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The Risks of Multi Package Contracts within Complex Projects

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Abstract: the multi package contracts that the owner would make with more than one contractor to achieve the objectives of the project, and that by distributing the works of the project to a number of contractors, each according to his specialization, a contract for achieving the civil works, another contract for electrical works and son on. Using this kind of separate contracting to implement strategic projects led to arising of some risks, obstacles and disputes between the parties of the project (Owner – Contractors – Consultant), this has caused an arising of additional works with additional cost and time or stoppage of one of the contractors.
In this paper a case study from the Libyan construction projects will be presented to investigate the current obstacle, and risks and their impact on project's constraint.
This study will present an assessment of one multi package contract which has been implemented in Libya, its GULF power plant project in General Electricity Company Of Libya (GECOL), to understand the strengths and weaknesses of practicing this kind of contracting. The results show that The delay of payment of the invoices due to the large number of the monthly invoices for the contractors, Some contractual terms are not clearly identified and Delays in contractor Mobilization and Transportation and customs delays are the main risks have been faced this type of contract.

Keywords: Multi package contracts, GULF power plant project, General Electricity Company of Libya (GECOL), project's constraint

I. Introduction

One of the most common used contracts in the implementation of large or small projects, is a single contract to whom all the project installation works are entrusted to one contractor, but in certain circumstances or a special policy followed by the owner to speed up the completion of the project or reduce the cost or ensure the high quality, especially in complex projects, where the owner resorts to implementing the installation phase of the project with the help of more than one contractor to carry out the work, whether consecutively or in parallel [1].
So the Multi Package Contract, is a project deliver method that the owner contracts with more than one contractor for the implementation of the Complex project's work through distributing the project's work to a number of contractors. For example, a contract is made with the first contractor on civil works, and a contract with the second contractor on electrical works and the third on mechanical works. ..... And so on [1].

II. Problem Definition

GECOL is the largest public company in Libya and its responsibility to operate and maintain the electricity network in all regions. It comprises of the three zones, these zones are west area, east and south area. There are many projects implemented to cover the demand of increasing energy in these zones, one of them is a GULF Complex project.
A GULF Complex project has exposed to many technical and financial Risks and circumstances that causing delaying for implementation and increasing budget. The Inappropriate choice for the type of contract and contractors are the main issue that causes of delaying and cost overrun

III. The aim

The main aim is to assess the implementation of the multi package contracts within Complex Projects, this aim is achieved by the three sub objectives which are:

- to study the complex Project's concepts,
- to study each of the single and multi-package contracts such as advantage, dis advantage

and the appropriate use of each one of them in the project

- To present a case study for an assessment of current multi-package contracts in GECOL projects and understanding of the current risks and weaknesses of the practice of this type of contracting.

IV. literature review

Some researchers have studied the use Multi Package Contracts in construction projects in Libya and their risks that could be faced during implementation.

A study has concerned with the importance of studying and evaluating the risks facing the application of the multi-contract method in (Napro Group) construction projects the analytical descriptive approach was followed in this study and concluded that the most important risks related to the application of multiple contracts in construction projects and have an impact on the contracting parties, are:[2]

disputes between contractors among themselves, which lead to an increase in costs, and delays from any contractor lead to delays in the work of another contractor from the specialized contractors, complications in paying the invoices , weak communication between the parties, shortcomings (lack of experience) of contractors, inconsistency between quantities, plans and specifications, multiple contracts and guarantees and their overlap between the parties in the project, overlapping and conflicting powers, no specific point of responsibility, increase in costs.

(Omarn, 2015), in his study has conclude that one of the most important reasons of using multi package contract is the desire of the owner to: [3] guarantee higher quality, to transfer knowledge and increase experience for his engineers through the participation into the phases of implement of the contract. The research has identified the main causes of delay of the project are delay of payments to the contractors, delay in the organizations at the points of interface points between contractors that resulted to an emergence of gaps (unresolved works) which necessitates some added works by the owner, and the non-systematic cash flow related to stages of achievement [4].

Hatush & skitmore (1997) in their paper are concerned with identifying universal criteria for prequalification and bid evaluation, and the means by which different emphases can be accommodated to suit the type of contact[4]. Hatush& skitmore (1998) developed a systematic multicriteria decision analysis technique and is described for contractor selection and bid evaluation based on utility theory and which permits different types of contractors for the appropriate contract.[5]

Hatush (1997) and skitmore (1997) have investigated this by a Delphic study in which a consensus was reached by several expert prequalifies via the PERT approach. Another paper describes A Delphic study investigating the perceived relationship between 20 contractor election criteria (CSC) currently in use and project success factors (PSFs) in terms of time, cost and quality [6,7]

V. Theoretical background

The construction phase of a project is generally delivered by engaging a single contractor to undertake the majority of the work. However, under some circumstances, there can be advantages gained by adopting a procurement method that involves "multiple contracts". Multiple contracts can be for: work packages; or trade packages.

This section outlines when it is appropriate to use a single main contract and when to use multiple contracts and describes the main benefits and risks of each arrangement.

6-1-Single Contract

A "single contract" procurement method is where the majority of the construction work required for the project is included in one contract, which then determines most of the cost of the project. The project may involve other small associated contracts for activities of different kinds, such as project management or consultancy services, site preparation, equipment supply or landscaping [8].

Any type of construction contract may be used for a single contract procurement method. Refer to Procurement Practice Guide *Contracts used for construction projects* for a discussion of the available options.

A single contract is suitable where [8]:

- the project requirements can be clearly defined and are unlikely to change after the contract is awarded;
- sufficient time is available to specify the requirements for the whole of the work before construction commences;
- there is no advantage in splitting work activities;
- one contractor can most efficiently manage the mix and scale of work;
- limited skilled resources are available for managing the construction work;
- The construction area can be clearly defined (where the site is occupied).

A single contract is the most common arrangement. It allocates more risk to the contractor than a multiple contract arrangement and should always be considered.

A single contract offers the following benefits [9]:

- most coordination risk is allocated to the contractor;
- a firm price for the work is available when the contract is awarded; and
- Less management resources are required for documentation, tendering and contract administration than for multiple contracts.

A single contract has the following risks:

- if the agency's requirements are not clearly and comprehensively described when the contract is awarded, the required outcomes may not be achieved or variations may be required, with associated delays and costs;
- changes to project scope after contract award, including reductions in scope, may be costly;
- cash flow requirements may not be met, since the contractor controls cash flow once the contract is awarded; and
- Programming is controlled by the contractor once the contract is awarded and if staging or early completion are required, acceleration costs may be incurred.

6-2-Multiple contracts

With "multiple contracts", the agency generally engages design and documentation consultants and awards a number of separate construction contracts of the "developed design" type for the construction work. These contracts can be either for different elements of the project ("work packages") or for different building trades ("trade-based packages"). Where developed design type contracts are used, the agency bears the risks of errors and omissions in the design, coordination of the many contracts and, usually, latent conditions. Multiple contracts can be effective in compressing the project program. Contracts can be let for separate elements of the work as documentation is completed, to implement a staged program or provide more time for the agency to develop the design. If multiple contracts are used, then the agency needs to decide on the appropriate type of contract for each package. Decisions must also be made as to whether the contracts will be for trade packages or for work elements, and whether these will be independent or integrated. Multiple contracts provide flexibility but have significant drawbacks because of the increased coordination risks for the agency. They also require more resources to manage the contracts than are required for a single contract. Unless there is a compelling need to use multiple contracts, a single contract [4]
is preferable.

A multiple contracts arrangement may be represented as follows

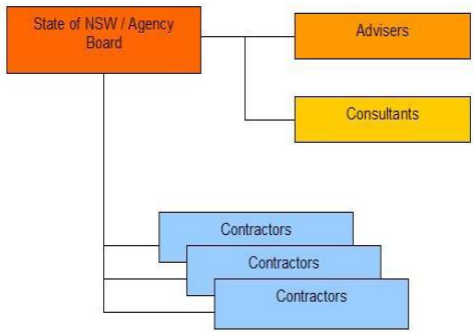

Figure (1) multiple contracts arrangement

Multiple contracts may be suitable for projects where: it is imperative that the construction work commence before the design can be completed and the agency's requirements cannot be defined adequately for the contractor to complete the design; [8]

- technological changes are likely to occur during the course of the work;
- the elements of the project involve different types of work suited to different contractors, and are located on independent sites;
- it is necessary to stage the work in order to manage budget or cash flow constraints;
- unresolved heritage, archaeological or hazardous materials issues are likely to affect the work;
- Site availability is limited, for example because it will continue to be occupied during the course of the work.

Multiple contracts offer the following benefits:

- changes to budget or service requirements can be accommodated by accelerating or decelerating, omitting or re-ordering work elements;
- the potential impacts of changing the design brief after construction commences are reduced
- there is greater capacity to react to rapid changes in technology and other developments;
- the agency retains more control of cash flow, through staging of the work packages;
- it is possible to meet time targets by commencing construction before the completion of design, or overlapping design and construction, or awarding long lead time contracts before the majority of the work is designed;

- contracts can be awarded after risks are defined, reducing risk allowances in tender prices;
- better control of the quality of the finished product is possible, through the direct selection of particular work or trade contractors; and
- Better control of the interfaces between construction areas and occupied areas of the site.

Multiple contracts have the following risks: [9]

- the likelihood of incurring delays and avoidable additional project costs is increased due to the agency's ability to direct changes as the work progresses;
- more management resources are required to prepare multiple tender documents, manage tender processes and coordinate and administer contracts, increasing overhead costs;
- cost forecasting and cost control are difficult since the costs are not known until the last contract package is let;
- the agency commits to construction contracts before knowing whether the project is affordable;
- the agency bears the risk of claims from every contractor for the acts and defaults of every other contractor;
- the agency bears the responsibility and risks involved in coordinating the work; and
- The agency accepts the risk of changes in market conditions during the construction period.

Multiple contracts offer can classified to [1,4]:

6-2-1-Work packages:

A project can be delivered using several discrete contracts awarded progressively as work packages. The work packages may be for separate elements of the work, for example separate buildings or facets of a building. Foundations, roadworks and services could be constructed under separate contracts as parallel activities. The silos, wharf and loading equipment required for a grain terminal could be packaged separately to attract better competition from specialist contractors. For a water supply augmentation, separate contracts could be let for the water treatment plant structure, the mechanical equipment, reservoirs, reticulation and pumping machinery, to accommodate different contractor competencies. A project manager and management team is needed for this type of arrangement. A construction manager (see Construction Management below) may be required.

The work package system is suitable for projects where: [4]

- separate work elements are independent in terms of timing, for example where staging is required or different parts of the work have different lead times or completion times;
- separate work elements are on different sites;
- separate work elements have significantly different natures and require contractors with different specialist expertise;
- Risk management requires some work elements to be completed separately to address the risks of subsequent work.

A Managing Contractor contract (refer to Procurement Practice Guide *Contracts used for construction projects*) can provide for these circumstances without the additional coordination risks and increased management resource requirements associated with multiple contracts. [9]

6-2-2-Trade packages

A project such as a building may be constructed using a separate contract for each different trade. Trade packages are interrelated to each other and the trade contractors are highly dependent on each other's performance. The success of this arrangement relies on a highly developed and detailed program for construction, and requires that design and documentation activities be completed to a schedule that supports the construction program.[1,4]

A construction management approach (see below) is essential if the project is to be delivered using this method. The work and trade package system is particularly used for building projects, often in combination with major work packages where: [1]

- there is insufficient time available to prepare documentation for a single contract or larger work packages;
- there is potential for the rapid development of technology in a trade/equipment area during the construction period, for example with special hospital equipment;
- the design brief, by the very nature of the facility, must be developed over time, with some areas to be addressed separately; and
- The work in a specific trade is an experiment or trial for new processes or technologies.

6-3 Construction management

Under a construction management approach, the work is split into work and/or trade packages which the agency contracts out to specialist contractors. The agency engages a construction manager to provide coordination services and often preliminaries and common services such as cranage, amenities and the

like. The engagement of the construction manager is generally on a "cost plus" fee arrangement. The construction manager generally does not undertake construction work, except possibly for providing common services, but oversees the activities of the various construction contractors. The construction manager may be engaged to [9]

- work with a design manager before and during construction, to assist in programming the design programming and addressing buildability issues;
- assist in determining appropriate contract packages for the project;
- assist in calling tenders and awarding contracts;
- program the construction work;
- direct the day to day activities of the construction contractors;
- process claims for payment and variations on behalf of the agency;
- Undertake the role of principal contractor (in terms of the Occupational Health and Safety Regulation).

The construction manager is commonly a construction contractor with expertise in managing construction projects. Under this arrangement, the agency enters into contracts with the construction manager and the many trade or work packages contractors. The agency must have the capability to manage the financial and administrative aspects of those contracts, including suitable procurement and delegation systems and sufficient internal resources with appropriate skills [1]>

The Department of Commerce is also able to undertake the role of construction manager. In this case, the Minister for Commerce may agree to act as the Principal in the trade or work package contracts, providing the agency with the required resources and systems

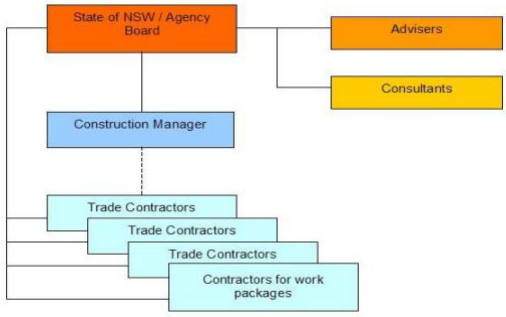

Figure (2) multiple contracts arrangement with Construction management

A construction management form of multiple contracts should be used where a project has the following requirements in addition to those applicable for multiple contracts:[8,1]

- it is imperative that the construction work commence before the design can be completed and the agency's requirements cannot be defined adequately for the contractor to complete the design;
- technological changes are likely during the course of the work;
- the project involves different types of work suited to different contractors;
- it is necessary to stage the work in order to manage budget or cash flow constraints;
- unresolved heritage, archaeological or hazardous materials issues are likely to affect the work;
- site availability is limited, for example because it will continue to be occupied during the course of the work;
- the separate contracts for work or trade packages are interdependent;
- the site is confined; and
- The separate contractors are to share services such as carnage, amenities.

Construction management has the benefits of a multiple contract arrangement and in addition:[9]

- The construction manager applies its specialist expertise to manage the contract package interfaces, call tenders and award contracts, program the work and control the budget.

Construction management has the risks of a multiple contract arrangement and in addition:

- There are a limited number of experienced construction managers.
- the success of the project depends on the quality of personnel provided and
- There is little incentive for a construction manager external to the agency to control costs.

6-4-Complex Project

Based on Literature review, there are many conditions for defining the Complex project, in order to determine the correct definition of the complex project. The study has summarized these conditions into: A large budget for the project.

- Diversity of financial sources to finance the project.
- It needs a large number of staff.
- It needs a long period of time.
- High technology.
- The volume of output is large.

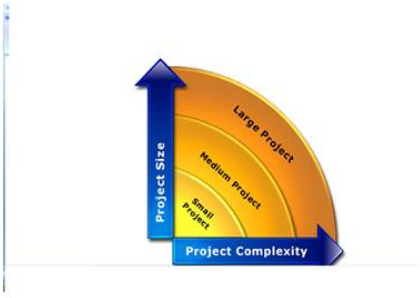

Figure (3) Complex Project

Many studies have mentioned, that there are many factors to be considered to ensure the complex project success such as [10].

- Proper planning of the complex projects where sufficient information should be defined to understand the scope of the project.
- The selected project team should be have an experience and skills to understand the project plans and be able to follow up on the tasks and activities of the project on an up-to-date basis.
- The project manager must understand the internal relationships between project activities and the processes to get the work done
- the appropriate choice for contract is the main issue that enhance to compete within time and cost

VI. Research Methodologies

A case study in GECOL Project is used to collect data and information from by Month progress reports during 2009-2011 and an interview has been done with Project teams during 2010 is used to assess risk multi package within the project**.**

7. GECOL CASE STUDY

In this research an interviews were conducted at the Gulf Power Plant Project, for assessing the risks that causes the delaying of the project and its overrun cost. The interviews where done with the project manager, Project Engineers, site Engineer, Accountants and other parties such as main contractors and consultant

7-1 project's data (before Force Major 2011)

• Project: Implementation of the Gulf Station project with the Combine cycle system
• Owner: General Electricity Company GECOL
• Consultant: Bechtel -
• Contractor: 5 contractors
• Contractual value: one billion two hundred and fifty dinars
• Duration of completion: four years
• Actual completion of the project: 34%

- Planning complete 34 months from start data 3-2009
- The actual implementation of the project (subject of the study) began after the handover of the site on 10-01-2007, [11]

7-2 Project parties

It was agreed to implement the Gulf generating station project in Sirte with a capacity of 1400 megawatts, according to the system of multiple specialized contracts (work packages type), [11,12]

• A contract for the implementation of civil works for the Gulf Steam Power Plant Project with the Turkish Gama Company.

• A contract for the supply and installation of steam turbines for the Gulf Steam Power Plant project with the Korean company Hyundai.

• A contract for the supply and installation of the main boilers for the construction project of the Gulf Steam Power Plant (Korean Doosan Company).

• A contract for the supply and installation of electrical and mechanical equipment for the construction project of the Gulf Steam Power Plant by the Daowa Company of Korea.

• Contract. Regarding the implementation of marine works for the construction of the Gulf Steam Power Plant (Greek Archirodon Company).

• Contract No. regarding the implementation of communications and control works with the French company Areva.

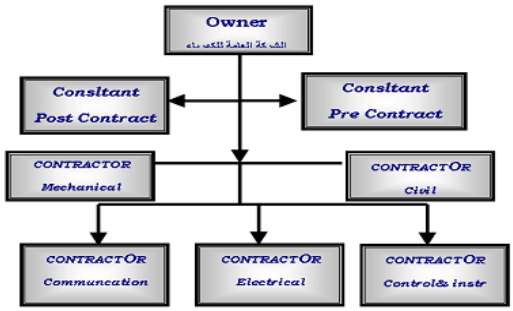

Figure (4) multiple contracts arrangement for the Gulf generating station project [11]

7-3 Project risk identification and assessment

After one year from the starting of the project, some disputes, obstacles and disputes appeared between the

GECOL and some contractors, this led to the suspension and delay of work on the project that has caused financial risk, which resulted in additional work to change the order borne by the General Electricity Company and an increase in the time period. Form the results of the interviews the risks can summarized as following [11, 12]:

• Some contractual terms are not clearly identified, which made the Bechtel consultant issue common definitions between the contractors and the project committee.

• The delay of payment of the invoices due to the large number of the monthly invoices for the contractors and the inability to pay the total value during each month to all the contractors, which caused some contractors to stop working. As a result, GECOL extended the time period for each contractor.

• The difficulty of coordination by the project committee in due to shortage communication meeting.

• The emergence of disputes between the owner and the contractor of control works regarding the connection with the national control center where it created a dispute with the project committee for non-compliance with the technical specifications (protocol) with the specifications of the control center

• Due to lack of scope definition at connection between the parties.

• Difficulty harmonizing between contractors in the implementation phase at the points of convergence, which resulted in the emergence of gaps (unresolved works) who provides the materials and who is responsible for their implementation, which led to the emergence of tendencies between contractors when joint works (each contractor tries to escape from responsibility at the interface points) and these works became relationship between contractors.

• lack of accurately define the scope of work of each contractor, which resulted in additional works (the civil works for the backup transformer bases Aux Transformer are not in the scope of the contractor's civil works, which necessitates the addition of these works by the company.

• The information network of the administrative building was not within the scope of communications work, which led to amend the contract

• The presence of errors during design in the protective equipment (Layout of Production Room and Control Room) made the consultant review the design work of prevention and control and make an adjustment to it.

• The emergence of new works that were not covered by the contractor's scope of work and became suspended

• Inaccuracy in defining the scope of work of each contractor during the contract (contractual errors, draw document contract).

•Land use issues

•Delays in contractor Mobilization and Transportation and customs delays

• Lack of timely Approvals

• Lack of onsite quality Assurance

•Weak communication between parties of project.

VII. Conclusion

One of the most important decisions made by any owner embarking on a Complex construction project is the choice of the appropriate project contracts and contractors, and to know how the project will be designed and constructed. There are two options for contracts, these are single and multi-package contract. An owner faced with choosing multi package contract method should consider several factors in making the decision, including: Project size, Schedule, Owner's resources and capabilities. When these factors are properly evaluated, a good decision can be made on the selection of a multi package that best fits the goals and requirements of the owner and the project.

The lack of experience of the consultant, in preparing design works, especially the specialized multi-contract interface point's project, also Negligence in some clauses of the contract due to the lack of experience of the General Electricity Company in defining the scope of work for each contractor, especially points in the joint works.

• Lack of a single overall Project Schedule to follow up

VIII. Recommendations

Recommendations that have been reached to ensure the success of project implementation, the project system of specialized contracts are as follows:

• The need to complete the preparation and approval of designs and project documents accurately, and to ensure their integrity and clarity before contracting for implementation.

• Giving the designer priority in assigning to supervise the implementation (assigning one consultant for the design and follow-up process) due to the lack of clarity of the design sometimes, its complexity or novelty, and its lack of understanding by the contractor, which causes delays.

• No delay in approving and paying the dues of the other parties to the project, such as the contractors and the consultant.

• Emphasizing the need for implementation contracts to include clear definitions of the duties and rights of each party.

• Drafting the terms of the contract clearly and in detail and not forgetting any clause or part of it.

• Use the appropriate cost reimburse contract, where the introduction of a number of contractors is the desire for early implementation

• Using project management techniques and programs to follow up the contractors' schedule.
• The owner must study the risks of the project before contracting it to avoid increasing the time and cost
• Failure to study the risks results in many conflicts between the owner and the contractor, which may result in stopping the project and the loss of both parties
• Failure to study and analyze risks means failure to manage projects, whether for the owner or the contractor
• Less investment opportunities in the absence of conducting these studies and the decrease in the rate of profit for the investor

References

[1]. The Construction Management Association of America, CMAA, "Multiple – prime Contracting Description ", August, 2012.
[2] أشرف محمد الأسطى(202) استخدام التحليل النوعي للمخاطر لتقييم المخاطر التي تواجه تطبيق أسلوب العقود المتعددة في المشاريع الإنشائية رسالة ماجستير غير منشورة في إدارة المشاريع الهندسية – أكاديمية الدراسات العليا.

[3] عمران عبد الرحمن (2015)، " تأثير استخدام العقود التخصصية على إنجاز المشاريع بليبيا " رسالة ماجستير غير منشورة في إدارة المشاريع الهندسية – أكاديمية الدراسات العليا. [4]. Criteria for contractor selection, Zedan hatush & Martin Skitmore, Construction management and economics, 1997 - Pages 19-38 [5]. Contractor selection using multicriteria utility theory: An additive model, Z. hatush, M. Skitmore, Building and Enviroment, 1998, Pages 105-115

[6]. Evaluating contractor prequalification data: selection criteria and project success factors, Z. hatush, M. Skitmore, Construction management and economics, 1996 - Pages 129-147

[7]. Assessment and evaluation of contractor data against client goals using PERT approach, Z.hatush, M. Skitmore, Construction management and economics, 1997 - Pages 327-340
[8].Phil Loots and Nick Henchy, (2007), "Construction Management
(The Single Contracts & Multiple Contracts), Washington DC.
[9]. Pratik Ghosh, "Single Contracts. VS. Multiple Contracts ", April 2012, New Delhi.
[10] -Toom Kristofer, (2014), " The Conflicts in Multi Contracts " ,2th Conference Hanover.
[11] –Month progress reports during 2009-2011. GULF power plant project
[12] Interviews with Project teams during 2010.