

## Types of risk in oil field EPCC construction projects in Sudan

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### Abstract

**Background:** This paper, discuss the major risks identified in EPCC projects executed in Sudanese oil field and affect the project's objectives. This risk identification process is a part of risk management.

**Methods and Materials:** descriptive study design based on 17 individual interviews face to face, supported by a questionnaire covered the study population, and Study case project (Provision of EPCC for Export Pipeline System, 2013) documents reviewed for risk register, the interviews conducted on January, 2018.

**Results:** Risk identification is an iterative process new risks may evolve or become known, throw this study the researcher was able to identify external risk factors that affect the project as the project progresses through its life cycle from outside boundaries for example the financial and economical risk, political and legal risk,, etc, or internal risk factors like scope changes, contractual failure, time and cost overrun organizational failure,, etc. The process should involve all of the project team so they can develop and maintain a sense of responsibility and ownership for the risks and associated risk response actions. Stakeholders outside the project team may

provide additional objective information. The key benefits of this process are the documentation of existing risks and the knowledge and ability it provides to the project team to anticipate events

**Key Words:** Risks, Risk Identification, Risk Management, Sudan oil field, EPCC Contract.

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## Introduction

Project risk management is the art and science of managing risks caused by unforeseen changes (uncertainties) which may require deviations from the planned approach and may, therefore, affect the achievement of the project objectives (Rahul Bali & Prof M.R Apte, 2014). Most of the textbooks in project management like (PMI, 2009), (PRMIA Institute, 2008), (ISO 31000, 2009),(Dale F. Cooper, Stephen Grey, Geoffrey Raymond and Phil WalkerGopal, 2005) and (Joseph, 2014) agreed on the risk management process definition as its involves systematically planning, identifying, analyzing, response and controlling risks.

Constructions in oil fields are high investment projects, associated with higher risk than other industries especially in Sudan make the risk identification process vital to reaching the project objectives, There is a huge risk forced on oil field construction projects in Sudan started from the challenging economic conditions since the secession of South Sudan in 2011, and the associated

loss of the bulk of oil production and exports (IMF Country Report, 2017). That was followed by Heglig crisis on April 10, 2012, when the South unilaterally occupied the Heglig oil region. The government of Sudan, GNPOC and the contractors working in Heglig acquired huge losses in assets and facilities. Following the secession Sudan has had to confront a wide-ranging set of issues that have included a decline in the importance of oil as a key source of growth for the economy, a heavy external debt burden, and more recently, a highly volatile macroeconomic environment characterized by major economic imbalances, and continued internal conflict (African Development Bank Group, 2016).

All of this factors forces risks that affect the EPCC projects in Sudanese oil fields, and moreover, the organization faces internal risk factors that associated with the organizations' process assets and the organization culture or related to the high employee turnover rates and the cultural factors, etc.

### **Materials and methods**

This is a descriptive study design based on individual interviews face to face, supported by a questionnaire covered the study population, and Study case project (Provision of EPCC for Export Pipeline System, 2013) documents reviewed for risk register, The study aims to identify the risk that affects the EPCC projects performed by construction organizations in oil field projects in Sudan,

The study interviews conducted in January 2018. All the study population mainly located in Khartoum state (the capital of Sudan),

**Population under the study:**

At the time this study was conducted there were only 8 EPCC approved contractors construction organizations working in oil fields all of their central offices are in the city of Khartoum all of them were interviewed and their feedback included in the study. Oil operator in Sudanese oil field at the time of this study was 8 central offices are in the city of Khartoum and the 8 of them were interviewed and their feedback included in the study, and the Oil Exploration & Production Authority OEPA which is the Sudanese government body which managing the policies and approvals.

**Ethical Consideration:**

Project managers in the construction organization, managers of the facilities departments in the oil operators, have been clearly informed about the academic purpose of the study. And assured that, the data provided will not be used in any way to support a decision; or harm against them.

**Results**

Risks in EPCC projects encountered right from concept to commissioning. Commonly encountered risk sources are commercial risks, design risks; natural disaster risk, cost overrun risk and time overrun risk the following table1 covered the main project risk

The data presented here was collected by the researched throw serials of interviews with the study population.

Figure 1 and 2 show the classification of the internal risk types and the external risk types as per of the respondents.

**Table 1. Souce of risk**

<b>External Risk</b>		<b>Internal Risk</b>	
Financial and economical risk	E1	Scope change	I1
Political and legal risk	E2	Contractual failure	I2
Design and specification risk	E3	Time overrun	I3
Safety and health risk	E4	Leadership and organizational failure	I4
Acts of God	E5	Cost overrun	I5
Ecology risk	E6	Resource failure	I6
Cultural	E7	Quality and specification failure	I7
Market inflation	E8	Technology change	I8

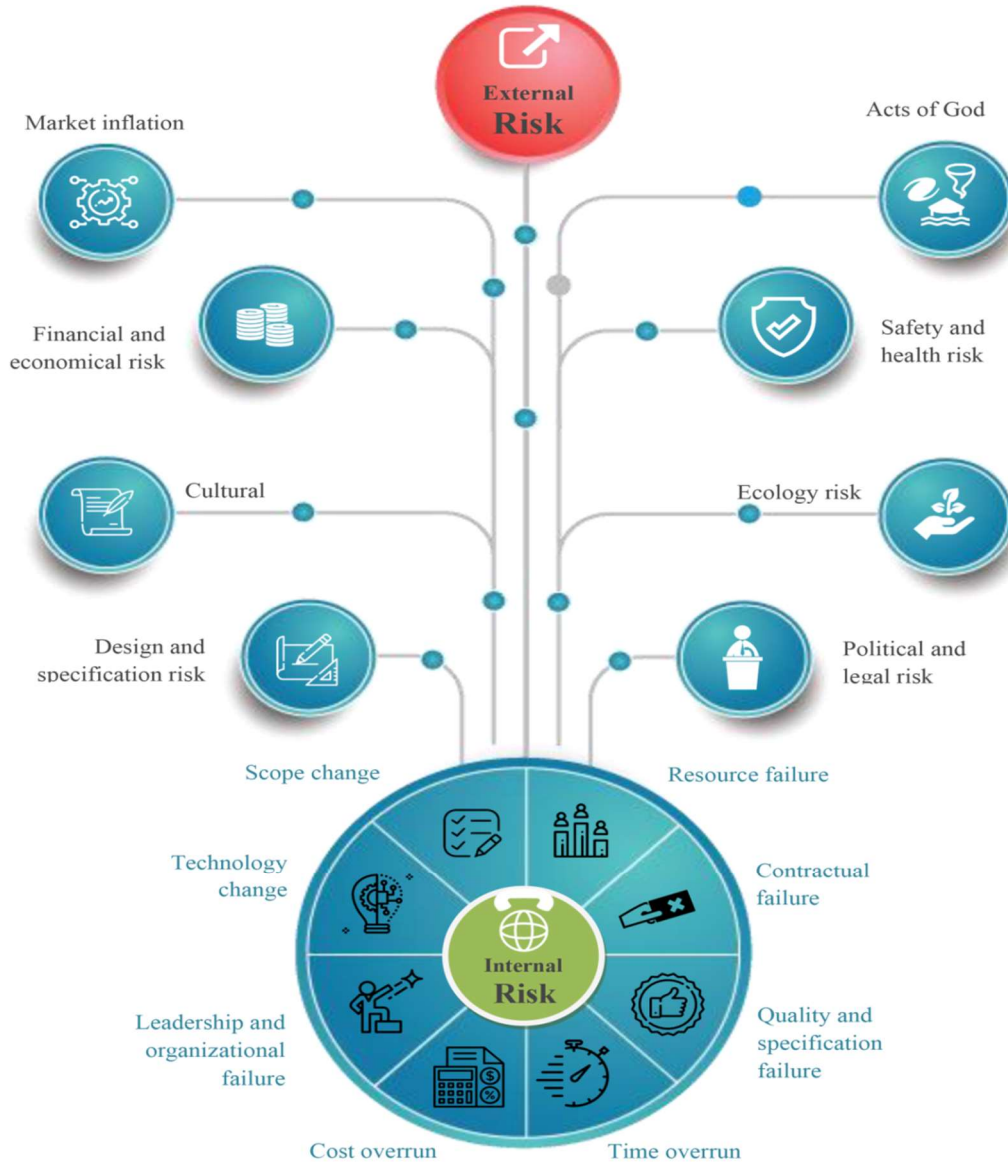
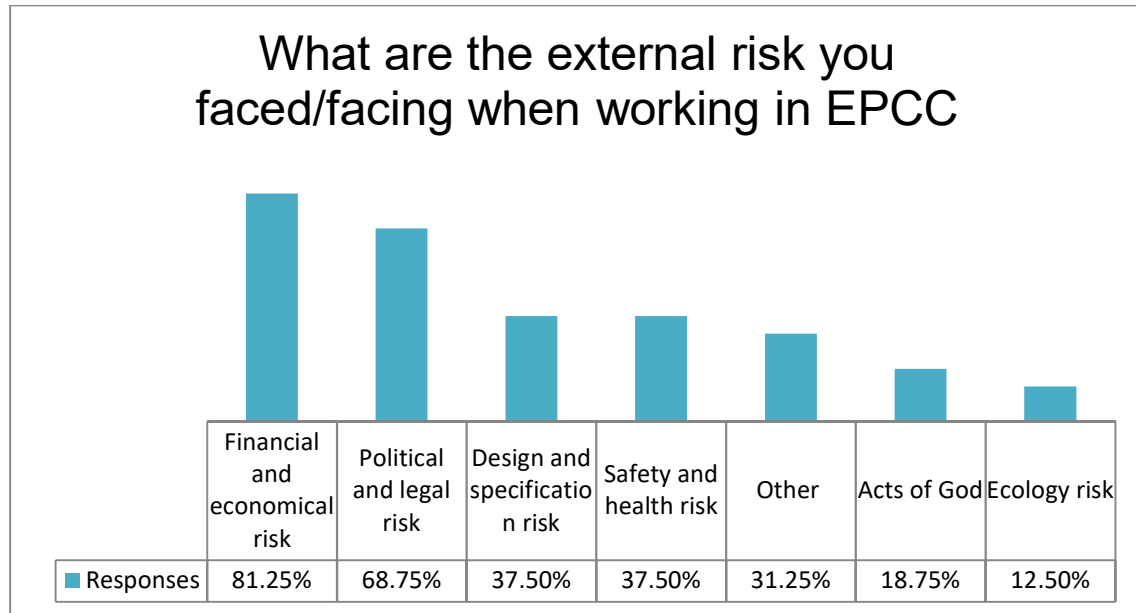
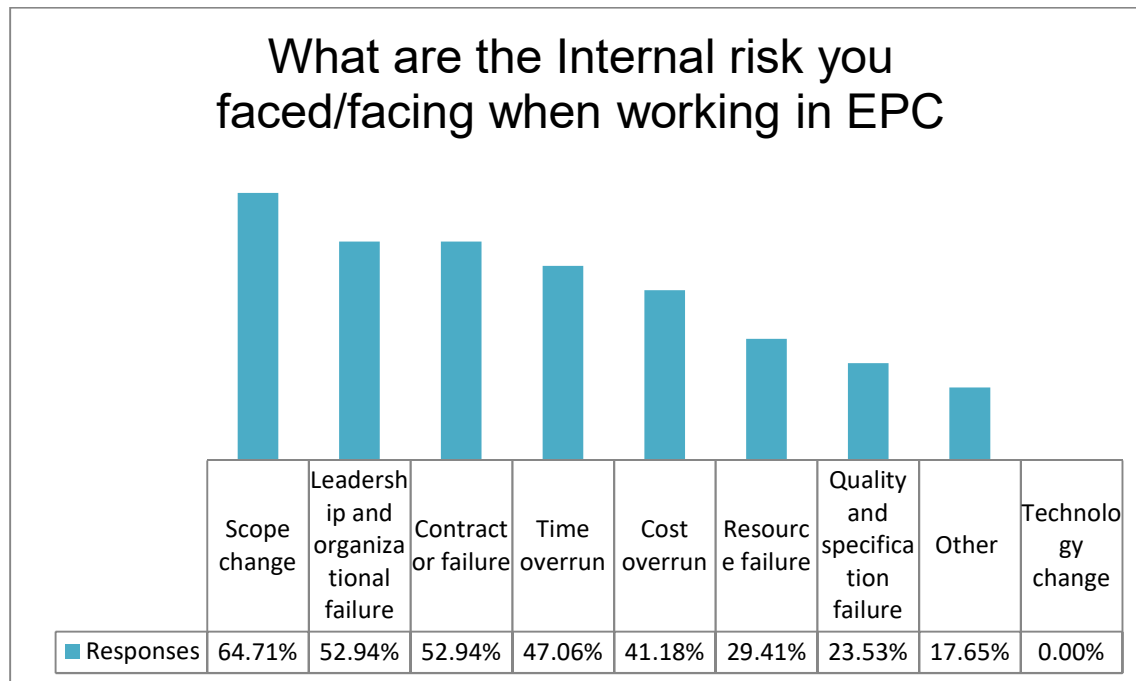


Figure 1 sources of risk.



Others; cultural, environmental and market inflation

**Figure 2 External Risk Types.**



**Figure 3 Internal Risk Types.**

Others; lack of project management knowledge lack of team working, no clear PM Plan, no risk register, Hiring unprofessional staff.

**Table 2 Event/ issue log; provision of EPCC for export Pipeline system**

Issue/ Event	Causes	Impact	Risk Type
Engineering Phase			
Late issuance and approval of Engineering Deliverables	Limited experience of the Engineering subcontractors in the oil & gas sector,  Frequent changes advises by the operator	Re-work of mostly all the engineering deliverables as poor engineering deliverable quality were produced by the subcontractor  Project schedule delay in both engineering and procurement phases	E3,I1,I2,I3
Late issuance and approvals of interface engineering documents	Many engineering interfaces between the different EPCC contractors/ miss-management of interface between contractors	Several design changes which has significantly delayed the overall project schedule	E3,I4,I3



**Table 3 Event / issue log; provision of EPCC for export Pipeline system**

Issue/ Event	Causes	Impact	Risk Type
Procurement Phase			
<p>Most of the material and equipment received at site were behind planned schedule</p>	<p>Difficulties in placement of hard currency transactions to different vendors</p> <p>Late tax exemption approval from owner and relevant governmental authorities</p> <p>Transportation schedule to site coincide with annual rainy seasons/ Frequent road blockages and security escort requirement</p>	<p>Significant delays on most of equipment/ material erection and installations</p> <p>Unnecessary demurrage &amp; Port charges to the contractor</p> <p>Delivery time from port Sudan to site was significantly overshoot due to bad road condition</p>	<p>E1, E2, I4, I5, I3, E6</p>
<p>Some of the project materials/ Equipments were damaged during land transportation</p>	<p>Packing was not intended for long distance gravel road condition</p> <p>Poor handling during land transportation</p> <p>Forwarder was not aware of the sensitivity of his transported material</p>	<p>Equipment and materials arrived at site with major defects and require major repair by vendor</p> <p>Major delays to the construction schedule due to re-work need to be done to the damaged equipment</p> <p>Additional time and cost incurred by the contractor due to equipment damages</p>	<p>I6, I2,I3,I5,I7</p>

**Table 4 Event / issue log; provision of EPCC for export Pipeline system**

Issue/ Event	Causes	Impact	Risk Type
Construction Phase			
Delayed Achievement of the construction completion dates (MCD)	<p>Frequent construction activities stoppages incurred by locals at the area.</p> <p>Poor Security Status all through project construction phase</p>	Contributes in Construction schedule delay	E4,E7, E2, I3
Slow progress of construction activities at site	<p>Major construction work was fall in rainy season</p> <p>Construction activity conflicts due to interfaces with the other EPCC contractors</p> <p>Late approvals of AFC documents due to interfaces with PE operator.</p>	Contributes in construction schedules delay	E6,I2,I4,I3

**Table 5 Event / issue log; provision of EPCC for export Pipeline system**

Issue/ Event	Causes	Impact	Risk Type
Commissioning			
Delayed pre-commissioning and commissioning phases of the project	<p>Last moment changes in the owner's production profile and total throughput data</p> <p>Absence of owner's proposed clear operational scenarios.</p> <p>Absence of firm agreement between the owner and the crude shipper (PE C) which led to late tie-in approvals.</p>	<p>Flow study/Design re-work</p> <p>Overall project schedule delay.</p> <p>Delayed project completion date</p>	E3,E2,I1,I2,I3,I7

**Table 6 Event / issue log; provision of EPCC for export Pipeline system**

Issue/ Event	Causes	Impact	Risk Type
Others			
Insufficient project Team/ staff	<p>Late punching of some disciplines in the project team</p> <p>procurement/ logistics presented part-time in the project team</p>	<p>Delayed activities/ work packages.</p> <p>Late/ delayed procurement and logistics activities</p>	I6, I3,E7
Delayed & late payment of the contractor's progress invoices/ claims	Owner has not made available enough project fund timely	Major set-back in project progress was experienced	E1

## Discussion

Project Management is effective and efficient only when there is awareness of risk exposures and method of handling risks, the identification and initial assessment of risk associated with a project or contract is a necessary first step before analysis and response. In the early stages of appraisal of a project, it is of direct assistance in establishing project constraints and provides useful data to assist the choice between different projects. Later this identification of risks provides a basis from which the appropriate organizational structure, tendering procedure, type of contract, and risk allocation through the contract documents can be formulated. The contractor, bidding for work, will need to identify both the risks allocated to him in the contract and also those inherent in the nature of the work in order to prepare his EPCC tender. Lists of the primary sources of risks in both project and contract are given under Applications of risk management. It is worth stressing that the ultimate burden of responsibility for the identification of risks and their subsequent treatment rests with the EPCC contractor. All stakeholders should be motivated to take this responsibility by the threat posed to the achievement of the project objectives in terms of cost, time and quality performance.

A major risk with the huge consequences on projects is the financial and economic risk usually has a direct effect on the project objectives and results creates more risk in cost overrun, time overrun and quality failure the contractors and the operators related this risk to the major changes due to the south Sudan separation losing fields decrease the operator's consortium budget and value. As will the operators and the contractors respondent stated that the oil international prices drop affect the financial situation of the oil operators and the budget allocated to each project and the received cash from each owner 'cash call' then the operator payment schedule and the high

probability of delay finance large-scale project in table 6, due to that the contractors find them self' forced to finance the project phase and in some cases the whole project which generate a financial deficiency for the contractors and the consequences affects the project objective. The contractors also commented that the risk forced by the US sanctions impacted the availability of tools & equipment this risk is relived after the US lifts sanctions on Sudan October, 2017. But still the contractor find that Central Bank of Sudan process for the payment transfer for the procurement activities is a very long in inconvenient process. Another financial and economic risk identified by the contractors with a high impact on construction projects is the local currency exchange rate and inflation which results in the contractors refuse to take the local currency.

The OEPA, some of the operators and contractors defined the political risk as a huge impact as well on project objectives and even more on the reservoir capacity of the field, as most of the decisions driven by political concerns from the OEPA impacted by fast-track projects which creates issues in the long run in the field capacity and the total production achieved from the reservoir. The political force allocate the available cash follow for the most urgent project and stop working on some projects by the contractors which consequences by time overrun and cost overrun or in sometimes jeopardize the quality stander to maintain cost or time constraints depends on the political force on the project and the operators payment received, which causes delay and cost impact on the other projects. In some cases the political and legal risk appears in terms changes in policy from the exportation policy to the road charges, lack of strategic plan from the operators and the OEPA impact in project scope changes as appeared in table 2 in the engineering and table 5 commission and in both cases re-work and time overrun acquired, the contractors added that forcing unrealistic projects schedules, or fast-track the projects.

Design and specification risk the unclear estimations or false information about the reservoir capacity that's used as the basis in all of the field's projects, for example, the pipeline capacity forecasting for the field as appeared in table 2 and table 5 changes in the owner's production profile and total throughput data and the contractors had to re-work the design and the whole project schedule was delayed. unclear scope provided by the operators to the contractors this risk must be identified during the Hazard and Operability Analysis (HAZOP) which is a structured and systematic technique for system examination and risk management (PQRI, 2015). In particular, HAZOP is used as a technique for identifying potential hazards in a system and identifying operability problems likely to lead to nonconforming products all of the main stakeholders must contribute to the HAZAP meeting.

Safety and health risk security hazard in fields located South and west of Sudan as shown in table 4 frequent construction activities stoppages incurred by locals at the area and poor Security conditions in the field, in addition to the job hazard. the OEPA respondent find that the operator not following the process by closing the project without proper hand over or changing the scope without the OEPA approval these cases were solved by applying a cost deduction and liability by the OEPA over the contractors, and the contractual failure risk shown in table 2, table 3 and table 5 when the subcontractor performance that affect the main contractor performance and the project objective.

Another risk identified by the project managers of the contractors is the risk of leadership and organizational failure like the late punching of the required resources in table 6 or and the functional organizations' approval process that may cause the delay in the project schedule, and the organizational culture, as well as the employee cultural factors, must be identified especially

in multinational organizations. Resources refer to men, materials and machinery are the Achilles' heel of all construction activities, the project managers of the contractors and the operators complained the construction Staff high turnover rate and recruitment issues in term of availability of qualified employees, equipment maintenance processes, and the source of the materials equipment and tools used in the field and its quality and the logistics process failure in table 3. The operators identified the contractors work quality as a risk its self as will the risk acquired as an outcome of the tough price negotiations for example dropping the quality.

If time overrun occurred, the result linked cost overrun for the overall project. The delay in contract duration is the most common risk in the projects in Sudan oil fields, the OEPA respondent suggested that the contractor proposal is mostly not realistic and very optimistic to win the contract. As well the contractors complained about the internal approval process by the operators' delays if approvals needed for new vendors impact in project schedule delay.

## **Conclusion**

In order to reach the project objectives the stakeholders must collaborate in risk identification process and it's the project manager responsibility to facilitate and encourage all of stakeholder's to contribute in risk identification process.

Risk identification process, if developed with the participation of the project team enables effective management of the project. Fast changing, unstable, risk-prone environments cannot be stopped; however, managers can prepare themselves for the resulting impacts of risks to their project. This, in turn, reduces exposure to project time, cost, quality and performance risks.

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