. 100% of respondents whose companies worked internationally used LS on Alberta oil and gas construction projects, while only 33.3% of respondents whose companies did not work internationally used LS contracting for local oil and gas construction projects.

- *Construction Company has Performed Lump Sum on Projects in Alberta Oil and Gas Industry versus Maximum Lump Sum Project Dollar Value in Alberta (c_Q3 * Q9)*

The hypothesized relationship between c_Q3 (Construction Company has Performed Lump Sum on Projects in Alberta oil and gas Industry) and Q9 (Maximum Lump Sum Project Dollar Value in Alberta) was:

Hypothesis 236: A construction company having performed lump Sum projects in Alberta oil and gas industry will be highly correlated with the maximum lump sum project dollar value used in Alberta.

A correlation was run on c_Q3 and c_Q4 versus Q9 to determine if there was a difference in the maximum size of LS projects executed by respondents who have used LS in oil and gas and those who have used LS outside oil and gas, in Alberta.

C_Q3 and Q9 were found to be highly correlated through the Fisher Exact Test (P=0.001). All of those respondents whose companies had performed LS projects above $5MM had used LS on projects in Alberta oil and gas. Respondents whose companies had performed LS on projects less than $5MM were more divided, with 53.8% having used LS on projects in Alberta oil and gas.

- *Construction Company has Performed Lump Sum on Projects in Alberta Oil and Gas Industry versus Company Used Lump Sum on past projects - Internationally (c_Q3 * Q10)*

The hypothesized relationship between c_Q3 (Construction Company has Performed Lump Sum on Projects in Alberta oil and gas Industry) and Q10 (Company Used Lump Sum on past projects - Internationally) was:

Hypothesis 237: A construction company having performed lump Sum projects in Alberta oil and gas industry will be highly correlated with whether a company has performed lump sum on international projects.

It was speculated that Constructors who had used LS internationally would be more likely to have used LS on projects in Alberta oil and gas. They may understand how to manage LS execution more effectively due to their international experience with LS and may be more

comfortable with and have more confidence accepting LS work in the local oil and gas environment.

C_Q3 and Q10 were found to have a medium correlation with the Fisher Exact Test (P=0.023). The majority of responders from both groups (international LS experience and no international LS experience) performed LS projects in Alberta oil and gas industry, 100% and 72.7%, respectively. A lower percentage of companies with no international LS experience had performed LS projects, locally, in Alberta oil and gas, when compared to companies with international LS experience.

1.1.15 Construction Company has Performed Lump Sum on Projects in Alberta Outside Oil and Gas (c_Q4)

- *Construction Company has Performed Lump Sum on Projects in Alberta Outside Oil and Gas Industry versus Maximum Lump Sum Project Dollar Value in Alberta (c_Q4 * Q9)*

The hypothesized relationship between c_Q4 (Construction Company has Performed Lump Sum on Projects in Alberta Outside Oil and Gas Industry) and Q9 (Maximum Lump Sum Project Dollar Value in Alberta) was:

Hypothesis 249: A construction company having performed lump sum projects in Alberta outside the oil and gas industry will be highly correlated with maximum lump sum project dollar value used in Alberta.

A correlation was run on c_Q3 and c_Q4 versus Q9 to determine if there was a difference in the maximum size of LS projects executed by respondents who have used LS in oil and gas and those who have used LS outside oil and gas, in Alberta.

C_Q4 and Q9 were found to have a medium correlation with the Fisher Exact Test (7.58, P=0.027). The pattern was much different than with companies that had performed LS projects within the oil and gas industry of Alberta. The majority of companies that had performed projects between $100MM and $1B on a LS basis had used LS on projects outside of the oil and gas industry (93.3%). This could be interpreted as the companies performing larger projects on

a LS basis are participating in both the oil and gas and other construction industries. Less than half of the $5MM to $100MM project group are performing LS projects outside of the oil and gas industry (46.2%), meaning more companies are performing LS projects in this dollar value range within oil and gas than outside of oil and gas. For the group in the less than $5MM project range, more companies are performing construction jobs on a LS basis outside of oil and gas with 76.9% having performed jobs of this range in Alberta outside of the oil and gas industry.

1.1.16 Difference in Types of Skilled Labour Required within the Oil and Gas Industry and Outside the Oil and Gas Industry (c_Q5)

- *Difference in Types of Labour required within the Oil and Gas Industry and Outside versus Role in Organization (c_Q5*Q2)*

The hypothesized relationship between c_Q5 (Difference in Types of Labour required within Oil and Gas and Outside) and Q2 (Role in Organization) was:

Hypothesis 255: Opinion of the difference in types of labour required within the oil and gas industry versus outside oil and gas will be highly correlated with role in an organization.

The perception of differences in types of labour required for projects both inside and outside the oil and gas industry may vary depending on role in an organization. A respondent with more years' working experience may have familiarity with more different labour situations for comparison purposes and to base an opinion on. A Project Manager who deals directly with the execution of a project may have an opinion about labour requirements based on experience executing both types of projects, projects inside oil and gas and projects outside oil and gas. Project Managers may be expected to perceive a difference between the two types of projects.

C_Q5 and Q2 were found to be highly correlated through the Fisher Exact Test (17.69, $P<0.001$). Executives (90%) and Project Managers (100%) held the opinion that there is a difference in what skilled labour is required for projects in oil and gas versus projects outside oil and gas. Senior Managers believed the opposite, with 83.3% of Senior Managers maintaining there is no

difference in the labour skill types required for projects within oil and gas versus outside oil and gas. The qualitative data did not uncover any reasons why the Senior Managers felt differently than the Project Managers and the Executives about labour requirements. Respondents who believed there was a difference in skilled labour requirements for projects in oil and gas versus projects outside oil and gas were very aligned in that difference. All respondents with that belief stated that oil and gas requires more stringent quality and safety codes and specifications; therefore, a higher labour skill level is required within oil and gas; more journeymen are required. In addition, there are more specialized labour areas required in oil and gas to construct equipment for severe service, such as high pressure welding and boilermakers.

- *Difference in Types of Labour required within the Oil and Gas Industry and Outside versus Years' Working Experience (c_Q5*Q3)*

The hypothesized relationship between c_Q5 (Difference in Types of Labour required within Oil and Gas and Outside) and Q3 (Years' Working Experience) was:

Hypothesis 256: Opinion of the difference in types of labour required within the oil and gas industry and outside oil and gas will be highly correlated with years' working experience.

Respondents with higher years' working experience may provide a more accurate answer to this question, as they are more likely to have had the benefit of having participated in or observed more projects both inside and outside the oil and gas industry, than less experienced individuals. Respondents with more experience may feel there is more of a difference in labour force composition and requirements for oil and gas projects versus projects in other industries, than the respondents with fewer years' working experience.

C_Q5 and Q3 were found to be highly correlated through the Fisher Exact Test (P=0.001). There were very few respondents in the 21-25 years' working experience category, therefore, this group was combined with the greater than 25 years' experience group, for this particular analysis. The majority of respondents with greater than 16 years' working experience felt there was a difference in labour force requirements within oil and gas versus outside of oil and gas: 60% (16-20 years') and 73.9% (greater than 20 years'). The percentage of respondents who

shared this opinion increased with years of experience. Respondents with less than 15 years' experience felt there was no difference in labour force skill requirements for projects within oil and gas versus outside oil and gas.

- *Difference in Types of Labour required within the Oil and Gas Industry and Outside versus Company Engages in Lump Sum Payment Structures (c_Q5*Q5.1)*

The hypothesized relationship between c_Q5 (Difference in Types of Labour required within Oil and Gas and Outside) and Q5.1 (Company Engages in Lump Sum Payment Structures) was:

Hypothesis 258: Opinion of the difference in types of labour required within the oil and gas industry and outside oil and gas will be highly correlated with whether the company engages in lump sum payment structures.

The theme of labour risk being a large factor influencing the desire to perform LS work was discussed repeatedly by participants in the pre-interview stage of the research. If a company already engages in LS payment structures, it may have assessed the skill requirements and availability of the labour, to form a portion of the job's risk premium. Companies that do not engage in LS may not have assessed this question in detail.

C_Q5 and Q5.1 were found to be highly correlated (χ^2 =7.06, *df*=1, P=0.008). The majority of respondents whose companies engage in LS (76.2%) felt there was a difference in labour skill requirements within oil and gas versus outside oil and gas. Respondents whose companies did not engage in LS felt the opposite, with much fewer (35%) believing there was a difference in labour skill requirements within oil and gas versus oil and gas.

- *Difference in Types of Labour required within the Oil and Gas Industry and Outside versus Maximum Lump Sum Project Dollar Value in Alberta (c_Q5*Q9)*

The hypothesized relationship between c_Q5 (Difference in Types of Labour required within Oil and Gas and Outside) and Q9 (Maximum Lump Sum Project Dollar Value in Alberta) was:

Hypothesis 262: Opinion of the difference in types of labour required within the oil and gas industry and outside oil and gas will be highly correlated with the maximum lump sum project dollar value a company has performed in Alberta.

Performing LS jobs of larger sizes within Alberta may give a respondent more knowledge about the types of labour required for projects within oil and gas versus projects outside oil and gas, due to more firsthand experience. However, perceived labour risk may play a factor in influencing the size of jobs a company is willing to perform within the oil and gas industry. Combining the experience factor and the labour risk factor, respondents whose companies have performed very low dollar value projects and those that have performed very high dollar value projects may perceive more difference in labour requirements for projects within oil and gas versus outside oil and gas.

C_Q5 and Q9 were found to be highly correlated (χ^2 =24.13, *df*=2, P<0.001). Respondents whose companies had performed a maximum LS project dollar value of $5MM were split in their opinions, with 53.8% believing oil and gas projects required different labour skill sets than projects outside oil and gas. All respondents whose companies had performed LS work between $100MM and $1B felt there was a different labour skill set required, specific to oil and gas. Most respondents on LS projects between $5MM - $100MM felt there was no difference in labour skills requirements for oil and gas projects versus projects outside oil and gas, with only 7.7% of respondents perceiving there to be a difference.

- *Difference in Types of Labour required within the Oil and Gas Industry and Outside versus Company Used Lump Sum on past projects - Internationally (c_Q5*Q10)*

The hypothesized relationship between c_Q5 (Difference in Types of Labour required within Oil and Gas and Outside) and Q10 (Company Used Lump Sum on past projects - Internationally) was:

Hypothesis 263: Opinion of the difference in types of labour required within the oil and gas industry and outside oil and gas will be highly correlated with a company's use of lump sum on past projects internationally.

If a Constructor has used LS on projects internationally in oil and gas, that Constructor may have an understanding of labour requirements on large oil and gas projects. Companies with that type of LS experience might have the opinion that there is a different labour skill set required for oil and gas projects versus projects outside oil and gas, as opposed to companies that have not worked internationally and, therefore, do not have the same type of experience or level of understanding.

C_Q5 and Q10 were found to have a medium correlation (χ^2 =5.33, *df*=1, P=0.021). The findings were the opposite of what was speculated. The majority of respondents who had worked internationally felt there was no difference in labour skill set required for oil and gas projects versus projects outside oil and gas, with 63.2% saying no difference. The majority of respondents who had not worked internationally felt that there was a different labour skill set required within oil and gas versus outside oil and gas, with 72.7% feeling there was a difference.

Upon deeper analysis of the data, the demographic of respondents who answered 'Yes' to this question, regardless of international project experience, were of a high level of working experience. All internationally experienced respondents who answered 'Yes' had greater than 25 years' working history, while 33% of respondents in this group who answered 'No' had 16-20 years' experience and 42% had less than 15 years' experience. Of the respondents without international experience who answered 'Yes' to the differences in labour requirements question, 62.5% had greater than 20 years' working experience; of the respondents in this group who said 'No' to the question, 50% had less than 15 years' experience. This finding also reveals that those Constructors with international experience are a less experienced demographic than those who have only worked locally.

1.1.17 Difference in Quantity of Labour Required in Oil and Gas versus Outside (c_Q6)

- *Difference in Quantity of Labour Required in Oil and Gas and Outside versus Role in Organization (c_Q6*Q2)*

The hypothesized relationship between c_Q6 (Difference in Quantity of Labour Required in Oil and Gas versus Outside) and Q2 (Role in Organization) was:

Hypothesis 268: Opinion of the difference in quantity of labour required in oil and gas versus outside oil and gas will be highly correlated with a respondent's role in their organization.

An executive level individual may see all projects a company is executing from a strategic level and could be familiar with what labour staffing levels have been required on different types of projects. A Project Manager level respondent at a Constructor would be involved directly in the project execution and could be expected to have firsthand knowledge of the crew numbers required to achieve acceptable progress on construction both within and outside of oil and gas.

C_Q6 and Q2 were found to be highly correlated through the Fisher Exact Test (P=0.001). Findings of note were that the majority of Executives (90%) and all Project Managers felt that there is a difference in quantity of labour required for projects within oil and gas versus projects outside of oil and gas. Unexpectedly, Senior Managers (83.3%) felt there was no difference in quantities of labour required in the two different environments. The reasons for differences in the quantity of labour requirements on oil and gas projects versus projects outside oil and gas provided by Project Managers and Executives included:

- Oil and gas projects have large scopes of work with very compressed schedules (fast tracked projects) so larger crews are required
- Larger number of skilled workers in more discipline areas are required in oil and gas
- Oil and gas is more highly regulated and the industry ensures that the labour crews meet the required Journeyman threshold, while other industries are not as strict with following the regulation.

- *Difference in Quantity of Labour Required in Oil and Gas and Outside versus Years' Working Experience (c_Q6*Q3)*

The hypothesized relationship between c_Q6 (Difference in Quantity of Labour Required in Oil and Gas versus Outside) and Q3 (Years' Working Experience) was:

Hypothesis 269: Opinion of the difference in quantity of labour required in oil and gas versus outside oil and gas will be highly correlated with a respondent's years' working experience.

As a respondent's years' working experience increased, they may have been exposed to more construction execution scenarios, potentially making their opinion about the difference in labour numbers required within different industries, a more informed opinion. The hypothesis is that respondents with higher years' working experience will be more likely to believe there are differences in quantity of labour requirements in oil and gas versus outside oil and gas than participants with fewer years' working experience.

C_q6 and Q3 were found to be highly correlated through the Fisher Exact Test (P=0.001). Since the group of respondents with 21-25 years' experience had such a small number of participants, this group was combined with the group that had less than 25 years' experience. The majority of respondents with greater than 15 years' experience believed there was a difference in quantity of labour required within oil and gas versus outside oil and gas; 16-20 years' group (60%) and greater than 20 years' group (73.9%). All respondents with less than 15 years' experience believed there was no difference in the labour numbers required within the different industries. The reasons for different requirements stated by those who did believe there was a difference in labour number requirements were the same as the reasons offered by Project Managers and Executives in Hypothesis 268, above.

- *Difference in Quantity of Labour Required in Oil and Gas or Outside versus Company Engages in Lump Sum Payment Structures (c_Q6*Q5.1)*

The hypothesized relationship between c_Q6 (Difference in Quantity of Labour Required in Oil and Gas versus Outside) and Q5.1 (Company Engages in Lump Sum Payment Structures) was:

Hypothesis 271: Opinion of the difference in quantity of labour required in oil and gas versus outside oil and gas will be highly correlated with a company having lump sum payment structure experience.

The correlation was run due to interest in determining if type of payment structures that a company engaged in impacted a participant's view of the differences in quantity of skilled

labour required in oil and gas versus in other industries. It was hypothesized that respondents whose companies engaged in LS would be more likely to consider there to be a difference in labour requirements, based on the industry. A construction company having to absorb the risk on labour in LS may force them to have performed a more comprehensive analysis of a project's labour requirements.

C_Q6 and Q5.1 were found to be highly correlated (χ^2 =7.06, *df*=1, P=0.008). Respondents whose companies had engaged in LS payment structures were much more likely to believe there was a difference in the quantity of labour requirements on oil and gas projects versus projects outside oil and gas (76.2%), whereas respondents whose companies did not engage in LS were much less likely to believe this same result (35%). Further analysis of the data indicated that all respondents with LS experience who had answered 'Yes' to the difference in labour numbers question, had greater than 25 years' working experience, while the majority (80%) of respondents of the same group who answered 'No', had less than 20 years' experience. Within the group whose companies did not engage in LS payment structures, 61.5% of respondents who answered 'No' to the labour quantity question had less than 15 years' working experience.

- *Difference in Quantity of Labour Required in Oil and Gas versus Outside versus Maximum Lump Sum Project Dollar Value in Alberta (c_Q6*Q9)*

The hypothesized relationship between c_Q6 (Difference in Quantity of Labour Required in Oil and Gas versus Outside) and Q9 (Maximum Lump Sum Project Dollar Value in Alberta) was:

Hypothesis 275: Opinion of the difference in quantity of labour required in oil and gas versus outside oil and gas will be highly correlated with what maximum dollar value of lump sum project the company has performed in Alberta.

It is possible that a respondent who has experience on a large dollar value LS project in Alberta would have considerable insight into the labour risk factors facing LS construction projects. It was hypothesized that the larger project demographic would see more of a difference in quantity of labour required between oil and gas versus other industries. It may also be possible that respondents from companies that performed very low dollar value LS projects in Alberta would share the same opinion. These companies may have chosen to perform low dollar value

LS projects because they considered labour risk as too great for larger scale projects in the region.

C_Q6 and Q9 were found to be highly correlated (χ^2 =24.13, *df*=2, P<0.001). All respondents whose companies had performed LS projects between $100MM - $1B felt there was a difference in quantity of skilled labour required in oil and gas versus outside oil and gas. All of these respondents also had greater than 25 years' working experience and were either Executives or Project Managers. More than half (53.8%) of respondents whose companies had performed LS projects of less than $5MM also believed there to be labour quantity differences based on industry. The respondents from mid-range projects ($5MM - $100MM) did not see a difference in the quantity of labour required in oil and gas versus outside oil and gas. This result may be explained by the fact that this group contains a larger younger or less experienced demographic (66.7% of respondents with less than 20 years' experience) and the group also contains no Project Managers and only one Executive. The majority of respondents for the mid-range group fell into the "Other" category, which was comprised of Project Controls specialists, Discipline Engineering Managers, Estimators, and Sales and Marketing representatives; roles which may involve less direct construction labour impact exposure.

- *Difference in Quantity of Labour Required in Oil and Gas or Outside versus Company Used Lump Sum on past projects - Internationally (c_Q6*Q10)*

The hypothesized relationship between c_Q6 (Difference in Quantity of Labour Required in Oil and Gas versus Outside) and Q10 (Company Used Lump Sum on past projects - Internationally) was:

Hypothesis 276: Opinion of the difference in quantity of labour required in oil and gas versus outside oil and gas will be highly correlated with a company having used lump sum on past projects internationally.

It is possible that a company that had worked internationally versus having only worked locally might be a larger company and thus have more knowledge of labour patterns on various types of projects, due to exposure to more projects.

C_Q6 and Q10 were found to be have a medium correlation (χ^2 =5.33, *df*=1, P=0.021). Respondents from companies that had not used lump sum internationally were more likely (72.7%) to think there was a difference in quantity of labour required in oil and gas versus outside oil and gas than respondents from companies that had used LS internationally (36.8%). These respondents had the same demographics as those from the comparison of c_Q5 (difference in types of labour required) and Q10.

1.1.18 Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally (bc_Q1)

- *Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally versus Employment Type (bc_Q1*Q1)*

The hypothesized relationship between bc_Q1 (Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally) and Q1 (Employment Type) was:

Hypothesis 280: Opinion of difference in risk level between contracting in Alberta oil and gas and contracting internationally will be highly correlated with a respondent's type of organization.

This question was asked of Engineers and Constructors. Given that Engineer interview participants indicated that their hesitation for using local LS contracts in oil and gas was due to lack of Constructor interest in LS, there may be a relationship between company type and view of risk, locally. This correlation was performed to determine what correlation existed.

Bc_Q1 and Q1 were found to be highly correlated (χ^2 =46.94, *df*=1, P<0.001). The majority of Engineers (80.5%) found the local industry to have a higher level of risk than the international industry, while the majority of Constructors found the opposite. 97.2% of Constructor respondents did not see a difference in risk level between locally and internationally.

Of those Constructors who said 'No' to difference in risk level between contracting in Alberta oil and gas versus contracting internationally, many had not performed LS contracts internationally, therefore they may have no basis for comparison. The main reasons provided

by both types of contractors (Engineers and Constructors) for why they considered contracting in international oil and gas to be less risky than contracting in Alberta oil and gas were:

- Cost and availability of labour and supervision internationally is much better (lower cost, more availability)
- Frozen work scope
- International Operators take a more hands-off approach once the LS portion of work begins
- Constructors more willing to accept LS work internationally
- Clearer contractual requirements.

- *Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally versus Role in Organization (bc_Q1*Q2)*

The hypothesized relationship between bc_Q1 (Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally) and Q2 (Role in Organization) was:

Hypothesis 281: Opinion of difference in risk level between lump sum contracting in Alberta oil and gas versus internationally will be highly correlated with a respondent's role in their organization.

The more senior role a respondent holds in their organization may have given them a broader view of the outcomes of more projects, thereby providing them a more extensive experience base from which to draw conclusions about the level of risk in oil and gas internationally versus locally. Project Manager level respondents may have experience with the day to day execution of a project and have experienced, first-hand, the consequences of risks locally and internationally. Based on the pre-interviews conducted for the risk question, the Executive group may be expected to believe that contracting locally is riskier than contracting internationally.

Bc_Q1 and Q2 were found to be highly correlated (χ^2 =19.31, *df*=3, P<0.001). Executives (63%) and Project Managers (57.1%) were more likely to view Alberta oil and gas as riskier than

international oil and gas. Senior Managers were split in their opinion with 50% considering the local industry to be riskier than the international industry.

The reasons why Executives consider the local industry to be riskier than the international industry include:

- Cost of international construction labour is a fraction of the cost of labour in Alberta
- Flexible access to a wide pool of labour and supervision resources, internationally
    - Not overtime restrained
- Construction contractors prepared to accept unit rate or LS contracts, sharing production risk, internationally
- Access to ocean ways for large module transportation
- Internationally, there is the opportunity to make more profit using LS if it is prepared correctly than in using cost reimbursable
- More hands-off clients after scope freeze
    - More client knowledge of LS payment structure management behaviours, internationally.

The reasons why Project Managers consider the local industry to be riskier than the international industry include:

- More hands-off clients after scope freeze, internationally
- Construction contractors prepared to accept unit rate or LS contracts, sharing production risk, internationally

The reasons why Senior Managers consider the local industry to be riskier than the international industry include:

- Internationally, client role in LS contracts is characterized as ‘auditing’
- Scope more completely defined on internationl projects

- *Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally versus Years' Working Experience (bc_Q1*Q3)*

The hypothesized relationship between bc_Q1 (Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally) and Q3 (Years' Working Experience) was:

Hypothesis 282: Opinion of difference in risk level between lump sum contracting in Alberta oil and gas versus international oil and gas will be highly correlated with a respondent's years of working experience.

Based on the pre-interviews, which were all conducted with participants having greater than 25 years' working experience, respondents with more years' experience could be expected to believe the local oil and gas industry is riskier than international oil and gas for LS contracting. Participants with longer years' experience may have contributed to a larger number of projects locally and internationally, thereby giving them a broader knowledge base from which to form an opinion.

Bc_Q1 and Q3 were found to be highly correlated through the Fisher Exact Test (P=0.001). Respondents having greater than 21 years' working experience were more likely to think that local oil and gas was risker than international oil and gas for LS payment structures: 21-25 years' experience (71.4%) and greater than 25 years' experience (56.5%). Respondents with less than 21 years' experience were more likely to think that Alberta was not riskier than internationally: less than 16 years' experience (100%) and 16-21 years' experience (80%). The reasons for believing the local industry to be riskier than the international industry were the same as the reasons stated in the Hypothesis 281 correlation, above.

- *Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally versus Company Engages in Cost Reimbursable Payment Structures (bc_Q1*Q5.2)*

The hypothesized relationship between bc_Q1 (Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally) and Q5.2 (Company Engages in Cost Reimbursable Payment Structures) was:

Hypothesis 285: Opinion of difference in risk level between lump sum contracting in Alberta oil and gas versus internationally will be highly correlated with whether a respondent's company engages in cost reimbursable payment structures.

If a company engages in cost reimbursable payment structures locally, it may be because the company perceives the risk in local oil and gas to be too high for conducting their business on a LS basis. For this reason, companies that engage in cost reimbursable may view local risk as higher than international risk.

Bc_Q1 and Q5.2 were found to be highly correlated (χ^2 =24.35, *df*=1, P<0.001). Respondents whose companies engaged in cost reimbursable payment structures were more likely to view local oil and gas as riskier than international oil and gas (61.8%). This group of respondents offered the same reasons for their opinion that the local industry is riskier than the international industry as as those found in the previous correlations. Respondents whose companies did not use cost reimbursable did not view local oil and gas as riskier than international oil and gas (100%).

- *Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally versus Maximum Lump Sum Project Dollar Value in Alberta (bc_Q1*Q9)*

The hypothesized relationship between bc_Q1 (Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally) and Q9 (Maximum Lump Sum Project Dollar Value in Alberta) was:

Hypothesis 288: Opinion of difference in risk level between lump sum contracting in Alberta oil and gas versus internationally will be highly correlated with the maximum lump sum project dollar value a company has executed in Alberta.

Bc_Q1 and Q9 were found to be highly correlated (χ^2 =12.20, *df*=2, P=0.002). As maximum LS project dollar value increased, so did the percentage of respondents who felt that Alberta oil and gas was riskier than international oil and gas. All respondents whose maximum local LS project dollar value was less than $5MM felt local risk was not higher than international risk. Slightly more of the respondents with LS projects between $5MM - $100MM felt that risk was

greater locally (23.5%) than internationally. Respondents with maximum LS project dollar values between $100MM - $1B had the largest percentage of people who viewed Alberta oil and gas as risker than international oil and gas for LS payment structures, with 54.2% of respondents selecting that answer. It is worth noting that 12 out of the 13 respondents from the $100MM - $1B group who selected locally as riskier than internationally reported having used LS internationally in the past. Comparatively, only three out of the 11 respondents, from the $100MM - $1B group, who selected locally as not riskier than internationally had reported using LS internationally.

- *Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally versus Company Used Lump Sum on past projects - Internationally (bc_Q1*Q10)*

The hypothesized relationship between bc_Q1 (Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally) and Q10 (Company Used Lump Sum on past projects - Internationally) was:

Hypothesis 289: Opinion of difference in risk level between lump sum contracting in Alberta oil and gas versus internationally will be highly correlated with whether a company has used lump sum on past projects internationally.

A difference in opinion could potentially be expected between respondents whose companies have used LS internationally and respondents whose companies have not. Respondents whose companies have not used LS internationally may lack the experience required to accurately compare the two different oil and gas markets. Based on the pre-interviews, it is hypothesized that companies with international LS experience will view local oil and gas as riskier than international oil and gas, for LS contracting.

Bc_Q1 and Q10 were found to be highly correlated (χ^2 =16.53, *df*=1, P<0.001). Respondents who had used LS internationally were more likely to believe that local oil and gas was riskier than international oil and gas (63.0%). While respondents whose companies had not used LS internationally were more likely to believe that local oil and gas was not riskier than international oil and gas, with only 16.1% believing the local market to be riskier.

- *Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally versus Maximum Project Dollar Value: Internationally (bc_Q1*Q11)*

The hypothesized relationship between bc_Q1 (Contracting in Alberta Oil and Gas Riskier than Contracting in Oil and Gas Internationally) and Q11 (Maximum Project Dollar Value: Internationally) was:

Hypothesis 290: Opinion of difference in risk level between lump sum contracting in Alberta oil and gas versus internationally will be highly correlated with the maximum project dollar value a company has performed internationally.

It is possible that the higher the project dollar value a company has performed internationally, the riskier a respondent would view the local oil and gas environment, by comparison. Larger value projects may have exposed a respondent to a larger cross section of risk types that a project can experience, thereby giving them a better understanding of what the largest factors are that could result in an unfavourable project outcome.

Bc_Q1 and Q11 were found to have a medium correlation through the Fisher Exact Test (9.93, P=0.013). The data shows that as the maximum project dollar value a company has performed internationally increases, so does a respondent's perception of local oil and gas risk level. Respondents whose companies had performed international projects of less than $5MM felt local oil and gas was not riskier (0%) than international oil and gas. Of the respondents from companies with international projects having maximum dollar values of $5MM - $100M and of $100MM - $1B, 35.7% and 77.8%, respectively, felt that local oil and gas was riskier than international oil and gas. 83.3% of respondents from companies that had performed international projects of greater than $1B felt that the local market was riskier than the international market.

Variables with no Correlation

Through the Chi Square and Fisher Exact tests, no correlations were found for the hypotheses in the following table.

Table 7-1 - Examination of Hypotheses H145 – H156 For Lack Of Owner Project Manager Empowerment (ab_Q1)

Independent Variable	Yes N (%)	No N (%)	X2	df	P	Value Reflects Fisher Exact Test
Q1: Employment Type						
Operating Company	31 (77.5%)	9 (22.5%)	1.504	1	0.220	
Engineering Company	36 (87.8%)	5 (12.2%)				
Construction Company	Null	Null				
Q2: Role in Organization						
Executive + VP	16 (80.0%)	4 (20.0%)			0.818	X
Senior Manager	20 (80.0%)	5 (20.0%)				
Project Manager	27 (87.1%)	4 (12.9%)				
Other	4 (80.0%)	1 (20.0%)				
Q3: Years Working Experience						
≤ 15 Years	4 (80.0%)	1 (20.0%)			0.891	X
16-20 Years	13 (81.3%)	3 (18.8%)				
21-25 Years	11 (91.7%)	1 (8.3%)				
> 25 Years	39 (81.3%)	9 (18.8%)				
Q4: Company Operates Internationally						
Works Internationally	66 (82.5%)	14 (17.5%)	Null	Null	Null	
Does Not Work Internationally	Null	Null				
Q5.1: Company Engages in Lump Sum Payment Structure						
Yes	36 (78.3%)	10 (21.7%)	1.347	1	0.246	

Independent Variable	Yes N (%)	No N (%)	X2	df	P	Value Reflects Fisher Exact Test
No	30 (88.2%)	4 (11.8%)				
Q5.2: Company Engages in Cost Reimbursable Payment Structure						
Yes	63 (84.0%)	12 (16.0%)			0.209	X
No	3 (60.0%)	2 (40.0%)				
Q5.3: Company Engages in Unit Rate Payment Structure						
Yes	30 (78.9%)	8 (21.1%)	0.633	1	0.426	
No	36 (85.7%)	6 (14.3%)				
Q8: Company Used Lump Sum on Past Project – Alberta						
Yes	47 (83.9%)	9 (16.1%)			0.753	X
No	20 (80.0%)	5 (20.0%)				
Q9: Project Dollar Value – Alberta						
< $5 MM	9 (100.0%)	0 (0.0%)			0.394	X
< $100 MM	7 (87.5%)	1 (12.5%)				
< $1 B	25 (78.1%)	7 (21.9%)				
Q10: Company Used Lump Sum on Past Project - Internationally						
Yes	43 (76.8%)	13 (23.2%)			0.054	X
No	23 (95.8%)	1 (4.2%)				
Q11: Project Dollar Value - Internationally						
< $5 MM	6 (100.0%)	0 (0.0%)			0.348	X

Independent Variable	Yes N (%)	No N (%)	X2	df	P	Value Reflects Fisher Exact Test
< $100 MM	9 (100.0%)	0 (0.0%)				
< $1 B	13 (76.5%)	4 (23.5%)				
> $1 B	6 (85.7%)	1 (14.3%)				
b_Q5: Company Has Internal Construction Division						
Yes	32 (88.9%)	4 (11.1%)			0.497	X
No	4 (80.0%)	1 (20.0%)				

1.2 Barriers to Lump Sum Contracts in Alberta

This section uses T-Tests (Sections 7.2.1- 7.2.6) and One-Way ANOVA (Sections 7.2.7 – 7.2.10) to determine relationships between respondents' demographic and company specific information and opinion on the relative importance of identified barriers to lump sum contracting. Barriers are listed in Section 4.3.4.

1.2.1 Organization Operates Internationally (Q4)

The hypothesized relationship between Q4 (Organization Operates Internationally) and the ranking of Barriers to Lump Sum Locally (Q14 - Q19) was:

Hypothesis 41-46: Ranking of barriers to lump sum locally will be highly correlated with whether an organization operates internationally.

This study was interested in determining if international operations influences the importance placed on the different barriers to local lump sum execution that were suggested in the pre-interviews. Using an independent samples T-Test, a statistically significant difference was between Q4 and Q14, Q15 and Q16. A 'Yes' answer to Q4 is equivalent to company operates internationally and 'No' is equivalent to company does not operate internationally.

- Q4 * Q14 had a medium correlation (t(106)= -2.23, P=0.028); ('Yes' M=2.58; 'No' M=3.67)
- Q4 * Q15 were highly correlated (t(84)= 3.60, P=0.001); ('Yes' M = 4.92; 'No' M = 3.22)
- Q4 * Q16 were highly correlated (t(104)= -5.12, P<0.001); ('Yes' M = 3.25; 'No' M = 5.33)

These results mean that respondents whose companies operate internationally are more concerned by (ranked higher) the field labour constraints and local cost reimbursable construction culture than respondents from companies without international operations. Companies with international operations were less concerned (ranked lower) about stability of weather than companies without international experience.

There are two potential limitations with this T-Test analysis: the difference in size between the two groups of Q4 and that the 'No' group contains fewer than 20 data points. Comparing a large and small group together may give inaccurate results and may reduce the ability to detect differences that exist.

1.2.2 Organization Engages in Lump Sum Payment Structures (Q5.1)

The hypothesized relationship between Q5.1 (Organization Engages in Lump Sum Payment Structures) and the ranking of Barriers to Lump Sum Locally (Q14- Q19) was:

Hypothesis 47-52: Ranking of barriers to lump sum locally will be highly correlated with whether an organization engages in lump sum payment structures.

Companies that engage in lump sum payment structures may have more experience with the barriers affecting LS execution and may have a different perception of importance placed on certain barriers than companies that do not use LS.

Using an independent samples T-Test, a statistically significant difference was between Q5.1 and Q15, Q16, and Q17. A 'Yes' answer to Q5.1 is equivalent to company uses LS and 'No' is equivalent to company does not use LS.

- Q5.1 * Q15 was highly correlated (t(84)= 4.07, P<0.001); ('Yes' M=5.28; 'No' M=4.13)
- Q5.1 * Q16 was highly correlated (t(103)= -3.90, P<0.001); ('Yes' M=3.00; 'No' M=3.94)

- Q5.1 * Q17 has a medium correlation (t(84)= -2.20, P=0.031); ('Yes' M=4.80; 'No' M=5.18)

The results show that respondents from companies that use LS contracting strategies are more likely to believe stability of weather has a lower impact on LS execution than respondents from companies do not use LS. Respondents whose companies use LS believe that the local cost reimbursable construction culture and lack of waterways for large modules are larger barriers to LS execution than do respondents from companies that do not use LS contracting strategies.

1.2.3 Organization Engages in Cost Reimbursable Payment Structures (Q5.2)

The hypothesized relationship between Q5.2 (Organization Engages in Cost Reimbursable Payment Structures) and the ranking of Barriers to Lump Sum Locally (Q14- Q19) was:

Hypothesis 53-58: Ranking of barriers to lump sum locally will be highly correlated with whether an organization engages in cost reimbursable payment structures.

Companies that engage in cost reimbursable payment structures may have a different perception of importance placed on certain barriers than companies that are not familiar with cost reimbursable.

Using an independent samples T-Test, a statistically significant difference was between Q5.2 and Q14, Q15, and Q16. A 'Yes' answer to Q5.2 is equivalent to company uses cost reimbursable and 'No' is equivalent to company does not use cost reimbursable. Equal variance was not assumed for Q14 and Q15, as the Levene test showed a significance level less than 0.05, denoting that the populations from which the two groups are samples have unequal variances.

- Q5.2 * Q14 has a medium correlation (t(55.62)= -2.34, P=0.023); ('Yes' M=2.51; 'No' M=3.15)
- Q5.2 * Q15 has a medium correlation (t(39.10)= 2.20, P=0.034); ('Yes' M=4.98; 'No' M=4.19)
- Q5.2 * Q16 was highly correlated (t(103)= -3.43, P=0.001); ('Yes' M=3.19; 'No' M=4.15)

The results indicate that respondents whose companies employ cost reimbursable payment structures believe that field labour market factors and cost reimbursable construction culture are larger risks to LS than do respondents from companies that do not use cost reimbursable. Companies that use cost reimbursable feel that stability of weather is a lower risk to LS than companies that do not use cost reimbursable.

1.2.4 Organization Engages in Unit Rate Payment Structures (Q5.3)

The hypothesized relationship between Q5.3 (Organization Engages in Unit Rate Payment Structures) and the ranking of Barriers to Lump Sum Locally (Q14- Q19) was:

Hypothesis 59-64: Ranking of barriers to lump sum locally will be highly correlated with whether an organization engages in unit rate payment structures.

This study wanted to determine if engaging in unit rate payment structures influenced the perceived importance of barriers to LS. Using an independent samples T-Test, a statistically significant difference was between Q5.3 and Q15 and Q17. A 'Yes' answer to Q5.3 is equivalent to company uses unit rate and 'No' is equivalent to company does not use unit rate.

- Q5.3 * Q15 was highly correlated (t(103)= 3.05, P=0.003); ('Yes' M=3.78; 'No' M=3.02)
- Q5.3 * Q17 has a medium correlation (t(108)= -2.30, P=0.023); ('Yes' M=2.52; 'No' M=3.08)

The results indicate that respondents whose companies use unit rate payment structures are less concerned about the local cost reimbursable construction culture and more concerned about client late changes than are respondents from companies that do not use unit rate.

1.2.5 Company use of Lump Sum on Past Projects: International (Q10)

The hypothesized relationship between Q10 (Company use of Lump Sum on Past Projects: International) and the ranking of Barriers to Lump Sum Locally (Q14- Q19) was:

Hypothesis 77-82: Ranking of barriers to lump sum locally will be highly correlated with whether company has used lump sum on past projects, internationally.

From the surveys and pre-interviews, it appears that larger LS projects are executed internationally than are executed locally. Participants whose companies have executed LS projects internationally may have a different view of what barriers affect LS projects compared with participants whose companies have not executed projects internationally.

Using an independent samples T-Test, a statistically significant difference was between Q10 and Q14, Q15, and Q16. A 'Yes' answer to Q10 is equivalent to company has used LS internationally and 'No' is equivalent to company has not executed LS internationally. Equal variance was not assumed for Q14 and Q15, as the Levene test showed a significance level less than 0.05, denoting that the populations from which the two groups are samples have unequal variances.

- Q10 * Q14 has a medium correlation (t(99.68)= -2.472, P=0.015); ('Yes' M=2.41; 'No' M=3.07)
- Q10 * Q15 was highly correlated (t(75)= 3.14, P=0.002); ('Yes' M=5.17; 'No' M=4.23)
- Q10* Q16 was highly correlated (t(104)= -2.70, P=0.008); ('Yes' M=3.16; 'No' M=3.83)

The results indicate that participants whose companies had worked internationally were more concerned about labour market constraints and the local cost reimbursable construction culture than respondents from companies that had not used lump sum internationally. Companies with international LS experience were also less concerned about weather stability than companies that had not worked internationally.

1.2.6 Variables with no Correlation

Through an independent samples T-test, no correlations were found for the hypothesis in the table below.

Table 7-2 - Examination of Hypotheses H65 – H70 Company Used Lump Sum on Past Project – Alberta (Q8)

Examination of Hypotheses H65 – H70 Company Used Lump Sum on Past Project – Alberta (Q8)						
Dependant Variable		**Independent Variable**		**T**	**(df)**	**P**
		Y	**N**			
Field Labour* (Q14)	Mean	2.619	2.833	-0.546	30.601	0.589
	S.D.	1.325	1.786			

Examination of Hypotheses H65 – H70 Company Used Lump Sum on Past Project – Alberta (Q8)						
	N	84	24			
Stability of Weather* (Q15)	Mean	4.723	4.810	-0.257	38.590	0.798
	S.D.	1.484	1.289			
	N	84	21			
Cost Reimbursable Construction Culture (Q16)	Mean	3.548	2.955	1.927	104	0.057
	S.D.	1.357	0.950			
	N	84	22			
Module Size* (Q17)	Mean	4.985	4.950	0.118	21.555	0.907
	S.D.	0.595	1.276			
	N	66	20			
Client Late Changes* (Q18)	Mean	2.736	3.000	-1.118	41.034	0.270
	S.D.	1.307	0.858			
	N	91	20			
Lack of Scope Definition (Q19)	Mean	1.835	1.640	0.703	114	0.483
	S.D.	1.293	0.952			
	N	91	25			
* Asterisk denotes equal variance not assumed.						

1.2.7 Type of Organization (Q1)

The hypothesized relationship between Q1 (Type of Organization) and the ranking of Barriers to Lump Sum Locally (Q14- Q19) was:

Hypothesis 29-34: Ranking of barriers to lump sum locally will be highly correlated with the type of organization a respondent belongs to.

Given that each party, operators, engineers, and constructors, typically has different roles within a project, each party might be expected to be concerned with different risks within LS execution. Using a one independent variable, between subjects One-Way ANOVA analysis, a statistically significant difference was found between Q1 and Q14, Q16, and Q18.

- Q1 * Q14 has a medium correlation ($F(2, 105)= 3.86$, $P=0.024$); ('Operator' M=2.55; 'Engineer' M=2.26; 'Constructor' M=3.12)
- Q1 * Q16 is highly correlated ($F(2, 103)= 12.83$, $P<0.001$); ('Operator' M=2.85; 'Engineer' M=3.05; 'Constructor' M=4.15)

- Q1 * Q18 is highly correlated (F(2, 108)= 7.11, P=0.001); ('Operator' M=2.81; 'Engineer' M=3.29; 'Constructor' M=2.29)

A post hoc test, Tukey's Test, was performed to determine where the significant differences were between the Operator, Engineer, and Constructor groups. For Q14, the major difference in opinion lay between the Engineers and Constructors, with the mean difference between the two groups being -0.859 and the significance is 0.02. Engineers viewed field labour constraints as a larger issue for LS than did the Constructors group. Constructors may feel they have more control over the field labour than Engineers do.

For Q16, significant differences were found between Constructors and both Engineers and Operators. The mean difference between Constructors and Operators was 1.29 and the significance was <0.001. The mean difference between Constructors and Engineers was 1.09 and the significance was <0.001. Engineers and Operators viewed the local cost reimbursable construction culture as a much larger issue for LS than did Constructors.

For Q18, a significant difference was found between Constructors and Engineers, with the mean difference at -1.0 and the significance at 0.001. Constructors saw client late changes as a much larger issue for LS than did the Engineers.

1.2.8 Role in Organization (Q2)

The hypothesized relationship between Q2 (Role in Organization) and the ranking of Barriers to Lump Sum Locally (Q14- Q19) was:

Hypothesis 35-40: Ranking of barriers to lump sum locally will be highly correlated with the participant's role in their organization.

This study wished to determine if organizational role had an impact on perception of barrier importance. Using a one independent variable, between subjects One-Way ANOVA analysis, a statistical significance was found between Q2 and Q14, Q15, Q16, Q18, and Q19.

- Q2 * Q14 is highly correlated (F(3, 104)= 12.05, P<0.001); ('Executive' M=1.83; 'Senior Manager' M=2.28; 'Project Manager' M=3.68; 'Other' M=2.82)
- Q2 * Q15 is highly correlated (F(3, 82)= 16.11, P<0.001); ('Executive' M=5.54; 'Senior Manager' M=3.29; 'Project Manager' M=5.38; 'Other' M=4.32)
- Q2 * Q16 is highly correlated (F(3, 102)= 9.36, P<0.001); ('Executive' M=3.57; 'Senior Manager' M=3.54; 'Project Manager' M=2.54; 'Other' M=4.30)
- Q2 * Q18 is highly correlated (F(3, 107)= 4.97, P=0.003); ('Executive' M=3.13; 'Senior Manager' M=3.13; 'Project Manager' M=2.60; 'Other' M=2.00)
- Q2 * Q19 is highly correlated (F(3, 112)= 3.85, P=0.012); ('Executive' M=1.93; 'Senior Manager' M=2.13; 'Project Manager' M=1.21; 'Other' M=2.00)

A post hoc test, Tukey's Test, was performed to determine where the significant differences were between the groups. For this analysis, the 'Other' group was ignored due to lack of ability to tell seniority of position from the category. For Q14, the major difference in opinion lay between the Project Managers and the Executives and the Senior Managers. The mean difference between the Project Managers and Executives is 1.84 and the significance is <0.001. The mean difference between Project Managers and Senior Managers is 1.40 and the significance is <0.001. Executives and Senior Managers viewed labour market constraints as a much larger issue for LS than did the Project Managers.

For Q15, significant differences were found between Senior Managers and both Executives and Project Managers. The mean difference between Senior Managers and Executives was -2.24 and the significance was <0.001. The mean difference between Senior Managers and Project Managers was -2.09 and the significance was <0.001. Senior Managers viewed weather stability as a much bigger concern for LS than did both the Executives and the Project Managers, who believed weather stability had very little importance.

For Q16, a significant difference was found between Project Managers and both Executives and Senior Managers. The mean difference between the Project Managers and Executives was -1.03 and the significance was 0.006. The mean difference between the Project Managers and Senior Managers was -1.00 and the significance was 0.01. Project Managers found the local cost

reimbursable construction culture to be a larger issue for LS than did either the Executives or the Senior Managers.

For Q18, a significant difference was found between 'Other' and both Executives and Senior Managers. This result was not analyzed as nothing could be concluded about the group.

For Q19, a significant difference was found between Project Managers and Senior Managers with the mean difference at -0.92 and the significance at 0.013. Project Managers viewed lack of scope definition as a larger issue for LS than did Senior Managers, although Senior Managers still saw it as a significant issue.

1.2.9 Maximum Lump Sum Project Dollar Value: Alberta (Q9)

The hypothesized relationship between Q9 (Maximum Lump Sum Project Dollar Value: Alberta) and the ranking of Barriers to Lump Sum Locally (Q14- Q19) was:

Hypothesis 71-76: Ranking of barriers to lump sum locally will be highly correlated with the value of a company's largest local lump sum project.

This study wished to determine if dollar value of largest local LS project had an impact on perception of barrier importance. Using a one independent variable, between subjects One-Way ANOVA analysis, a statistical significance was found between Q9 and Q14, Q15, Q16, Q17, and Q18.

- Q9 * Q14 has a medium correlation ($F(2,74)= 3.67$, $P=0.03$); ('<$5MM' M=2.68; '<$100MM' M=2.14; '<$1B' M=3.08)
- Q9 * Q15 is highly correlated ($F(2,58)= 17.88$, $P<0.001$); ('<$5MM' M=3.65; '<$100MM' M=4.15; '<$1B' M=5.75)
- Q9 * Q16 is highly correlated ($F(2,75)= 15.96$, $P<0.001$); ('<$5MM' M=4.63; '<$100MM' M=3.95; '<$1B' M=2.87)
- Q9 * Q17 is highly correlated ($F(2,59)= 16.83$, $P<0.001$); ('<$5MM' M=4.88; '<$100MM' M=5.50; '<$1B' M=4.65)

- Q9 * Q18 is highly correlated (F(2,81)= 7.48, P=0.001); (‘<$5MM’ M=2.86; ‘<$100MM’ M=3.47; ‘<$1B’ M=2.21)

A post hoc test, Tukey’s Test, was performed to determine where the significant differences were between the groups. For Q14, the major difference in opinion lay between the ‘<$1B’ and ‘<$100MM’ groups. The mean difference between the ‘<$1B’ and ‘<$100MM’ is 0.94 and the significance is 0.023. Respondents whose company’s largest LS project was between $5MM and $100MM viewed field labour market constraints as a larger issue for LS than did respondents from companies that had performed larger LS projects.

For Q15, the major difference was between ‘<$1B’ and the other groups. The mean difference between ‘<$1B’ and ‘<$5MM’ is 2.10 and the significance is <0.001. The mean difference between ‘<$1B’ and ‘<$100MM’ is 1.60 and the significance is <0.001. Respondents whose companies had performed projects larger than $100MM viewed weather stability as a lower or lesser issue for LS than did respondents whose companies had not performed projects larger than $100MM.

For Q16, the major difference was again between ‘<$1B’ and the other groups. The mean difference between ‘<$1B’ and ‘<$5MM’ is -1.76 and the significance is <0.001. The mean difference between ‘<$1B’ and ‘<$100MM’ is -1.08 and the significance is 0.003. Respondents whose companies had performed projects larger than $100MM viewed the local cost reimbursable construction culture as a larger issue for LS than did respondents whose companies had not performed projects larger than $100MM.

For Q17, the major difference was again between ‘<$100MM’ and the other groups. The mean difference between ‘<$100MM‘ and ‘<$1B’ is 0.85 and the significance is <0.001. The mean difference between ‘<$100MM‘ and ‘<$5MM’ is 0.63 and the significance is 0.001. Companies with ‘<$100MM’ projects viewed module size transportation constraints as a smaller issue for LS than did the other groups.

For Q18, the major difference was between ‘<$100MM’ and ‘<$1B’ with the mean difference at 1.26 and the significance at 0.001. Respondents whose companies had performed the largest

dollar value projects considered client late changes to be a larger issue for LS than did respondents whose companies had performed smaller projects with LS.

1.2.10 Maximum Lump Sum Project Dollar Value: International (Q11)

The hypothesized relationship between Q11 (Maximum Lump Sum Project Dollar Value: International) and the ranking of Barriers to Lump Sum Locally (Q14- Q19) was:

Hypothesis 83-88: Ranking of barriers to lump sum locally will be highly correlated with the value of a company's largest international lump sum project.

This study wished to determine if dollar value of largest international LS project had an impact on perception of barrier importance. Using a one independent variable, between subjects One-Way ANOVA analysis, a statistical significance was found between Q11 and Q15, Q16, Q17, and Q18.

- Q11 * Q15 are highly correlated (F(3, 29)= 24.60, P<0.001); ('<$5MM' M=3.00; '<$100MM' M=5.44; '<$1B' M=6.00; '>$1B' M =4.50)
- Q11 * Q16 are highly correlated (F(3, 41)= 6.54, P=0.001); ('<$5MM' M=4.57; '<$100MM' M=3.56; '<$1B' M=2.71; '>$1B' M =2.00)
- Q11 * Q17 are highly correlated (F(3, 31)= 6.17, P<=.002); ('<$5MM' M=4.71; '<$100MM' M=5.56; '<$1B' M=4.75; '>$1B' M =5.00)
- Q11 * Q18 are highly correlated (F(3, 44)= 4.04, P=0.013); ('<$5MM' M=3.33; '<$100MM' M=2.50; '<$1B' M=2.47; '>$1B' M =3.67)

A post hoc test, Tukey's Test, was performed to determine where the significant differences were between the groups. For Q15, a major difference in opinion lay between the '<$5MM'and both the '<$1B' and '<$100MM' groups. The mean difference between the'<$5MM' and the '<$100MM' is -2.44 and the significance is <0.001. The mean difference between the '<$5MM' and the '<$1B' was -3.00 and the significance was <0.001. Respondents whose largest project was less than $5MM saw stability of weather as a larger issue for LS than did respondents whose companies had performed larger projects.

For Q16, the major differences were between '<$5MM' and both '<$1B' and '>$1B', and '<$100MM' and '>$1B'. The mean difference between '<$5MM' and '<$1B' was 1.86 and the significance was 0.008. The mean difference between '<$5MM' and '>$1B' was 2.57 and the significance was 0.002. The mean difference between '<$100MM' and '>$1B' was 1.56 and the significance was 0.038. Respondents whose companies had performed projects larger than $100MM viewed the local cost reimbursable construction culture as a larger issue for LS than did respondents whose companies performed smaller projects.

For Q17, the major difference was again between '<$100MM' and '<$5MM' and '<$1B'. The mean difference between '<$100MM' and '<$5MM' was 0.84 and the significance is 0.009. The mean difference between '<$100MM' and '<$1B' was 0.81 and the significance is 0.008. Respondents from the '<$100MM' group viewed module size transportation constraints as less significant than did respondents from the '<$5MM' and '<$1B' groups, although they did not rank it as very significant, either.

For Q18, the major difference was between '>$1B' and both '<$100MM' and '<$1B'. The mean difference between '>$1B' and '<$100MM' was 1.17 and the significance was 0.49. The mean difference between '>$1B' and '<$1B' was 1.20 and the significance was 0.48. Respondents whose company projects fell within the intermediate ranges of project value viewed client late changes as a more significant issue for LS than did respondents whose companies executed large projects.

1.3 Predicting interest in Lump Sum Contracting: Regressions Analysis

The following regressions, interest in lump sum and financial ranges of interest, were chosen for the following reasons:

- Operators are driving the lump sum market in Alberta
- A predicting model of interest in lump sum contracts may help Operators evaluate contractor companies and whether it is justified to extend a Request for Proposal
- A predicting model for financial ranges of interest for lump sum projects may help Operators evaluate what value of project for which a contractor is most willing and suited.

1.3.1 Multiple Logistic Regression – Company Interest in Lump Sum (Q12)

A logistic regression was performed to predict the outcome of Q12 (company interest in LS), a dichotomous dependent variable, using multiple categorical predictor variables with which Q12 was found to be highly correlated, specifically:

- Q1: Organizational Type
- Q3: Years' Working Experience
- Q4: Company Operates Internationally

In analyzing the null hypothesis, there was found to be a 74.2% ability to predict a respondent company's interest in LS, without using any predictor variables. The Omnibus Tests of Model Coefficients, having included all the predictor variables, compares the model against the null hypothesis. The significance levels of this comparison are all <0.001, meaning the model will be a good predictor of Q12. The next result examined was the Nagelkerke R Square which explains how much of the variance in the outcome of Q12 is explained by the predictor variables. In this case, 59.4% of the variance in the outcome is predicted by the independent variables.

The Hosmer and Lemeshow Test was also reviewed for goodness of fit of the model, showing a significance of 0.64. Since this result is higher than 0.05 it shows it to be a good model. From the Contingency Table for the Hosmer and Lemeshow Test, out of 11 subjects observed to be interested in LS, the model predicted 10.7. Finally, examining the Classification Table, the model was able to successfully predict 85% of the actual outcomes, approximately 10% better than without the model. The model in shown in Appendix 5.

To confirm that none of the independent variables displayed multicollinearity, Pearson Chi Squared correlations were run. Q1 and Q4 were found to be highly correlated (χ^2 =18.97, *df*=2, P<0.001). The logistic regression was re-run for Q1 and Q3 as the predictor variables and Q4 and Q3 as the predictor variables. The model including Q1 and Q3 was found to most successfully predict the actual outcomes, predicting 82.6% of the actual outcomes, compared with 80% success rate using Q4 and Q3. The final model is shown in Appendix 5. From the model, Q1 was found to be the most significant factor in predicting whether a company was interested in LS. Q3 showed significantly less influence over the outcome. Operators were the

reference category of Q1. From the model, the likelihood of being open to LS decreases from Operators to Constructors to Engineers.

1.3.2 Ordinal Regression – Financial Ranges a Company is Willing to Lump Sum (Q24)

An ordinal regression was performed to predict the outcome of Q24 (financial ranges a company is willing to lump sum). The response variable, Q24 was treated as ordinal because the levels of Q24 have a natural low to high ordering, but the difference between values is arbitrary. The model uses multiple categorical predictor variables, with which Q24 was found to be highly correlated, specifically:

- Q2: Role in Organization
- Q3: Years' Working Experience
- Q5.1: Company uses LS Payment Structures
- Q5.2: Company uses Cost Reimbursable Payment Structures
- Q10: Company has used LS Internationally

Q2 and Q3 are categorical variables with Q5.1, Q5.2 and Q10 being dichotomous. Originally, Q9 (maximum dollar value of local LS projects) and Q11 (maximum dollar value of international LS projects) were to be included in the model, given that they were highly correlated with the responses variable Q24. However, very few respondents answered these questions due to confidentiality, leaving only 34 valid cases in the ordinal logistic regression. The model would be over-fitted, causing a very misleading result.

The Model fitting information, a comparison of the 'Intercept Only' model against the model including the predictor variables, showed that the final model significantly improved the fit to the data. The chi-square significance of $P<0.001$ indicates that the model gives better predictions for the outcome categories. The Goodness of Fit table compares whether the observed data are consistent with the fitted model. The null hypothesis is that the model is good and if the chi square significance is greater than $P=0.05$, then the null hypothesis is not rejected and the fit is good. The analysis of the Q24 model shows a significance of <0.001. Unfortunately, this indicates that the model does not fit very well. Chi-square is sensitive to

missing cells, and in this model there are 17 missing cells to 105 valid entries. Looking at the pseudo R-square is a better indicatory of goodness of fit. The Pseudo R-square Negelkerke statistic indicates whether the model is a good predictor of the outcome. The lower the R-square, the worse the model is. In this model the Negelkerke statistic is 0.413, indicating that the model can explain 41.3% of the variation between outcomes.

The Parameter Estimate Table shows the model, the relationship between the predictor variables and the outcome of Q24. What can be seen from the model is that only use of LS (Q5.1), use of cost reimbursable (Q5.2), past use of LS internationally (Q10) and years' experience 16-20 years (Q3) are statistically significant predictors of Q24. Respondents whose companies use LS (Q5.1) are more likely to select higher levels of Q24. As well, respondents whose companies use cost reimbursable are more likely to choose higher levels of Q24. Respondents whose companies have performed LS internationally (Q10) are less likely to be willing to LS larger projects.

The Test of Parallel lines examines the proportional odds assumption. The null hypothesis assumes the slope of the coefficients in the model is the same across response categories. Failing to reject the null hypothesis ($P>0.05$) concludes that the assumption holds. For this model, $P=0.059$ so the assumption holds. The model for the ordinal regression is shown in Appendix 5.

2 Secondary Survey Data Analysis

2.1 Alberta Industry Willingness to use Lump Sum Contracting

This section uses Chi Square to find significant correlations between the survey questions about Alberta industry's willingness to use lump sum contracting and the demographic- and company-specific factors that may influence respondents' opinions. Fisher Exact Test should have been used for several of the analyses discussed below; however, the computer used for the analyses had insufficient memory to complete the simulation, therefore Chi Squared is used as an approximation.

2.1.1 Payment Structure Used Most Frequently: by Scope (Major Projects, Equipment, Buildings, Tankage) (Q4-Q7)

- *Payment Structure Used Most Frequently: (Major Projects, Equipment, Buildings, Tankage)Versus Organizational Type (Q4-Q7 * Q3)*

The hypothesized relationship between Q4 - Q7 (Payment Structure Used Most Frequently by Scope) and Q3 (Organizational Type) was:

Hypothesis 3-12: A correlation will exist between payment structure used most frequently for scopes of work (major projects, equipment, buildings, tankage) and Organizational Type.

Operators, Engineers, and Constructors represent different sectors of the oil and gas industry with different business drivers. They may be expected to prefer different payment structure types for similar scopes of work.

From the correlations shown in Tables 8-1 to 8-4, the following correlations of interest were found to exist.

- Q4 *Q3
- Q7 * Q3

Q4 and Q3 were found to be highly correlated (χ^2 =14.54, *df*=6, P=0.006). Based on the results, all organizational types were more likely to use cost reimbursable than the other contract types listed, with Operators the most likely (76.9%) and Constructors the least likely (48.6%). More

Engineers (37.1%) and Constructors (32.4%), were using LS for major projects than Operators (10.3%), by approximately 20%. No Engineers were using unit rate for major projects.

Q7 and Q3 were found to have a medium correlation (χ^2 =13.34, *df*=4, P=0.010). Based on the results, all organizational types were more likely to use LS for tankage than the other contract types listed, Operators (83.3%), Engineers (45.5%) and Constructors (61.1%). A major difference was that no Operators purchased tankage on a cost reimbursable basis while both Engineers (36.4%) and Constructors (27.8%) purchased tankage using cost reimbursable .

Q5 (Equipment) and Q6 (Buildings) were found to have no significant difference in the contract type used between the different Organizational Types.

2.1.2 Payment Structure Used Most Frequently: Internationally (Q8)

- *Payment Structure Used Most Frequently: Internationally versus Organizational Type (Q8 * Q3)*

No statistically significant correlations.

2.1.3 Payment Structure Used Most Frequently: Locally (Q9)

- *Payment Structure Used Most Frequently: International versus Payment Structure Used Most Frequently: Locally (Q8 * Q9)*

The hypothesized relationship between Q8 (Payment Structure Used Most Frequently: International) and Q9 (Payment Structure Used Most Frequently: Locally) was:

Hypothesis 19: A correlation will exist between payment structure used most frequently locally and internationally.

It was speculated that companies that had used LS internationally would be more likely to use LS locally. Q8 and Q9 were found to be highly correlated (χ^2 =21.80, *df*=4, P<0.001). The results were different than hypothesized, with companies that used LS internationally, used cost reimbursable locally (80.6%). All of the companies that used cost reimbursable internationally, used cost reimbursable locally and the companies that used unit rate internationally used unit rate locally. This may indicate that it is the local market, rather than experience with LS execution, that is dictating the use of cost reimbursable.

2.1.4 Payment Structure Used Most Frequently (Q10)

- *Payment Structure Used Most Frequently versus Organizational Type (Q10 * Q3)*

The hypothesized relationship between Q10 (Payment Structure Used Most Frequently) and Q3 (Organizational Type) was:

Hypothesis 22: A correlation will exist between payment structure used most frequently and Organizational Type.

Operators, engineers, and constructors represent different sectors of the oil and gas industry with different business drivers. They may be expected to prefer different payment structure types.

Q10 and Q3 were found to have a medium correlation (χ^2 =10.93, *df*=4, P=0.027). Operators (69.2%) and Engineers (62.2%) used cost reimbursable most frequently, while Constructors used LS (43.9%) slightly more frequently than cost reimbursable (41.5%). Unlike Operators and Constructors, Engineers did not use unit rate frequently.

2.1.5 Dollar Value of Largest Lump Sum Project Performed in Alberta (Q11)

- *Dollar Value of Largest Lump Sum Project Performed in Alberta versus Organizational Type (Q11 * Q3)*

The hypothesized relationship between Q11 (Dollar Value of Largest Lump Sum Project Performed in Alberta) and Q3 (Organizational Type) was:

Hypothesis 26: A correlation will exist between dollar value of largest lump sum project performed in Alberta and Organizational Type.

This study was interested in understanding what differences would exist between organizational types and the dollar value of projects performed with LS structures, in Alberta. A difference was anticipated between Constructors and Operators/Engineers. It was speculated

that Constructors may be more likely to have performed larger projects on a LS basis because government contracts on large civil projects are required to be LS.

Q11 and Q3 were found to be highly correlated (χ^2 =15.80, *df*=4, P=0.003). As speculated, Constructors (22.0%) were found to have performed the largest dollar value LS projects, followed by Operators (8%). Engineers from that sample had not performed LS projects greater than $500MM. However, the majority of all groups had performed LS projects of less than $100MM. This data shows that the majority of large projects in Alberta are not being performed on a LS basis.

2.1.6 Interested in Lump Sum if Risk Sharing with another Organization (Q12)

- *Interested in Lump Sum if Risk Sharing with another Organization versus Payment Structure Used Most Frequently: Major Projects (Q12 * Q4)*

The hypothesized relationship between Q12 (Interested in Lump Sum if Risk Sharing with another Organization) and Q4 (Payment Structure Used Most Frequently: Major Projects) was:

Hypothesis 30: Interest in lump sum with risk sharing will be highly correlated with a company's payment structure strategy for major projects.

Companies where the major project payment strategy is LS might be more likely to be interested in LS with risk sharing than companies that use other payment structures for major projects, because these companies would have more experience with LS and a greater understanding of what risks it might be beneficial to share. Companies that most often perform major projects using cost reimbursable might be the least likely to be interested in risk sharing. Risk sharing with LS might still require a contractor to take on more risk than when using a cost reimbursable payment structure.

Q12 and Q4 were found to have a medium correlation (χ^2 =8.68, *df*=2, P=0.013). As hypothesized, companies that have used LS for major projects were the most interested in risk sharing (100%) and companies that used cost reimbursable for major projects were the least interested in risk sharing (75.4%). All groups had more participants that were interested in LS with risk sharing than participants that were not interested.

- *Interested in Lump Sum if Risk Sharing with another Organization versus Payment Structure Used Most Frequently (Q12 * Q10)*

The hypothesized relationship between Q12 (Interested in Lump Sum if Risk Sharing with another Organization) and Q10 (Payment Structure Used Most Frequently) was:

Hypothesis 36: Interest in lump sum with risk sharing will be highly correlated with a company's most frequently used payment structure strategy.

Companies where the most frequently used payment structure is LS might be more likely to be interested in LS with risk sharing than companies that use other payment structures most frequently because such companies would have more experience with LS and a greater understanding of what risks it might be beneficial to share. Companies that most often use cost reimbursable might be the least likely to be interested in risk sharing. Risk sharing with LS might still require a contractor to take on more risk than when using a cost reimbursable structure.

Q12 and Q10 were found to have a medium correlation (χ^2 =6.13, *df*=2, P=0.047). As hypothesized, companies that use LS most frequently were most interested in risk sharing (95.1%). Companies that used cost reimbursable (77.3%) most frequently and unit rate (77.8%) most frequently were relatively equal in expressing an interest in LS with risk sharing. All groups had more participants interested in LS with risk sharing than participants that were not interested in LS with risk sharing .

2.1.7 Effect of Risk Premiums in Lump Sum on Project Cost Compared to Cost Reimbursable (Q13)

- *Effect of Risk Premiums in Lump Sum on Project Cost Compared to Cost Reimbursable versus Years of Experience (Q13 * Q1)*

The hypothesized relationship between Q13 (Effect of Risk Premiums in Lump Sum on Project Cost Compared to Cost Reimbursable) and Q1 (Years of Experience) was:

Hypothesis 38: Perception of effect of Risk Premiums in Lump Sum on Project Cost Compared to Cost Reimbursable will be correlated with a respondents years' working experience.

This study was interested in investigating if there was a correlation between years' working experience and perception of the risk premium impact on project cost. Q13 and Q1 were found to be highly correlated (χ^2 =14.48, *df*=4, P=0.006). Below 10 years' working experience, most participants (76.5%) felt that risk premiums would not result in higher project cost compared to using cost reimbursable for the same project. Between 10-15 years' experience, the opinion was reversed with 85.7% believing risk premiums would result in higher project costs. Above 16 years' working experience, the opinions were not as well defined; 16-20 years' experience and greater than 25 years' experience were split approximately in half between 'Yes' and 'No'; while participants with 21-25 years' experience (66.7%) were slightly leaning toward 'No' – that risk premiums would not result in higher project cost compared to using cost reimbursable for the same project. It appears that as industry experience increased, certainty on payment structure project cost outcome decreased.

- *Effect of Risk Premiums in Lump Sum on Project Cost Compared to Cost Reimbursable versus Role in Organization (Q13 * Q2)*

The hypothesized relationship between Q13 (Effect of Risk Premiums in Lump Sum on Project Cost Compared to Cost Reimbursable) and Q2 (Role in Organization) was:

Hypothesis 39: Perception of effect of Risk Premiums in Lump Sum on Project Cost Compared to Cost Reimbursable will be correlated with a respondent's role in their organization.

This study was interested in investigating if there was a relationship between role in organization and perception of the risk premium impact on project cost. Q13 and Q2 were found to be highly correlated (χ^2 =13.07, *df*=3, P=0.004).The group 'Other' was ignored for this question as it was not possible to tell seniority of role. For the remaining groups, as seniority of role increased, so did the perception that risk premiums increased LS project cost compared with using cost reimbursable for the same project: Project Managers (19.2%), Senior Managers (48.4%), and Executive (56.5%).

- *Effect of Risk Premiums in Lump Sum on Project Cost Compared to Cost Reimbursable versus Organizational Type (Q13 * Q3)*

The hypothesized relationship between Q13 (Effect of Risk Premiums in Lump Sum on Project Cost Compared to Cost Reimbursable) and Q3 (Organizational Type) was:

Hypothesis 40: Perception of effect of Risk Premiums in Lump Sum on Project Cost Compared to Cost Reimbursable will be correlated with a respondent's organizational type.

This study was interested in understanding what differences would exist between organizational types and the perception of risk premium effect on project cost compared to using cost reimbursable for the same project. It was anticipated that Engineers would view the effect of LS risk premium most negatively, given that in the previous survey Engineers were the most likely to believe that LS in the current oil and gas environment would increase project cost. Operators were shown to be the most interested in LS in the previous survey, therefore may view the effect of risk premium more positively.

Q13 and Q3 were found to be highly correlated (χ^2 =12.75, *df*=2, P=0.002). As expected, Operators were shown to view the effect of risk premium the most positively of all participant groups with 71.4% believing LS risk premiums would not drive project cost higher than cost reimbursable, in the Alberta environment. Engineers also viewed risk premiums slightly more positively, with 57.6% believing LS risk premiums would not result in higher costs. Surprisingly, Constructors viewed risk premiums the most negatively with 69.2% believing project costs would be higher under LS versus cost reimbursable because of the risk premiums in LS. This opinion is understandable because most of the risks to LS (labour availability and productivity, lack of LS execution experience, etc.) manifest during the construction phase.

2.1.8 Lump Sum Payment Structure Effect on Project Behaviours (Q14)

- *Lump Sum Effect on Project Behaviours versus Organizational Type (Q14 * Q3)*

The hypothesized relationship between Q14 (Lump Sum Effect on Project Behaviours) and Q3 (Organizational Type) was:

Hypothesis 51: Perception of the effect of using lump sum on project behaviours will be correlated with a respondent's organizational type.

It might be anticipated that perception of the effect of LS on project behaviours would vary by organizational type, as the analyses results indicate in Table 8-11, above. Operators may be more likely to believe LS will cause a shift to healthier or improved project behaviours as Operators are the group most interested in LS.

Q14 and Q3 were found to be highly correlated (χ^2 =11.57, *df*=2, P=0.003). Operators were significantly more positive about LS and project behaviours with 86.1% believing lump sum would correct or improve current project behaviours. Engineers and Constructors were much more conservative and split on their opinions. 50% of Engineers believe current project behaviours would change for the better under LS, while the other 50% of Engineers believe current project behaviours would increase problems when changing to a lump sum payment strategy. Constructors were similarly split, but having a slightly more positive perception; 54.8% believed current project behaviours would change for the better under lump sum.

- *Lump Sum Effect on Project Behaviours versus Payment Structure Used Most Frequently: Major Projects (Q14 * Q4)*

The hypothesized relationship between Q14 (Lump Sum Effect on Project Behaviours) and Q4 (Payment Structure Used Most Frequently: Major Projects) was:

Hypothesis 52: Perception of the effect of using lump sum on project behaviours will be correlated with the payment structure most frequently used for major projects.

This study wanted to determine if there was a difference in perception of effect of LS on project behaviours between respondents whose companies use different payment structures on major projects. It was speculated that frequent users of LS on major projects would have the most positive perception of the effect of LS on project behaviours. It was speculated that frequent users of cost reimbursable on major projects would believe that the current project behaviours would be perpetuated under LS, thereby causing problems in a LS environment.

Q14 and Q4 were found to have a medium correlation (χ^2 =7.08, *df*=2, P=0.029). The results were slightly different than expected. Both groups, companies that most frequently use LS for major projects and companies that most frequently use cost reimbursable for major projects, were more likely to believe that LS use will change current project behaviours, 66.7% and 68.8%, respectively. Unexpectedly, the companies that primarily use Unit Rate for major projects were more likely to believe that current project behaviours will negatively impact LS execution (72.7%).

- *Lump Sum Effect on Project Behaviours versus Payment Structure Used Most Frequently: Locally (Q14 * Q9)*

The hypothesized relationship between Q14 (Lump Sum Effect on Project Behaviours) and Q9 (Payment Structure Used Most Frequently: Locally) was:

Hypothesis 57: Perception of the effect of using lump sum on project behaviours will be correlated with the payment structure most frequently used in Alberta oil and gas.

This study wanted to determine if there was a difference in perception of effect on project behaviours between respondents whose companies primarily used different payment structures, locally. It was speculated that frequent users of LS, locally would have the most positive perception of project behaviours under LS. It was speculated that frequent users of cost reimbursable, locally would believe that the current project behaviours would be perpetuated, thereby causing problems in a LS environment.

Q14 and Q9 were found to have a medium correlation (χ^2 =6.41, *df*=2, P=0.041). The results were as expected with frequent users of LS, locally (85.7%) being more likely to believe that LS will change project behaviours. Frequent users of cost reimbursable, locally were the least likely of the three groups of payment structure types (LS, cost reimbursable, and unit rate) to believe that behaviours will change, with 54.0% of cost reimbursable users selecting project behaviours will change under LS compared with 62.5% of unit rate users.

2.1.9 Top Labour Market Risk to Lump Sum Execution (Q22)

- *Top Labour Market Risk to Lump Sum Execution versus Years Working Experience (Q22 * Q1)*

The hypothesized relationship between Q22 (Top Labour Market Risk to Lump Sum Execution) and Q1 (Years Working Experience) was:

Hypothesis 60: Perceived top labour market risk to lump sum execution will be highly correlated with a respondent's years' working experience.

Respondents with more years' working experience would likely have a larger body of knowledge to draw from in answering this question. They might be expected to be more aligned and accurate in their responses.

Q22 and Q1 were found to be highly correlated (χ^2 =33.60, *df*=8, P<0.001). With the exception of the 21-25 years' experience group, all groups selected labour availability and labour productivity as being the most important risks to LS execution. The 21-25 years' experience group selected labour availability and labour cost as the most important risks to LS execution. Unexpectedly, alignment within a group did not increase with years' experience. Above 16 years' experience, there was no dramatic percentage difference between the top two selected labour risks. For example in the greater than 25 years' experience group, labour productivity (43.2%) and labour availability (45.9%) were separated by only 2.7 percentage points. This may indicate that as years' working experience increases, the top two labour risks to LS execution are equally concerning.

- *Top Labour Market Risk to Lump Sum Execution versus Organizational Type (Q22 * Q3)*

The hypothesized relationship between Q22 (Top Labour Market Risk to Lump Sum Execution) and Q3 (Organizational Type) was:

Hypothesis 62: Perceived top labour market risk to lump sum execution will be highly correlated with organizational type.

Different organizational types may be concerned with risks in different aspects of the labour market. Engineers might be concerned about productivity and cost because their core business is based on a comparatively small labour force (compared to the labour requirements of construction companies), therefore the productivity and cost of that labour force would directly affect their profit margins. Availability of resources may affect Engineers less than the other

two labour factors. Construction companies might be concerned about productivity and availability because their core business requires a large labour force, therefore productivity and availability would directly affect their ability to execute the contract work. Cost of that labour force might be a secondary concern. The top labour market concerns of Operators were not speculated on.

Q22 and Q3 were found to be highly correlated (χ^2 =26.05, *df*=4, P<0.001). Engineers were found to be equally concerned with labour productivity and labour cost, with both risks selected by 42.4% of the sample. Constructors were found to be most concerned about availability of resources (58.5%), followed by labour productivity (31.7%). Operators were aligned with Constructors, with 53.8% of Operators selecting labour availability and 41.0% selecting labour productivity.

2.1.10 Reason for Greater Local Client Input (Q25)

- *Reason for Greater Local Client Input versus Years Working Experience (Q25 * Q1)*

The hypothesized relationship between Q25 (Reason for Greater Local Client Input) and Q1 (Years Working Experience) was:

Hypothesis 82: Perceived reason for greater local client input will be highly correlated with a respondent's years' working experience.

Q25 and Q1 were found to be highly correlated (χ^2 =68.65, *df*=16, P<0.001). Respondents with over 25 years' working experience believed the reason for greater local client input to be the difference in mix of expertise at local operators compared to international operators (42.4%), followed closely by the occurrence of local project fast tracking (39.4%). Respondents with 21-25 years' experience believed the reason for greater local client input to be project fast tracking (55.6%).

- *Reason for Greater Local Client Input versus Role in Organization (Q25 * Q2)*

The hypothesized relationship between Q25 (Reason for Greater Local Client Input) and Q2 (Role in Organization) was:

Hypothesis 83: Perceived reason for greater local client input will be highly correlated with a respondent's role in their organization.

Q25 and Q1 were found to be highly correlated (χ^2 =41.40, *df*=12, P<0.001). Executives (66.7%) and Senior Managers (43.3%) were more likely to view project fast tracking as the reason for greater operator or client interference on Alberta projects. Project Managers (43.5%) were more likely to view the local operator's level of expertise as the reason for greater local client input.

- *Reason for Greater Local Client Input versus Payment Structure Used Most Frequently: Major Projects (Q25 * Q4)*

The hypothesized relationship between Q25 (Reason for Greater Local Client Input) and Q4 (Payment structure for major projects) was:

Hypothesis 85: Perceived reason for greater local client input will be highly correlated with the payment structure type used for major projects.

Q25 and Q4 were found to be highly correlated (χ^2 =23.77, *df*=8, P=0.003) Companies that most frequently used LS for major projects (55.6%) and unit rate for major projects (66.7%) considered the issue causing greater local client input to be project fast tracking. Companies that most frequently used cost reimbursable for major projects were more evenly distributed on the issue, but respondents (38.6%) were more likely to believe the issue causing greater local client input is the local operator mix of expertise.

- *Reason for Greater Local Client Input versus Payment Structure Used Most Frequently: Internationally (Q25 * Q8)*

The hypothesized relationship between Q25 (Reason for Greater Local Client Input) and Q8 (Payment structure for international projects) was:

Hypothesis 89: Perceived reason for greater local client input will be highly correlated with the payment structure type used for international projects.

Q25 and Q8 were found to be highly correlated (χ^2 =26.45, *df*=8, P=0.001). Companies that most frequently used LS internationally were more likely to view operator mix of expertise (42.3%) as

the issue behind greater local client input. The other two contract types had very few respondents and thus it is difficult to draw conclusions from the data.

- *Reason for Greater Local Client Input versus Payment Structure Used Most Frequently: Local Projects (Q25 * Q9)*

The hypothesized relationship between Q25 (Reason for Greater Local Client Input) and Q9 (Payment structure for local projects) was:

Hypothesis 90: Perceived reason for greater local client input will be highly correlated with the payment structure type used for local projects.

Q25 and Q9 were found to be highly correlated (χ^2 =22.76, *df*=8, P=0.004). Companies that most frequently used LS (38.9%) or unit rate (71.4%) for local projects were more likely to consider project fast tracking as the main reason for greater local client input. Companies that most frequently used cost reimbursable for local projects believed the main reason for greater local client input is the mix of expertise at client companies (41.7%).

- *Reason for Greater Local Client Input versus Payment Structure Used Most Frequently (Q25 * Q10)*

The hypothesized relationship between Q25 (Reason for Greater Local Client Input) and Q10 (Payment structure used most frequently) was:

Hypothesis 91: Perceived reason for greater local client input will be highly correlated with the payment structure type used most frequently.

Q25 and Q10 were found to be highly correlated (χ^2 =27.40, *df*=8, P=0.001). Companies that most frequently used LS (60.0%) or unit rate (57.1%) for projects were more likely to view project fast tracking as the main reason for greater local client input. Companies that most frequently used cost reimbursable for projects believed the reason for greater local client input is the mix of expertise at client companies (37.7%).

2.1.11 Variables with no Correlation

Through the Chi Square and Fisher Exact tests, no correlations were found for the hypotheses presented in Table 8-14, below.

Table 8-1 - Examination of Hypotheses H71-H81 for Sufficient Companies Capable Of Lump Sum Bidding (Q23)

Independent Variable	Yes N (%)	No N (%)	X2	df	P	Value Reflects Fisher Exact Test
Q1: Years Working Experience						
≤ 10 Years	11 (57.9%)	8 (42.1%)	6.674	4	0.154	
11-15 Years	7 (50.0%)	7 (50.0%)				
16-20 Years	13 (92.9%)	1 (7.1%)				
21-25 Years	19 (65.5%)	10 (34.5%)				
> 25 Years	23 (62.2%)	14 (37.8%)				
Q2: Role in Organization						
Executive + VP	17 (60.7%)	11 (39.3%)	1.269	3	0.736	
Senior Manager	23 (71.9%)	9 (28.1%)				
Project Manager	17 (65.4%)	9 (34.6%)				
Other	16 (59.3%)	11 (40.7%)				
Q3: Type Of Organization						
Operating Company	22 (61.1%)	14 (38.9%)	5.584	2	0.061	
Engineering Company	30 (78.9%)	8 (21.1%)				
Construction Company	21 (53.8%)	18 (46.2%)				
Q4: Payment Structure: Major Projects						
Lump Sum	18 (66.7%)	9 (33.3%)	0.067	2	0.967	
Cost Reimbursable	43 (64.2%)	24 (35.8%)				
Unit Rate	8 (66.7%)	4 (33.3%)				

Independent Variable	Yes N (%)	No N (%)	X2	df	P	Value Reflects Fisher Exact Test
Q5: Payment Structure: Equipment						
Lump Sum	32 (62.7%)	19 (37.3%)	2.436	2	0.296	
Cost Reimbursable	9 (42.9%)	12 (57.1%)				
Unit Rate	7 (53.8%)	6 (46.2%)				
Q6: Payment Structure: Buildings						
Lump Sum	43 (70.5%)	18 (29.5%)	9.286	2	0.010	
Cost Reimbursable	7 (33.3%)	14 (66.7%)				
Unit Rate	3 (50.0%)	3 (50.0%)				
Q7: Payment Structure: Tankage						
Lump Sum	30 (65.2%)	16 (34.8%)	1.558	2	0.459	
Cost Reimbursable	6 (46.2%)	7 (53.8%)				
Unit Rate	5 (62.5%)	3 (37.5%)				
Q8: Payment Structure: Internationally						
Lump Sum	20 (60.6%)	13 (39.4%)	2.215	2	0.330	
Cost Reimbursable	4 (44.4%)	5 (55.6%)				
Unit Rate	2 (100.0%)	0 (0.0%)				
Q9: Payment Structure: Locally						
Lump Sum	18 (72.0%)	7 (28.0%)	3.106	2	0.212	
Cost Reimbursable	34 (63.0%)	20 (37.0%)				
Unit Rate	3 (37.5%)	5 (62.5%)				

Independent Variable	Yes N (%)	No N (%)	X2	df	P	Value Reflects Fisher Exact Test
Q10: Payment Structure Used Most Frequently						
Lump Sum	30 (76.9%)	9 (23.1%)	4.535	2	0.104	
Cost Reimbursable	36 (56.3%)	28 (43.8%)				
Unit Rate	6 (66.7%)	3 (33.3%)				
Q11: Dollar Value of Largest LS Project Performed In Alberta						
< $100 MM	49 (68.1%)	23 (31.9%)	3.706	2	0.157	
$100 MM - $500 MM	18 (72.0%)	7 (28.0%)				
> $500 MM	5 (41.7%)	7 (58.3%)				

2.2 Barriers to Lump Sum Contracting in Alberta

This section uses One-Way ANOVA to determine relationships between respondents' demographic and company specific information and opinion on the relative importance of identified barriers to lump sum contracting. Barriers are listed in Section 5.3.4.

2.2.1 Role in Organization (Q2)

The hypothesized relationship between Q2 (Role in Organization) and the ranking of Barriers to Lump Sum Locally (Q16- Q21) was:

Hypothesis 93-98: Ranking of barriers to lump sum locally will be highly correlated with a respondent's role in their organization.

This study was interested in determining if a person's role in an organization influenced that person's perception of barrier importance, when looking at barriers to local LS. Using a one independent variable, between subjects One-Way ANOVA analysis, a statistical significance was found between Q2 and Q21.

- Q2 * Q21 has a medium correlation (F(3, 99)= 3.18, P=0.027); ('Executive' M=3.11; 'Senior Manager' M=3.77; 'Project Manager' M=4.64; 'Other' M=3.57)

A post hoc test, Tukey's Test, was performed to determine where the significant differences were between the groups. For this analysis, the 'Other' group was ignored due to lack of ability to tell seniority of position from the category. For Q21, the major difference in opinion was between the Project Managers and the Executives. The mean difference between the Project Managers and Executives is 1.53 and the significance is 0.02. Executives viewed lack of LS management experience within the industry as a much larger issue or barrier to local LS than did the Project Managers.

2.2.2 Type of Organization(Q3)

The hypothesized relationship between Q3 (Type of Organization) and the ranking of Barriers to Lump Sum Locally (Q16- Q21) was:

Hypothesis 99-104: Ranking of barriers to lump sum locally will be highly correlated with the type of organization a respondent belongs to.

Given that each party, Operators, Engineers, and Constructors, typically has different roles within a project, different parties might be expected to be concerned with different risks within LS execution. Using a one independent variable, between subjects One-Way ANOVA analysis, a statistically significant difference was found between Q3 and Q20 and Q21.

- Q3 * Q20 are highly correlated (F(2, 98)= 5.48, P=0.006); ('Operator' M=3.36; 'Engineer' M=3.67; 'Constructor' M=2.53)
- Q3 * Q21 is highly correlated (F(2, 100)= 7.11, P=0.001); ('Operator' M=4.50; 'Engineer' M=3.06; 'Constructor' M=3.64)

A post hoc test, Tukey's Test, was performed to determine where the significant differences were between the Operator, Engineer, and Constructor groups. For Q20, the major difference in opinion lay between the Constructors and both the Engineers and Operators. The mean difference between the Constructors and Operators was -0.83 and the significance was 0.34.

The mean difference between the Constructors and Engineers was -1.14 and the significance was 0.009. Constructors felt that client desire for fast tracking was a much larger issue or barrier to local LS than the other two groups of respondents considered it to be.

For Q21, the major difference in opinion lay between the Operators and Engineers. The mean difference between the Operators and Engineers was 1.44 and the significance was 0.001. Engineers felt that lack of industry experience with LS execution was a much larger issue or barrier to local LS than Operators considered it to be.

2.2.3 Payment Structures Most Frequently Used: International (Q8)

The hypothesized relationship between Q8 (Payment Structure used for International Projects) and the ranking of Barriers to Lump Sum Locally (Q16- Q21) was:

Hypothesis 105-110: Ranking of barriers to lump sum locally will be highly correlated with the payment structure most frequently used on international projects.

This study hoped to determine if payment structure used on international projects had an impact on perception of barrier to local LS importance. Using a one independent variable, between subjects One-Way ANOVA analysis, a statistical significance was found between Q8 and Q17 and Q18.

- Q8 * Q17 have a medium correlation (F(2, 36)= 3.79, P=0.032); ('Lump Sum' M=4.46; 'Cost Reimbursable' M=5.44; 'Unit Rate' M=3.00)
- Q8 * Q18 are highly correlated (F(1, 37)= 8.34, P=0.006); ('Lump Sum' M=3.40; 'Cost Reimbursable' M=4.89; 'Unit Rate' M=0)

A post hoc test, Tukey's Test, was performed to determine where the significant differences were between the payment structure groups. For Q17, the major difference in opinion lay between the unit rate and cost reimbursable payment groups. The mean difference between unit rate and cost reimbursable was -2.44 and the significance was 0.046. Companies that most frequently used cost reimbursable internationally viewed the local cost reimbursable

construction culture as a much smaller problem or smaller barrier to local LS than did the companies that most frequently used unit rate on international projects.

For Q18, a post hoc test was not performed because the unit rate case had fewer than 2 participants. However, from the mean of the responses, companies that used lump sum internationally viewed client late changes as a larger problem or larger barrier to local LS than did the companies that used cost reimbursable, internationally.

2.2.4 Payment Structures Most Frequently Used: Locally (Q9)

The hypothesized relationship between Q9 (Payment Structure used for Local Projects) and the ranking of Barriers to Lump Sum Locally (Q16- Q21) was:

Hypothesis 111-116: Ranking of barriers to lump sum locally will be highly correlated with the payment structure most frequently used on local projects.

This study wished to determine if payment structure used on projects in Alberta oil and gas had an impact on perception of barrier to local LS importance. Using a one independent variable, between subjects One-Way ANOVA analysis, a statistical significance was found between Q9 and Q18, Q19, and Q21.

- Q8 * Q18 are highly correlated (F(2, 72)= 5.30, P=0.007); ('Lump Sum' M=3.65; 'Cost Reimbursable' M=4.37; 'Unit Rate' M=2.67)
- Q8 * Q19 have a medium correlation (F(2, 83)= 3.41, P=0.038); ('Lump Sum' M=1.50; 'Cost Reimbursable' M=2.09; 'Unit Rate' M=1.00)
- Q8 * Q21 have a medium correlation (F(2, 75)= 3.90, P=0.025); ('Lump Sum' M=4.05; 'Cost Reimbursable' M=3.34; 'Unit Rate' M=5.17)

A post hoc test, Tukey's Test, was performed to determine where the significant differences were between the payment structure groups. For Q18, the major difference in opinion lay between the unit rate and cost reimbursable groups. The mean difference between unit rate and cost reimbursable was -1.70 and the significance was 0.014. Companies that most

frequently used unit rate locally perceived that client late changes were a much larger risk or barrier to local LS than companies that most frequently used cost reimbursable locally.

For Q19, no significant differences were found in post hoc tests. Future work may be to investigate the cause of the potential error.

For Q21, the major difference in opinion again lay between the unit rate and cost reimbursable groups. The mean difference between them was 1.83 and the significance was 0.36. Lack of experience with LS was of much less importance to frequent users of unit rate as a barrier to local LS.

2.2.5 Payment Structures used Most Frequently Overall (Q10)

The hypothesized relationship between Q8 (Payment Structure used most frequently overall) and the ranking of Barriers to Lump Sum Locally (Q16- Q21) was:

Hypothesis 117-122: Ranking of barriers to lump sum locally will be highly correlated with the payment structure most frequently used.

This study hoped to determine if the payment structure a company is most familiar with had an impact on perception of barrier to local LS importance. Using a one independent variable, between subjects One-Way ANOVA analysis, a statistical significance was found between Q10 and Q18 and Q19.

- Q8 * Q18 have a medium correlation ($F(2, 92)= 4.32$, $P=0.016$); ('Lump Sum' M=3.29; 'Cost Reimbursable' M=4.04; 'Unit Rate' M=2.71)
- Q8 * Q19 are highly correlated ($F(2, 108)= 6.34$, $P=0.002$); ('Lump Sum' M=2.31; 'Cost Reimbursable' M=1.58; 'Unit Rate' M=1.00)

A post hoc test, Tukey's Test, was performed to determine where the significant differences were between the payment structure groups. For Q18, no significant difference in opinion was shown between the payment structure groups. Future work could be done in investigating for a potential error.

For Q19, the major difference lay between LS and the other payment structure groups. The mean difference between LS and cost reimbursable was 0.73 and the significance was 0.011. The mean difference between LS and unit rate was 1.31 and the significance was 0.011. Frequent users of LS were less concerned by the lack of scope definition as a barrier to local LS than users of the other payment structure types.