

MANAGING SCOPE CREEP IN CONSTRUCTION PROJECTS IN EGYPT

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Abstract

Construction Projects widely experience the “Scope Creep” phenomena, which consumes both resources and contingencies allocated for those projects. Creep is always an unknown project risk and managing scope creep is a very complicated task. So, preventing the causes leading to scope creep seems an efficient strategy.

To succeed in preventing scope creep in construction projects an understanding for conditions that lead to the creep is required, and an ability to choose the suitable action when the creep arises is needed. Hence, this research sought to identify, evaluate and rank the most important and frequent factors responsible for scope creep in construction projects. It considered the perspective of the owners, consultants and contractors in Egypt. Moreover, it aimed to identify and develop appropriate strategies for scope creep prevention.

The study concluded that problems such as scope creep will arise in construction projects and should be taken into consideration in every project. The obtained information provides guidance for strategies to be developed to provide project leaders and other stakeholders with a practical professional approach for construction scope creep prevention.

Key words: Project scope creep; prevention; phenomena; Egypt.

1. Introduction

Complex construction projects yield scope creep leading to disputes. For many reasons, construction disagreements have become increasingly common [1]. Resolution of these disputes, which vary in nature, size and complexity, has become very expensive from the financial, personnel and time point of view [2].

As a result of scope creep, construction disputes increase. So, there is a need to develop strategies which mitigate the risk of disputes and to help avoiding the unnecessary escalation of disagreements into contested disputes.

The complex and uncertain nature of the Construction Projects’ environment introduces many challenges in forecasting the number and impact of changes. The mitigation of change in early stages of project prevents project failure and maintains a manageable scope.

The aim of this study is to develop preventive strategies for scope creep and to develop a decision support matrix that aids the owner during pre-awarding phase to choose a

proper contract type and delivery system to complete the project on time and within budget.

To realize the above aims, the following points have been addressed:

1. Classifying possible factors which cause scope creep in construction projects in Egypt;
2. Assessing and ranking the significance and occurrence of factors causing scope creep from the perspective of owners, consultants and contractors in Egypt;
3. Identifying and developing strategies to prevent scope creep occurrences in construction projects; and
4. Verifying the research outcomes in an ongoing construction project.

2. An Overview of Scope and Scope Creep

According to PMBOK [3], “Project Scope” refers to a project’s boundaries which determine what work will be completed during the project lifecycle. Also, it includes identifying the work that will not be included in the current round of product/service development. During the planning process, outputs are created to capture and define the work that needs to be completed. The controlling and monitoring process is concerned with managing scope creep, documenting, tracking, and approving/disapproving project changes. Finally, the closing process includes an audit of project deliverables and assesses the outcomes against the original plan. Scope is about product scope and project scope. Project scope includes business requirements, project requirements and delivery requirements. Product scope includes technological requirements, security requirements and performance requirements.

On the other hand, the term “Scope Creep” generally refers to jeopardizing scope of work by uncontrolled changes [3] that creep towards and into the project scope causing continuous, but distorted, growth of the project’s scope. It is the gradual expansion of project work without formal acceptance or acknowledgement of their associated costs, schedule impacts or other effects.

Groff & Jones [6] described scope creep as “a phrase used to describe a situation in which project goals are altered or expanded so often that the assignment no longer resembles the original project commitment”. While, Ryan A. Dibble [7] mentioned that the context, the objectives, the function and the performance make up the scope. Scope creep is the expansion of this scope. On the other hand, Melton and Iles-Smith [8] described scope creep as “the incremental change of scope overtime”.

3. Research Method

A questionnaire was developed to facilitate data collection. The questionnaire methodology was built on Pilot Survey [9], Likert Analysis [10] and a research of Kometa and Olomolaiye [4].

The selection of the respondents was limited only to the First Category Contractors, Multi-discipline Consultants and Clients in the Greater Cairo region. The choice of this class of contractors and consultants was made on the basis that they are approachable and are exposed to scope creep by virtue of the type and size of projects they handle. Clients consisted of public and private individuals, e.g. Ministries, Departments Agencies, District Assemblies, Financial institutions, etc. The decision to focus on this region was based on the list obtained from the Egyptian Federation for Construction and Building Companies which showed about 78% of the First Category Contractors are located in Greater Cairo.

The sample size has been determined according to Israel [5] using the following equations:

$$n_o = Z^2 * P(1 - P) / d^2 \quad \text{Eq.1}$$

$$n = n_o / (1 + (n_o - 1) / N) \quad \text{Eq.2}$$

Where:

n_o = sample size of unlimited population;

Z = statistic for a level of confidence ($Z = 1.64$ for 90% confidence level);

P = expected prevalence or proportion, or degree of variance between element population (20% $P = 0.2$);

d = precision (90% confidence; 10% error $d = 0.1$);

n = sample size of limited population;

N = population.

Commonly the calculated sample size is increased by (30% - 40%) to compensate for non-response. Therefore, the sample size was decided to be as following:

- i. According to The Egyptian federation for construction and building contractors, the total number of First Category Contractors in the Greater Cairo region = 133 contracting Companies. Therefore, the questionnaire was distributed to 60 construction companies in Greater Cairo region during the period from October 2015 to September 2016.
- ii. According to the Egyptian Syndicate for Engineers, the total number of Consulting Firms and Multidiscipline Consultants = 45 Consultants. Therefore, the questionnaire was distributed to 32 Consultants offices during the period from October 2015 to September 2016.
- iii. The list of clients obtained from Consultants and Contractors was sorted out and the individual clients, companies which don't have technical department and the Sovereign ministries were excluded from the list. Individuals and companies without technical department always leave management problems totally to their consultants as they don't have experience in it. In addition, the Sovereign ministries are very strict are not expected to cooperate in completing any research questionnaires as they are so conservative. Thereafter, the list of clients contained 70 entities. Therefore, the questionnaire was distributed to 37 clients during the period from October 2015 to September 2016.

The statistical methods, used in analyzing the data obtained from the three groups of respondents on the causes of scope creep in construction projects in Egypt and the various ways of preventing them, included the following:

Significant Testing (P-Value Approach): Significant test (at 95% confidence interval) was conducted on each of the factors which aided in identifying the significant factors that causes scope creep in construction projects from the clients, consultants and contractors.

Relative Importance Index: This method of analysis was used to determine the relative importance of the factors causing scope creep in construction projects that was identified by the literature survey and some questions intended to capture background information of the respondents.

$$RII = \sum W / A * N \quad \text{Eq.3}$$

Where:

W = the weighting given to each cause by respondents, ranging from 1 to 5;

A = the highest weight (i.e. 5 in the study);

N = the total number of samples;

This was used in ranking the significant factors in terms of degree of importance.

Frequency Index (F.I): This method of analysis was used to rate the frequency of occurrence for each cause according to three ordinal scales: high (3), medium (2), or low (1). In addition, F.I. was used to find out the actual causes that repeatedly occur in construction projects. This is because the cause may be important but not occurring frequently in the construction projects.

$$F.I = (3n_1 + 2n_2 + n_3) / 3(n_1 + n_2 + n_3) \quad \text{Eq.4}$$

Where:

n1 = the number of respondents who answered “high”,

n2 = the number of respondents who answered “medium” and

n3 = the number of respondents who answered “low”.

Agreement Analysis: A Kendall rank correlation coefficient (W) which is a non-parametric statistic was used for assessing or evaluating the degree of similarity/agreement between the three sets of ranks to the same set of the probable causes of scope creep. This tool is used to enable the researcher find out whether there is a trend of agreement among the respondents.

$$R = \sum_{i=1}^k (R_i - \bar{R})^2 \quad \text{Eq.5}$$

Now, define **Kendall's W** as:

$$W = \frac{12R}{m^2(k^3 - k)} \quad \text{Eq.6}$$

Where:

$m^2 (k^3 - k)/12$ = the maximum possible squared deviations, i.e. the numerator which will occur if there were perfect agreement among k sets of ranks, and the average ranking were 1, 2, 3.... m ;

R_i = the rank assigned by an individual judge to one factor;

$0.0 \leq W \leq 1.0$

k = the number of raters;

m = the number of factors to be ranked;

R = average of the ranks assigned to the n th factor being ranked.

Spearman Correlation: This inferential statistics method was also used to find out whether the differences in the rankings of the three groups of respondents on the probable ways of prevention of scope creep in construction projects are statistically significant or not. The Spearman correlation coefficient, ρ , can take values from +1 to -1. A ρ of +1 indicates a perfect association of ranks, a ρ of zero indicates no association between ranks and a ρ of -1 indicates a perfect negative association of ranks. The closer ρ is to zero, the weaker the association between the ranks.

$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)} \quad \text{Eq.7}$$

Where: d = difference between ranks and d^2 = difference squared.

4. Results, Analysis and Recommendation

The questionnaire was sent to 129 persons, consisting of clients, consultants and contractors of which 101 responses were received for a response rate of 77.8%. The responses were further analyzed to determine the profile of respondents, the most important causes of scope creep and ways of preventing these causes from the perspective of the clients, contractors and consultants. The respondents position, experience in the industry, whether the respondents have had any form of scope creep in construction projects and the origination of such scope creep causes were some of the major areas of concern.

According to Figure [1], 46.5% of the questionnaires were sent to Contractors, 24.8% to Consultants, while 28.7% were given to Clients. Their experience with scope creep in their projects is shown in Table [1].

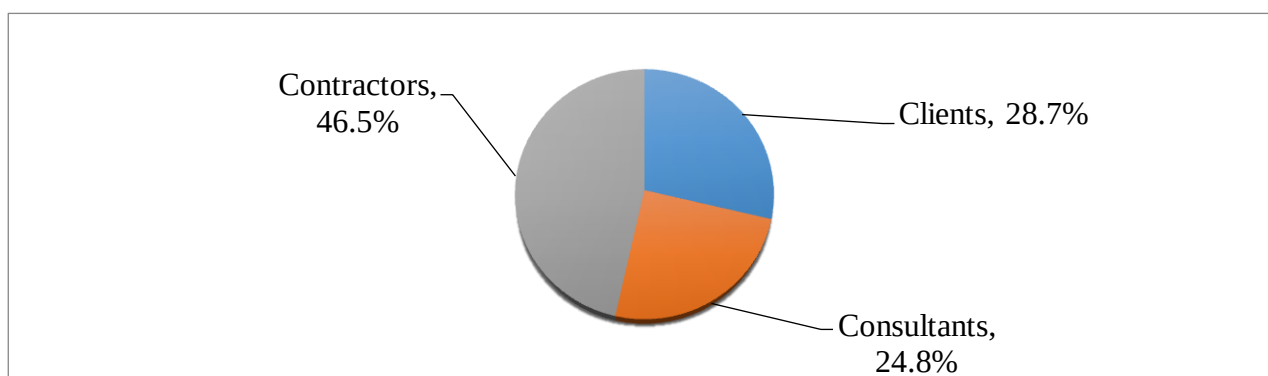


Figure 1. Survey distribution to Owners, Consultants and Contractors.

Table1 Experience of respondents with scope creep in construction projects.

		Client	Contractor	Consultant	Total
Company Type	Holding Company/Public Sector	10	5	0	15
	Private Sector	11	48	27	86
	Others	0	0	0	0
Project Type	Residential	10	30	15	55
	Commercial	7	10	10	27
	Infra –Structure	3	10	1	14
	Mixed Use	1	3	1	5
Project Classification	Horizontal	10	10	5	25
	Vertical	5	22	10	37
	Linear	6	18	7	31
	Offshore	0	3	5	8
Project Size	Small: Less than 10Million EGP	5	10	12	27
	Medium: (10:50)Million EGP	7	8	8	23
	Large: (50:200)Million EGP	4	15	3	22
	Mega : More than 200 Million EGP	5	20	4	29
Party Responsible for Scope Management	Client	15	20	15	50
	Project Management Firm	1	5	5	11
	Engineer	2	20	5	27
	Contractor	0	2	0	2
	Collective Responsibility	3	6	2	11
Contract Style	Balanced	15	15	11	41
	Client Side	6	35	9	50
	Other	0	3	7	10
Scope Change/Creep (0:10)	0:2 (Moderate change Happened)	1	3	2	6
	2:4 (High change Happened)	3	10	2	15
	4:6 (Very High change Happened)	3	10	9	22
	6:8 (Extreme change Happened)	5	10	9	24

	8:10 (Catastrophic change Happened)	9	20	5	34
Average Percentage of Variation	All Variations	42%	26%	11%	
	Uncontrolled Changes (Scope Creep)	35%	20%	7%	
Relevant Constraint	Time	5	18	3	26
	Cost	6	15	2	23
	Quality	1	5	5	11
	Scope	5	5	5	15
	Resources	1	3	2	6
	Risk	2	2	4	8
	Customer Satisfaction	1	5	6	12
Major Success/Failure	Success	5	13	8	26
	Failure	10	35	12	57
	Other	6	5	7	18
Risk Type	+VE Risk	3	18	8	29
	-VE Risk	18	35	19	72

Causes of scope creep in construction projects in Egypt which were shown in the results of questionnaire were analyzed from the cumulative view of the client, consultant and contractor.

Based on the result, it is observed that the client-related causes are the following:

1. Poor scope definition;
2. Periodical design requirements change;
3. Lack of funds;
4. Change of the operator during the construction phase;
5. Delay of permissions;
6. Unstable economic and political conditions;
7. Client changes during construction;
8. Acceleration of works requested by client that leading to change in schedule;
9. Delay of approval/ invoicing;
10. Poor risk allocation;
11. Deficient management, supervision and coordination efforts by the project managers;
12. Variations and late confirmation of variations.

On the other hand the consultant-related causes are the following:

1. Over design and underestimating the costs involved;
2. Design and specification oversights and errors or omissions resulting from uncoordinated civil, structural, architectural, mechanical and electrical designs;

3. Incompleteness of drawing and specifications;
4. Unsafe designs lead to delay during the construction;
5. Unclear and incomplete description of items in the bills of quantities;
6. Inexperience Consultant;
7. Over measurement or under measurement of works by consultants for work in progress;
8. Unconfirmed oral instructions;
9. Failure to respond in timely manner.

While, the contractor-related causes are the following:

1. Delay/ suspension of works;
2. Delays in the supply of workshop drawings;
3. Disputes with subcontractors/suppliers;
4. Late payment of subcontractors/suppliers;
5. Site conditions which differ from those described in the contract documents (especially unforeseen underground conditions);
6. Poor records kept by client ,contractor and consultant;
7. The parties fail to identify and deal with issues on time;
8. Delay of contractor payment;
9. Inadequate contractor's management, supervision and coordination;
10. Inexperience of subcontractors
11. Inexperienced contractors

The respondents after indicating the significant causes of scope creep in Egyptian construction projects were asked to rate the frequency of occurrence for each cause. It can be clearly seen that the ten most frequent causes of scope creep in Egyptian construction projects from the combined perspective of all the three contact groups (clients, contractors and consultants) are:

1. Inexperienced contractors and clients (FI=0.855);
2. Client changes during construction (FI=0.851);
3. Lack of funds (FI=0.838);
4. Delay of permissions (FI=0.835);
5. Over design and underestimating the costs involved (FI=0.825);
6. Periodical design requirements change from the client side (FI=0.802);
7. Delay of approval/ invoicing (FI=0.802);
8. Poor scope definition (FI=0.802);
9. Inexperience Consultant (FI=0.795);
10. Change of the operator during the construction phase (FI=0.785).

The following are the comments from the prospective of Clients Contractors and Consultants on the frequent causes of scope creep in construction projects:

1. Poor scope definition

Poor definition for the scope of work is a frequent cause of scope creep. The scope definition should be the owner's responsibility and sometimes the owner does not have the required experience to define it. When the contractors price items become out of original project scope, they usually use "reservation of rights" language to allow themselves the opportunity to make future claims for additional time or money to complete the project.

2. Client changes during construction

The second most frequent cause of scope creep in Egyptian construction projects with a frequency index of 0.851. This is not surprising since many of the respondents mentioned this problem as one of the causes of scope creep in construction projects in Egypt.

3. Incomplete drawings and specifications

This problem is one of sources of scope creep in construction projects. Hence its frequency index of 0.782. From the conducted interviews, it is found out that incomplete drawings and specifications result in uncertainties in the work which generally lead to remedial work prior to completion and an increase in the number of changes in the work. Increased changes in a construction project generally reduce productivity and performance, and increase the chances of scope creep.

4. Inadequate government regulations

Inadequate government policy which encourages low evaluated tenders is an important cause of scope creep in Egyptian construction projects as it usually leads to many problems due to inefficiency of contractors. It is ranked the first most frequent cause of scope creep in Egyptian construction projects.

5. Lowest price approach when engaged with contractors or designers

From the interviews the researcher conducted, many of respondents believe that most of Private Sector clients in Egypt follow the lowest price approach when engaged with contractors or designer with frequency index= 0.795 This approach may led to the work to incapable contractor or consultant and this causes scope creep in construction projects in Egypt.

6. Design and specification oversights, errors or conflicts

Design and specification oversights, errors or conflicts resulting from uncoordinated civil, structural, architectural, mechanical and electrical designs does occur frequently on projects as its frequency index is 0.752. From the interviews the researchers conducted, it was found out that some contractors in Egypt rarely have sufficient time to thoroughly scrutinize the entire tender documents during the hectic process of tendering. In most cases, the contractor may uncover only the most glaring drawing mistake at tender time and surprisingly would not find any minor or major discrepancies until the construction is underway.

Contractor's response indicated that, upon discovery and notification of the design professionals, the response might be, "Well, the tender document required that you must notify us, in writing, when errors were discovered prior to submitting the tender, otherwise you are considered to be fully responsible". If this certainly happens and with such a response, most project managers would really have problems to deal with. Sometimes the questions which arise out of this problem are: doesn't the contractor has the right to assume that the plans and specifications submitted by the clients architect/engineer are reasonably complete for the tendering process? If there are major discrepancies, shouldn't they be able to rely on everyone's good faith to find an equitable solution to correct major errors and omissions? If answers to these questions and other issues pertaining to this problem are not communicated properly a dispute can easily erupt.

7. Poor financial arrangements leading to late payments

Late payments by clients to contractor or any other worker can severely hinder the work progress of any project making it a source of scope creep. Delay in progress payments and final payments affect the cash flow of contractors and ultimately affect the project as a whole as many contractors are not able to continue with the execution of the project. As a result many respondents ranked it the most frequent cause of scope creep which occurs in Egyptian construction projects.

8. Unclear and incomplete description of items in the bill of quantities

Another important cause of scope creep in Egyptian construction projects is the unclear and incomplete descriptions of items in the bill of quantities. The respondents were of the view that this problem makes contractors and subcontractors unable to interpret what is written. Hence, they do what is not required to be done.

9. Disputes with subcontractors/suppliers

Disputes between general contractor and subcontractors/suppliers affect the project progress and leads to disputes between general contractor and the client. Thus, make many respondents believed that disputes between general contractor and subcontractors/suppliers as source for scope creep in construction projects.

10. Delay of approval/invoicing

Delay of consultants to approve invoice can severely hinder the work progress of any project making it a source of disputes. Delay in progress payments and final payments affect the cash flow of contractors and ultimately affect the project as a whole as many contractors are not able to continue the execution of the project.

The value of coefficient of concordance (W) obtained is 0.721. This result therefore shows that there is a good level of agreement amongst the respondents consisting of clients, consultants and contractors hence there is no bias on how they ranked the 41 causes of scope creep.

The most important ways in which scope creep in Egyptian construction projects could be prevented are as follows:

1. Setting expectations correctly at the beginning of the project;
2. Adequate contract documentation;
3. Designing contract conditions that are fair to all parties (allocating projects risks fairly to all parties);
4. Communication of potential problems at the earliest opportunity;
5. Establish a robust change management process;
6. Assign the design to qualified consultant and the construction to qualified contractor;
7. Team building including the introduction of partnering approaches to establish common objectives;
8. Setting up of Dispute Review Boards prior to the start of construction;
9. Choosing the appropriate project delivery method (procurement system).

Table 2 shows the interaction matrix between the proposed prevention ways and the significant causes of scope creep.

Table 2 Interaction matrix between prevention ways and significant causes.

No.	Causes of scope creep in construction projects in Egypt	Methods of preventing scope creep in construction projects								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.	Change of the operator during the construction phase;		X	X	X				X	
2.	Delay of permissions;		X	X	X				X	
3.	Delay of contractor payment;		X		X			X	X	
4.	Delay of drawings and submittals approval;		X		X					
5.	Unstable economic and political conditions;				X			X	X	
6.	Client changes during construction;	X	X	X	X	X	X			X
7.	Poor scope definition	X						X		
8.	Acceleration of works requested by client that leading to change in schedule;		X	X		X		X	X	X
9.	Deficient management, supervision and coordination efforts by the project managers;		X		X					

It can clearly be seen that the five most important ways in which scope creep in Egyptian construction projects could be prevented from all the respondents' point of view are as follows:

1. Adequate contract documentation (RII=1.186);
2. Choosing the appropriate project delivery method (procurement system) (RII=1.065);
3. Communication of potential problems at the earliest opportunity (RII=1.059);
4. Setting expectations correctly at the beginning of the project (RII=1.027);
5. Assign the design to qualified consultant and the construction to qualified contractor (RII=0.893).

The Spearman rank correlation coefficient for the 9 probable ways of preventing construction disputes are 0.28 for contractors and consultants, 0.58 for consultants and client and 0.27 for contractors and clients. This indicates that the clients and the consultant agree more on the importance of ways of preventing scope creep in construction projects in Egypt more than the client and the consultant and the client and the contractor.

The following are the comments on the five most important ways of preventing scope creep in construction projects from the view point of clients, contractors and consultants in Egypt.

1. Adequate contract documentations

A contract document which is adequate, accurate and consistent throughout saves construction time, facilitates the effective utilization of contractor's resources and thus, prevents disputes due scope creep. From the tabulated responses given by the 101 respondents, it was observed that 51 respondents of the 101 respondents totally agreed that the provision of adequate contract documentation is the first most important way of preventing scope creep in Egyptian construction projects (RII= 1.186). These respondents were on the view that the client in conjunction with the consultant should exercise the utmost care and consideration when preparing the contract documents during the design phase to minimize the impact of any dispute on project progress. They also indicated that proper planning and careful review of project plans and specifications can substantially minimize the likelihood of scope creep and provide basis for timely resolution of any problem that may occur.

2. Choosing the appropriate project delivery method (Procurement System)

During the pre-award phases, Scope Creep can be aborted if the developer and his Project Management team (whether in house or outsourced) ensured that they had four major success keys in their defensive plan against Scope Creep. Those keys are: Well Defined Scope, Complete Design, the Proper Delivery System and contracting method for the relevant construction project (s).

3. Communication of potential problems at the earliest opportunity

The longer a potential problem is allowed to go on the more likely it is to escalate and the less likely the matter will be resolved without a dispute. This was the reason why 38 of the respondents ranked the communicating of a potential problem at the earliest opportunity as the third most important way of preventing scope creep in construction projects in Egypt. The respondents indicated that construction projects rarely are completed without encountering some problems not anticipated or anticipated by the client, consultant or the contractor such as errors in the construction plans, site conditions differing from what were expected and so on. As a result giving an advance warning of a potential problem has an advantage of avoiding surprise by the other side and enables the parties at the earliest opportunity to consider solutions to avoid or minimize the impact of any potential problem.

4. Expectations correctly at the beginning of the project

Create a realistic goal that allows sufficient time for key tasks to be accomplished. So its recommended to hedge your bets by adding a 15-20% margin to estimate when estimating times required to complete key tasks in the construction projects in Egypt.

5. Assign the design to qualified consultant and the construction to qualified contractor

Adequate selection and involvement and buy-in from stakeholders are absolutely essential to the success of any project. Failure to do so can quickly send your project careening, not just creeping, away from the original scope of the project. Keep these guidelines in mind when involving stakeholders in the project:

1. Identify all of the project's stakeholders at the beginning of the project;
2. Involve the stakeholders at the earliest possible stage of the project;
3. Include the stakeholders in the information gathering as well as decision making process;
4. Obtain buy-in from the stakeholders on the project's requirements and project plan.

5. Conclusions

Based on the results of this investigation, the following recommendations can be made to the parties involved in construction projects in Egypt.

It is recommended that Clients should:

1. Set up Dispute Review Boards prior to the start of construction;
2. Assign the design to qualified consultant and the construction to qualified contractor;
3. Establish a robust change management process;
4. Provide a good and clear brief to the design team;
5. Set up independent contract review team to review the contract document as a whole;
6. Appoint the appropriate project team to monitor the progress of works and carry out supervision; and
7. Have adequate funds for the project to make payments as and when due.

It is also recommended that Consultants should:

1. Identify responsibilities and allocate risks to the party best able to control it;
2. Provide specifications which are clearly written, reflecting the skills, materials and plant readily available and finally relating to the specific project. Refrain from simply adding to or deleting specifications from sets of previously employed documents and using them;
3. Prepare contract bills of quantities using adequate tender information so that there is accuracy in both descriptions and quantities;
4. Draft clauses to address scope creep at relevant stages in a project; and
5. Undertake close supervision of the works as it progresses.

It is also recommended that Contractors should do the following to help prevent scope creep:

1. Involve in only tender for works you have expertise to do;
2. Do not accept any job when you sense that the job is going to be more trouble than it's worth. Use foresight rather than hindsight;
3. Employ qualified staff;
4. Pay attention to what is written in the contract and never skim over it without reading all of the terms and understanding what they mean. Ask for help from the professionals you have employed when the need arises;
5. Start with a clear understanding of the scope and quality of works to be performed and what your client's expectations are;
6. Never start a construction project without complete, clear plans and specifications;
7. Price the work to ensure that documentation errors do not cost you in both real money and time wasted in arguments and disputes;
8. Maintain good communications with all throughout the project;
9. Put all variation orders, no matter how small, in writing;
10. Ensure that all variation instructions are confirmed in writing and the cost is determined and approved, where possible, prior to undertaking the work;
11. Keep good records of everything that occurs both on and off the site that has any influence on that project; and
12. Plan works on site carefully, pursue them diligently and construct them correctly by following specifications provided.

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