

# **Perceived Causes and Effects of Project Delays: A Study of Government Building Construction Projects in the Central Province of Sri Lanka**

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## **INTRODUCTION**

Improvement of infrastructure and development of physical entities are portrayals of the economic development of a nation. The construction industry is a major contributor to the development of any country. Sri Lanka had a boom in the construction industry between the periods from 2010 to 2015. Infrastructure, as well as lifestyle needs of the people undertook a significant change during this period. As indicated by the Central Bank of Sri Lanka, construction industry was a key player behind the high growth rate of the country's GDP in the year finishing 2015. Hence, this evidently highlights the significant job that is played by the construction industry towards a solid economy in the said period. There are a variety of activities involved in the process of developing and executing a construction project in terms of the project life cycle. However, there could be differences in how projects are managed in government organizations, non-governmental organizations and in the private sector.

According to Williams (2003) projects are classically defined by the requirement to complete a task on schedule, to budget, and appropriate quality of technical performances. The majority of the construction projects cannot be completed within the estimated finishing date even when the client requests the construction to be completed on the scheduled date. This is a major problem that both the contractors and the clients face in the construction industry. The success or the failure of the construction project mainly depends on the construction timeline and whether that has met on the exact time. It has been found that the project management has been successful in procurement strategies in construction projects. However, due to the way in which projects have been planned or managed there are delays and cost overruns (Khalid, 2019). Not adhering to construction schedules, lead to delays that negatively affect both owners and contractors. Property owners are troubled by delays due to the

additional expenses it entails and their inability to use or occupy the property for their intended purposes at the intended time. Since construction is a multi-party stakeholder project, delays impose a negative impact on contractors by driving up the costs of building, causing from having to pay for idle equipment as the delays continue. In addition, contractors may incur extra costs due to the price escalation of construction materials and labour wages during the delay, affecting overall project's financial health. Construction delays negatively affect both clients and contractors financially, and it has become the prime cause for disputes, arbitration and litigation.

The relative importance of causes and effects of project delays can vary according to the project conditions. Identifying causes of project delays and their effects are helpful for project managers to take precautionary actions and proactive measures to mitigate delays. Several studies have been carried out to identify the causes of project delays in countries such as Malaysia, Saudi Arabia, Jordan, Ghana and Sri Lanka (Asaaf & Al-Hejji 2006; Odeh & Battaineh 2002; Jayawardane & Pandita, 2003). Some studies have focused on effects due to project delays (Aibinu & Jagbro, 2002) whereas few other studies have focused on identifying both causes and effects of project delays (Sambasivan & Soon, 2007). There are only a few studies published in Sri Lanka, which investigate the causes and effects of project delays. One such research was carried out by Jayewardene and Pandita (2003) to recognise the construction delays in the building construction industry of Sri Lanka as a whole. However, we identify that the causes of project delays can differ according to the type of the project and the context. A few studies have been conducted in Sri Lanka on the completion of construction projects in general but rarely explicitly on government-funded projects. Since government-funded projects have a direct liability towards the country's fiscal situation, it is important to conduct a study on the causes and effects of project delays pertaining to government funded projects. Identification of causes and effects of the delays in government construction projects will help future project managers to diminish the project delays. Therefore, this research aims to identify the causes and effects of project delays concerning low and medium-rise government building construction projects in the Central Province. Medium and low-rise buildings contribute for more than 60% of the industry (Central Bank of Sri Lanka, 2018). Delays are common in these medium and low-rise buildings. Therefore, the finding of causes and effects of project delays in low and medium-rise buildings has a high level of significance in the construction industry of Sri Lanka. Generally, three primary parties are involved in construction projects namely the client, consultant and the contractor. The causes of the delay of the construction projects can be client, consultant or contractor related and how each party perceive project delays could be different. Therefore, this study aims to find the causes and effects of delays in government funded building construction projects at Central province in Sri Lanka as perceived by clients, consultants and contractors and assess their level of agreement.

## **METHODOLOGY**

There are three prime parties involved with any government construction project in Sri Lanka; the client, consultant and the contractor. The client is the organization or individual procuring the building development and usually referred to as an employer. The consultant is the professional appointed by the client to perform an expert task on a project. The contractor is the person or a firm that undertakes a contract to provide materials and labourers to perform services or to do a job. The study identified the above three parties as respondents.

The respondents consisted of professionals working for government construction projects in the Central province of Sri Lanka. These professionals have been working as consultants, contractors, or clients. This sample of professionals consisted of engineers, architects, and quantity surveyors, etc. The snowball sampling technique was used for the selection of the respondents. They were identified through their referral networks. This method of sampling is preferred when it is difficult to get responses from sample elements selected at random (Williams, 2003). The questionnaire was forwarded to thus identified 39 consultants, 68 contractors and 21 clients. The causes and effects of project delays were elicited as perceived by these three parties separately.

### **Questionnaire Design**

The primary causes and effects of project delays were recognized by referring to previous research findings and interviewing professionals working on the construction projects with an exposure to government construction projects. These professionals comprised of engineers, architects, and quantity surveyors working for construction and consultancy companies, as the clients, consultants or contractors in the Central province. Sambasivan & Soon (2007) had identified 27 causes for project delays. However, some of the causes identified by Sambasivan & Soon (2007) were not taken into consideration when conducting this research since they are of marginal significance to Sri Lanka based on experts' opinions. Some additional causes identified by interviewing the above parties were included in the list of causes borrowed from Sambasivan & Soon (2007). Accordingly, 25 causes of project delays of government construction projects in the Central province were used for the research. They were categorized as the causes related to client, consultant, contractor and other. Further, from the interviews with the professionals, six effects of project delays were identified for Sri Lanka and used in this study.

The questionnaire was prepared to identify the frequency of occurrence and degree of severity of each cause of project delays and the effects as perceived by the three primary project stakeholders; clients, consultants and contractors. Sambasivam & Soon (2007), Odeh & Battaineh (2002), and Aibinu & Jagboro (2002) have directly asked the respondents the importance of each cause of delay in their questionnaires. However, Assaf & Al-Hejji (2006) Have made an inquiry focusing on the frequency of the occurrence and the degree of severity in an independent manner and then calculated relative importance. After evaluating both methods, it was decided that the method used

by Assaf & Al-Hejji (2006) is more appropriate for this study. A five-point Likert scale was used to measure the level of agreement on the causes and effects of the project delays by the Clients, Consultants and Contractors.

### **Data Analysis**

Sambasivan & Soon (2007), Jayawardane & Pandita (2003), and Aibinu & Jagoor (2002) used the relative important index (RII) to define the relative importance of the causes of project delays. They have implemented a five-point Likert scale to define the importance of the causes. The relative importance index (RII) as follow:

$$\text{Relative importance index (RII)} = \sum \frac{W}{A*N} \quad (1)$$

Where, the weighting given to each factor by the respondent (ranging from 1 to 5) is denoted by 'W', 'highest weight (i.e., 5) by 'A', and the total number of respondents by 'N'. 'RII' value had a range from 0 to 1. A greater value of RII gives higher significance for the cause.

Assaf & Al-Hejji (2007) has used a different approach to calculate the importance of the causes. They have defined "Frequency Index" and "Severity Index" as follows:

$$\text{Frequency Index (FI)} = \sum w / (5*N) *100 \quad (2)$$

Where the constant expressing the weight given by each respondent by 'w', and the total number of responses by "N". The frequency index was used to sort causes according to the frequency of occurrence.

$$\text{Severity Index (SI)} = \sum w / (5*N)*100 \quad (3)$$

Where the constant expressing the weight given by each respondent by 'w', and the total number of responses by "N" . The severity index was used to sort the causes according to the severity of the occurrence. The importance of each cause is based on the frequency and severity of it. Therefore, Assaf & Al-Hejji (2007) defined relative important index as follows,

$$\text{Relative Importance Index (RII)} = FI * SI \quad (4)$$

Assaf & Al-Hejji's (2007)'s approach of calculating relative importance index is adopted in this study. Respondents were required to answer two questions related to each cause (i.e., frequency of occurrences and degree of severity) and hence it gives a more realistic picture about the causes and effects of project delays.

### **Difference in Perception among Consultants, Contractors and Clients**

Spearman rank correlation tests were performed to obtain the correlation between the RII calculated for any two parties among clients, consultants and contractors. This was performed for both causes and

effects of project delays. The Kruskal-Wallis test was performed to test if the RII calculated for contractors, clients, and consultants were significantly different for at least one party.

## RESULTS AND DISCUSSION

Ninety-seven completed questionnaires were received and were taken for the analysis. They comprised of responses from 32 consultants, 49 contractors and 16 clients. The calculated RII for individual causes of project delayed perceived by contractors, clients and consultants and overall sample are shown in table 3.1. The ranks identified for each cause of delay according to RII values are also given in table 3.1.

*Table 3.1: Consultants', clients' and contractors' perception on causes of project delays*

Item No.	Cause of Project Delay	Perception							
		Contractors		Clients		Consultants		Average	
		RII	Rank	RII	Rank	RII	Rank	RII	Rank
<b>Client related factors</b>									
1	Client's financial problems	67.07	1	52.64	6	42.68	4	52.19	3
2	Delay in payment process	51.78	6	52.54	7	43.13	3	43.50	5
3	Scope changes	42.31	8	50.75	8	39.30	6	42.77	6
4	Slow decision making	34.22	15	32.94	13	35.46	10	34.61	14
5	Delay in taking over the project site	31.59	18	30.03	18	40.16	5	34.60	15
6	Delay due to ceremonial functions	27.55	20	20.31	23	37.42	7	29.53	20
<b>Consultant related factors</b>									
1	Delays in drawings submission	49.39	7	31.80	14	30.55	13	39.83	7
2	Mistakes and discrepancies	29.63	19	53.25	5	22.64	23	30.57	18
3	Lack of experience of the Consultant	24.16	24	27.33	20	23.38	21	24.60	22
4	Delays in approvals	55.49	3	31.50	15	23.29	22	39.76	8
5	Delays in inspections	37.21	12	30.64	17	28.05	18	34.13	16
6	Attitude of Consultant's persons	24.78	23	18.56	24	15.03	25	20.46	25
<b>Contractor Related factors</b>									

1	Improper project management	53.51	5	82.13	1	52.50	1	57.62	1
2	Improper construction methods	33.11	17	57.00	4	29.53	15	35.51	12
3	Improper day-work planning	54.52	4	72.19	2	31.77	12	49.27	4
4	Errors during construction	26.55	21	41.44	10	28.22	17	29.77	19
5	Inadequate experiences of Contractor's staff	35.69	14	33.78	12	27.95	19	32.84	17
6	Financial difficulties of the Contractor	38.65	11	47.27	9	36.50	9	39.32	9
7	Problems with Sub-contractor	25.49	22	24.75	21	26.72	20	25.86	21
<b>Other factors</b>									
1	Shortage of materials	36.37	13	28.98	19	37.08	8	35.36	13
2	Shortage of labour	55.71	2	62.91	3	51.47	2	55.44	2
3	Lack of communications	39.76	10	37.38	11	33.93	11	37.50	10
4	Disputes	18.69	25	24.22	22	29.23	16	23.10	24
5	Government regulatory obstacles	33.34	16	13.56	25	16.95	24	23.84	23
6	Unforeseen bad weather conditions	40.12	9	31.08	16	30.48	14	35.53	11

Improper project management by contractors was identified as the main cause of project delays by both the consultants and clients. However, contractors categorized improper project management by contractors as the fifth most important cause of project delays. This includes, contractors project management at the execution stage, variation claims and invoicing at right time, documentations and relevant correspondences to report project matters, work progress monitoring and following the feedbacks at the site level etc. In Malaysian construction industry improper planning was categorized as the main cause for the project delays. Poor site management comes as the second major contractor related cause of project delays (Sambasivam & Soon 2007). This shows that improper planning is a considerable problem that occurs not only in Sri Lanka but also in other countries.

The second major cause of project delays identified by both the consultants and contractors was 'Shortage of labour', whereas clients recognized this as the third main cause of project delays. In overall perception, 'shortage of labour' comes as the second main cause of project delays in government construction projects in the Central province. This finding is in line with the findings of Jayewardene and Pandita. (2003) who find that man power shortage as the second main cause of the delays in building construction projects in Sri Lanka. In Malaysian construction projects 'inadequate labour supply' was categorized as the fifth main cause of project delays (Sambasivan and soon 2007). This shows that the labor shortage is not a major cause for project delays in Malaysian construction

industry. Still a large proportion of workers in construction industry are employed on a temporary basis in Sri Lanka. Therefore, when they find a better work opportunity, they leave the former construction site. This may have created a huge labour shortage in Sri Lankan construction projects to be perceived by clients, consultants and contractors as one of the key causes of project delays.

Financial problems of the clients were identified as the third major cause of project delays. Previous studies also found that financial difficulties and economic problems as one of the major causes of project delays in the construction industry. (Sambasivam & Soon, 2007). This cause of project delay gained importance specifically in recent years due to the fiscal and budgetary constraints experienced by the government of Sri Lanka. Further, the inflation rate of the country could cause prices to increase rapidly and hence may require re-assessment of the budget which could cause delays. For instance, in Sri Lanka in 2017 the inflation rate was close to 7% compared to 4% in the preceding year. Moreover, the depreciation of rupee could also cause financial difficulties to the client since most of the construction materials are imported to Sri Lanka. All these could lead to price escalations causing cost overruns and project delays. When funds to concerned Ministries and Departments were not released on timely basis by the government would ultimately lead to notification of the client to contractor about the unavailability of funds resulting in project delays. Construction works take in huge amounts of money and most of the contractors find it very difficult to bear the daily construction expenses when the payments are delayed. Work progress can be delayed due to the late payments from the clients because there is inadequate cash flow to support construction expenses especially for those contractors who are not financially sound.

The fourth-ranked cause for project delays is improper day-work planning by the contractors. Contractors categorized this as the fourth most important cause of project delays, whereas consultants identified it at the twelfth place. However, according to the clients, improper day-work planning is the second most important cause of project delays in the government construction projects in the Central Province of Sri Lanka. Some studies have also identified project planning as the most important factor that contributes to the success of the project. Local Contractors often fail to come-out with a practical and workable “work programme” at the initial planning stage (Sambasivam & Soon, 2007). That indicates, most contractors neglect prior planning. It is a requirement that contractor provides a work program together with the bidding document involving their day works. It is likely that the contractors just submit a work program with the bidding document but are unable to meet the milestones properly.

Delay in payments process is recognized as the fifth most significant cause of project delays. While the consultants recognized this as the third most important cause of project delays, the contractors ranked this as the sixth most significant cause of the project delays and clients as the seventh most important cause. A possible reason for delay in payments in government construction projects could be the government bureaucratic procedures and the red-tape.

Scope change is identified as the sixth major cause of project delays. Both the clients and contractors ranked it at the eighth place and the consultants ranked it at the sixth place. Similarly, Jayawardane & Pandita (2003) identified that the changes done by the owners and consultants are a major cause of project delays in building construction projects. The findings of this research are going along with their findings. In a study carried out on project delays in large construction projects in Saudi Arabia, this is identified as the 10<sup>th</sup> most important cause for the project's delays (Assaf & Al-Hejji, 2006). This shows that clients changing their original scope has become a major reason for project delays not only in Sri Lanka but also in other countries.

Delay in drawings submission is the 7<sup>th</sup> most important cause of project delays identified in this study with respect to the medium scale government construction projects in the Central Province in Sri Lanka. Delay in approvals, financial difficulties of the contractor and lack of communications are identified at eighth, ninth and tenth ranks respectively as most important causes of project delays.

**Difference in Perception among Consultants, Contractors and Clients on the Causes of Project Delays**

Spearman's rank correlation coefficient was used to assess the agreement among the three primary stakeholders; clients, consultants and contractors on the causes of project delays in government construction projects. Accordingly, the calculated Spearman's correlation coefficients and respective significance level for the three parties are shown in following table 3.2.

*Table 1: Agreement for causes of delays between Consultants, Contractors and Clients*

<b>Stakeholder Groups</b>	<b>Spearman's Rank Correlation Coefficient</b>	<b>Significance Levels</b>
Consultants & Contractors	0.5477	0.01
Contractors & Clients	0.6285	0.01
Consultants & Clients	0.4931	0.01

A higher level of agreement was observed among contractors and clients, whereas the least agreement was observed between the consultants and clients. The significant level for all three parties is less than 1%. Therefore, we can apply 99% of confidence that the correlation has not occurred by chance. In the construction industry, in most instances disputes arise between consultants and contractors at the execution stage of the construction projects. Therefore, it is acceptable to observe clients and contractors are having lower level of agreement with consultants.

The Kruskal-Wallis test was performed to see if any stakeholder group is significantly different in their perception of causes of project delays. The test results show that no party is significantly different from

other parties in the perceived importance of the causes of project delays. The Kruskal-Wallis test statistics are given in table 3.3. According to the  $p$  value, there is no significant evidence to say that the RII of the three parties is different in at least one party from others.

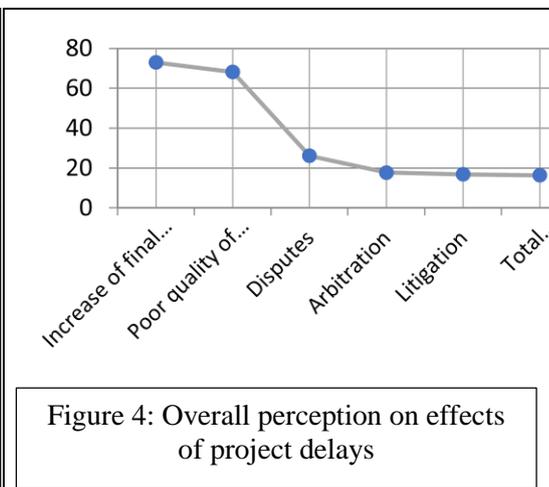
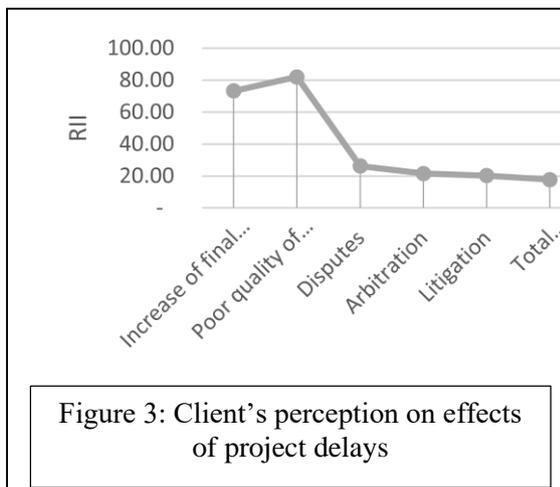
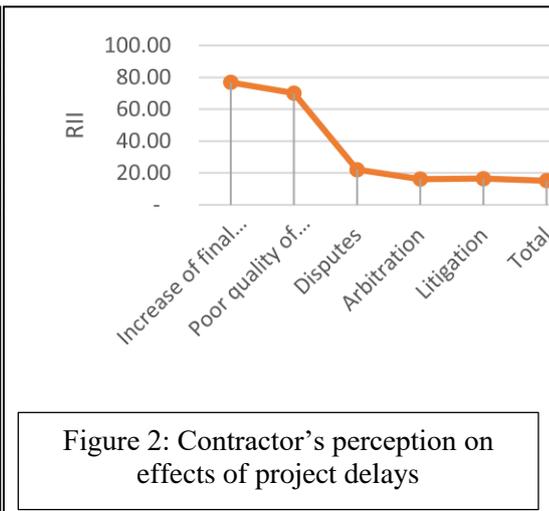
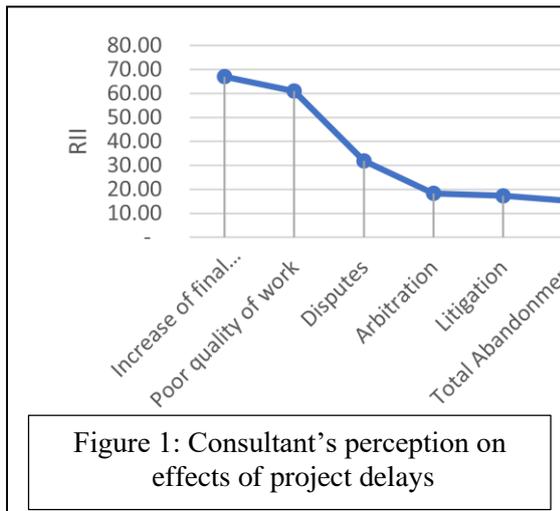
*Table 3.3: Kruskal-Wallis test results- All three parties*

H	3.19
Chi-Square	5.99
P value	0.20

The Spearman rank correlation and Kruskal-Wallis test results show that there is an agreement among the three main stakeholder groups on the perceived importance of the causes of construction project delays. This confirms the causes of project delays identified in relation to the government construction projects in the Central Province in Sri Lanka as independently the clients, the consultants and the contractors more or less the same causes as the important cause of project delays.

#### **Effects Due to Project Delays**

Six effects due to the project delays were identified after the preliminary interview with the professionals working in the government construction projects in the Central province and by referring to previous studies. Accordingly, identified delays due to project delays are cost overrun, quality of the work, disputes, litigation, arbitrations and total abandonment. These effects of project delays were ranked by the clients, consultants and contractors according to their perceived importance. Frequency index, severity index and relative importance index (RII) were calculated from the ranks given for the above effects of project delays for each stakeholder party separately and overall. They are shown in Figures 1-4.



Cost overrun is identified as the main effect of project delays. Consultants and contractors both rank this as the major effect of the project delays. However, clients placed this as the second major effect of project delays. This shows that the consultants and contractors are more concerned about the cost overrun than the time overrun. Cost overrun includes the payment to the consultants for additional price increase of material and services due to inflation, contract-related factors such as change orders and discrepancies in bidding document. However, it has been identified that cost overruns and time overruns are related and, in most instances, time overrun leads to cost overrun (Sambasivan & Soon, 2007).

Poor quality of the work outcome is the second most crucial effect due to the delays. Price escalation of the materials, services and labour charges directly affecting to final lower quality work due to contract constrains towards contractor. Even though consultants keep pushing contractors to get final outcome as per agreed specifications and finishes, above disappointments due to delays lead to poor quality work outcome. Further, clients are also liable to compensate all-natural losses resulting from

their action, which disrupt the contractor's progress. According to the above factors, we can understand that the delays can lead to other effects such as dispute litigation.

Disputes are identified as the third main effect of the project delays. Disputes can be resolved by arbitration or litigation. However, resolving disputes either through arbitration or through litigation involves a substantial amount of time and money, therefore, it is best to avoid them. Mistakes of the contractors while construction projects are underway are identified as a factor leading to disputes. Therefore, consultants should use their strength to ensure the quality of the work. However, inspection by consultants is merely a quality control activity that does not necessarily assure the quality of the final product. Hence, contractors should always take preventive measures to eliminate potential non-conformities. This will help to reduce disputes arising due to the quality aspects of the projects.

Factors such as delay in the payments for completed work, frequent owner interference, changing requirements, lack of communication between the various parties, problems with neighbours, and unforeseen site conditions give rise to disputes between various parties. The disputes, if not resolved amicably, can lead to arbitration or litigation (Sambasivan & Soon, 2007).

Arbitration is identified as the fourth effect of the project delays. In all construction contracts, there is a clause dealing with dispute resolution. If any pre-arbitral alternate dispute resolution mechanism fails, arbitration can be done. The law related to arbitration in Sri Lanka is covered by the Arbitration Act No. 11 of 1995. In Sri Lanka, the arbitration process is a time-consuming dispute resolution method. Including a pre-arbitral alternate dispute resolution mechanism to contract is a better way to minimize the arbitrations. The most important method to diminish the arbitration process is by reducing disputes.

Litigation is the fifth major effect of project delays. Litigation is used for dispute resolution when an arbitration clause is not available. Litigation is conducted under the jurisdiction of the courts. When considering the Sri Lankan construction industry litigation process is a time-consuming dispute resolution method. Therefore, it is recommended to minimise disputes and, if any disputes, solve them through pre arbitral dispute resolution methods.

Due to the delays, some construction projects were totally abandoned. This is identified as the sixth effect of project delays. This is high with governmental construction projects like roads and power plants. However, the effect of total abandonment of project is low in government construction projects in the Central province. Most of the time, the abandoning of projects happens due to disputes. Sometimes dispute resolution methods such as litigation take a long time. Due to these delays, some projects were totally abandoned on certain occasions.

### **Difference in Perception among Consultants, Contractors and Clients on Effects of Project Delays**

The Spearman's rank correlation coefficient was used to check the agreement between clients, consultants and contractors on perceived effects of project delays in government construction projects in the Central Province in Sri Lanka. Accordingly, the calculated Spearman's correlation coefficients and significance level for the effects due to project delays as identified by the consultants, contractors and clients are shown in the following table 3.4.

*Table 3.4: Agreement among Consultants, Contractors and Clients for effects due to project delays*

<b>Stakeholder Group</b>	<b>Spearman's Rank Correlation Coefficient</b>	<b>Significance levels</b>
Consultants & Contractors	0.9429	0.01
Contractors & Clients	0.8857	0.01
Consultants & Clients	0.9429	0.01

The Spearman rank correlation coefficients show a high level of agreement between all the stakeholder groups involved about the effects due to project delays. The correlation coefficients are significant at 1%. Thus, we can say at 99% confident that the correlation has not occurred by chance.

To check if the perceived effects are significantly different at least for one party among the three parties concerned, Kruskal-Wallis H test was performed. Accordingly, calculated Kruskal-Wallis H test, Chi-square value and *p* value are shown in the following table 3.5. There is no significant evidence to say that the RII on perceived effects of project delays of the three parties; clients, consultants and contractors are significantly different for at least one party from others.

*Table 3.5: Kruskal-Wallis H test results- All three parties*

H	1.06
Chi-Square	5.99
<i>P</i> -value	0.58

## **CONCLUSIONS**

The main objective of this study was to identify and rank the delay factors and their effects and assess the difference in the perceptions of three major industry stakeholders, namely clients, consultants and contractors, on the causes and effects of project delays in medium scale government building construction project completion in the Central province of Sri Lanka. Improper project management of contractors is identified as the main factor for project delays in government construction projects in the

Central province. Both consultants and clients identify this as the main cause, while contractors recognized it in the third place. Shortage of labours is considered to be the second leading cause of the project delays. According to the ranking order, the other crucial causes of project delays are financial problems of the clients, improper work planning by the contractor, delay in payment process, clients changing their original scope, delay in drawings submission, delays in approvals, financial difficulties of the contractor and lack of communication of interested parties.

Clients, consultants and contractors agreed that the following causes are the least important for the project delays in government construction projects in the Central province of Sri Lanka. They are lack of experience of the consultants, government regulatory changes during the construction, disputes and attitude of consultant's persons. There is no significant difference in relative importance given for causes of project delays by contractors, consultants and clients. The level of agreement between any two parties is also significant.

The main effect of project delays is identified as cost overrun. The other effects of project delays are cost poor quality of the work, disputes, arbitrations, litigation and total abandonment. Furthermore, there is no significant difference in relative importance given for effects of project delays by contractors, consultants and clients. There is a high and significant level of agreement on the effects of project delays between any two parties.

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