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# AN EXPLORATION OF THE TECHNIQUES FOR MANAGING CONSTRUCTION PROJECTS RISKS IN THE OIL & GAS SECTOR

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## ABSTRACT

The construction industry is wide and varied, with participants carrying out several activities, especially in the Oil & Gas Sector. This makes the sector prone to several risks. This study establishes the strategies for managing construction risks in Nigeria. A secondary data collection method was used, comprising past works on risk drafted from web sources, articles, and journals. The findings revealed that risk is an uncertainty that can be positive or negative. The major types of risks confronting the construction industry are physical, political, and economic, while technical risks are minimal due to the continuous emphasis on training. It was concluded that positive risks can be enhanced while negative ones can be mitigated or eliminated using a defined risk management process of planning, identification, analysis, and control.

**Keywords:** Risk, Risk Management, Contingency, Insurance, Oil and Gas.

## 1. INTRODUCTION

Risk is inherent in all spheres of human activities because all aspects of human life involve decision-making; hence, there is a need for proper risk management. According to Covello and Mumpower's (1985) article and Grier (1981), the first signs of risk management go back as far as 3200 BC in the Tigris-Euphrates valley with a group of people called the Asipu who worked as risk consultants through divine assistance from the gods.

The construction industry is risk-prone and has a reputation for bad work (Raftery, 1997). The decision to embark on a building project has some inherent risks because it employs humans, nature, and other resources in the conception, design, construction, and maintenance of the building and civil engineering works, making it one of the riskiest of all business types (Clough and Sears, 1994). In the study of Akintola S. A. and Malcolm J. M (1997) on how the construction industry perceives risks, they found that management of risk is important to construction activities in loss minimization and profit enhancement. Contrary to other industries, the degree of uncertainty differs and is enormous for construction works (Gbolagun, 1998; Okunbor, 2008). Recently, the form, nature, mode of occurrence, and effects of risks in construction works are gaining more traction due to the serious effect it has on the time and cost of construction projects.

Actualising projects from the conceptual stage to their completion is complex and time-consuming since it involves different stakeholders with varying degrees of skills and interests who come together to achieve the project goal despite the overwhelming external influences outside their control. Hence, the high risk is involved. Risk is important to contractors as well as clients and consultants in the industry; however, the problems of risk assessment are complex and poorly understood in practice (Laryea, 2008). Jagboro and Ojo (2005), however, explained that construction activities are influenced by a variety of external and internal factors. Smith (1999) observed that projects are heavily influenced by a variety of factors that are external to them. Therefore, change is a usual occurrence in construction work, which is regarded in terms of how it affects project cost estimates and programmes.

According to Sir Michael Latham (1994), no construction project is risk-free. Project risks can be shared, transferred, accepted, minimized, managed, or ignored.

BS 6079 (British Standards Institution, 1996) sees risk as the uncertainty inherent in plans and the possibility of something happening that can affect the prospects of achieving business or project goals. Therefore, risk can be defined as the likelihood that an unfavorable result may happen. Risk and uncertainty, depending on how they are managed, can create opportunities or result in challenges. When these risks are ignored, they lead to;

a. Increase in costs
b. Decrease in profit
c. Loss of Goodwill and;
d. Business Collapse

It has been known that Project risks also include;

a. Quality of work
b. Work safety
c. Cost management

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d. Time management (programme/schedule)
e. Management of scope
f. Management of change
g. Procurement issues
h. Human Resource Management
i. Communication management
j. Management of Stakeholder Influences

Risk management entails the process of identifying issues that could have a significant negative impact or create opportunities in your construction activity, evaluating and maximising or minimising the potential effects of those risks.

Construction risk management has been adjudged to be paramount in achieving the objectives of projects in terms of time, cost, quality, safety, and environmental sustainability.

According to Nerija, B. and Audrius B. (2012), construction risk management process includes the following:

a. Identification
b. Assessment
c. Mitigation
d. Risk Monitoring

Risk management is also important for due following reasons;

a. Minimising uncertainty or increasing opportunities on projects;
b. Better decision-making – risk management can ensure that strategic decisions are well informed.
c. Focusing on critical problems within a project, like risks associated with design, construction, and maintenance.
d. It enables you to balance risks with low and high potentials.
e. Once risks are identified, handling such risks can be assigned to specific individuals within the project team.
f. It helps to provide partners with a common purpose.

## 2. AIM AND OBJECTIVES

This study establishes the techniques for managing construction project risks in the Oil and Gas Sector in Nigeria, with the view to suggesting efficient ways of tackling risk issues that will lead to greater satisfaction.

To meet the aim of the study, the following objectives would be achieved;

a. Understand the key concept of risk.
b. Develop ways of identifying project risks.
c. Understand ways of managing construction project risks.
d. Outline strategies for mitigating construction project risks.

## 3. LITERATURE REVIEW

Construction activities carry substantial risk since, by their nature, they are complicated and there are some unknown factors involved in construction operations (Akintoye and Black, 1999). Ashworth & Hogg (2002) observed that every construction project contains risks from various factors, including external influences and operational aspects, as well as commercial, design, and construction factors. Therefore, to achieve project objectives, there is a need for effective management of risks.

Understanding the Concept of Risk

According to Nasir et al. (2003), risk is a lack of predictability about structure, outcome, or consequences in planning or decision situations. Edward and Bowen (1998), further stated that risk is the chance that an unfavorable event will occur within the specified time. Zayed and Chang (2002) described risk as the probability of actual or potential problems that may impede project performance leading to partial or total failure throughout construction or usage. According to Yoe (2000), risks are conditions under which certain results may happen while at least one of them presents an undesirable effect. Greene (2001) stated that risk has no single definition yet offered his interpretation of risk components: Risk = Hazard × Exposure.

In traditional terms, risk means either the prevention or the reduction of unfavourable outcomes whenever possible. The field of project management has witnessed a continuous discussion between practitioners and academics regarding the appropriate approach to risk perception. The word ‘risk’ has its common usage to convey only the negative aspects, according to Hilson (2002). Traditional language in standard dictionaries and technical terminology shows negative connotations, yet some professional bodies, along with standards organizations, have evolved their risk definitions to include positive and negative aspects. Analysing risk from a project management viewpoint based on PMI`s Project

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Management Body of Knowledge (2013), it is an uncertain event or condition that affects project objectives, including scope, schedule, cost, and quality.

Construction projects face risks that impact their outcome and specifically time and budget. All construction projects of any size contain inherent risks as well as uncertainties. According to Bufaied (1987), risks in construction works mean variables that affect construction project processes, thereby creating uncertainty about cost, duration, and quality outcomes. Each phase of project development, according to Ashworth and Hogg (2002), follows a defined sequence from start to finish, and every phase includes some level of risk. Perry and Hayes (1985), Stewart and Fortune (1995), as well as Lam (1999), also confirmed this in their study. Tar and Carr (2000) pointed out that too often, if risks are not dealt with satisfactorily, the industry suffers poor performance. Risk management techniques should be integrated into construction project cost and time estimation to achieve better results to avoid excessive overruns. Smith (1999) noted that successful projects would show better performance if companies integrated risks into their project control and quality systems.

Risk Management

Edward and Bowen (1998), posit that risk management cannot occur without first understanding the nature of risks. Ojo (2005), recognized design changes during construction, inadequate specification, local disturbances, poor site investigation, construction errors, design errors, and weather conditions as the primary factors for risk assessment. The research carried out by Dada in 2010 highlighted that financial, physical and political risks were of great importance in the construction projects in Nigeria. This is because the construction industry as well as other sectors have been in the process of going through a lot of turmoil due to the political and economic crises that are being witnessed in the country.

If risks are well attended to, there will be a reduction in cases of project duration overrun and abandoned projects, Uher and Toakley (1999), identified certain structural and cultural factors related to the management of risk at the inception of a project and observed that although risk management was well known to most industry practitioners, at the conceptual level it was low; qualitative rather than quantitative analysis approaches were often employed; thus, the overall application of risk management was hindered by low levels of knowledge and skill, due to lack of commitment to training and professional development.

Risk classification is important in risk management process which is an attempt to organize the numerous risks that may affect a construction projects. As stated in PMBOK (2013), Project risk management includes activities such as risk management planning, identification, analysis, developing a response plan, monitoring and controlling risks in a project. This is an ongoing and continuous process and should be done all through the project. It is important to note that risk is not always negative, there are opportunities and there are threats. The opportunities are positive risks, whereas the threats are negative risks. Thus, the main goal of project risk management is to reduce the potential and impact of unfavorable outcomes while maximising the chances of favorable results.

PMI (1996), pointed out that the following should be determined when considering risk;

a. The chance that it will occur
b. The range of possible outcomes (consequences or amount at risk)
c. The expected time (when) in the project life cycle.
d. Expected frequency of risk events from a source (how often).

In this paper, the five risk management processes identified by PMBOK (2013) are;

a. Plan Risk Management
b. Risk Identification
c. Qualitative Risk Analysis
d. Quantitative Risk Analysis
e. Risk Responses
f. Monitoring and Controlling Risks.

a. Risk Management Planning: This is the process of defining how to conduct risk management activities for a project. The project manager, the project team and other stakeholders can be involved at this stage to specify how the risk process will be organized and implemented for the project. This process is initiated when a project is being planned for and should be done at the beginning of the project. To plan for this, the project teams hold planning sessions to come up with the risk management plan. According to Nerija B. and Audrius B. (2012), the risk management plan includes; Methodology, Roles and Responsibilities, Budgeting, Timing, Risk categories, Definition of risk probability and impact, Probability and impact matrix, Revised stakeholder tolerances, Reporting formats and Tracking.

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b. Risk Identification: In qualitative risk analysis, risk management acts as a means to register the properties of each risk (Kuismanen et al., 2002). This is the process of defining the possible threats to the project and recording their characteristics. To begin the process of identifying the risks, Garg (2005), stated that the following methods can be used; grouping them into controllable and uncontrollable risks (Flanagan and Norman, 1993). The risks that a decision maker can willingly get involved with and the results can be directly influenced are called controllable risks while the risks that cannot be influenced are uncontrollable (Chege & Rwelamila, 2000). Secondly, the identification of risks consists of a method used to generate risks, and guides on what those risks should look like when written down (Isaac, 1995). This should involve all stakeholder, review of literature, research on similar projects done earlier, and talking to non-stakeholders. Risk identification is an ongoing process because new risks may emerge or be identified as the project progresses across the project life cycle.

c. Quanlitative Risk Analysis: Prioritization for further assessment or action occurs during qualitative risk analysis by combining risk probability with impact levels. This method provides the decision-making process with increased certainty (Estate Management Manual, 2002). It requires generating a concise list from prior risk identifications. Risk identification leads to qualitative risk analysis which provides a personal evaluation of the detected threats. The general approach to ranking risks uses a 1-10 scale or High, Medium, and Low levels. Watch lists emerge from this analysis together with ranked relative priorities and causes of risks as final products.

d. Quantitative Risk Analysis: This process of evaluating how risks affect project objectives requires a numerical analysis known as Quantitative Risk Analysis. The approach of quantitative risk analysis involves determining factor occurrence probabilities and establishing their corresponding impact values before determining the severity levels of each factor (Abu Rizk, 2002). The project undergoes a numerical evaluation of its highest risk probability and impact levels (amount at stake or consequences) to set cost and schedule reserves while identifying crucial risks and establishing realistic project targets (Ahmed et al, 2001). Most analysts tend to choose the quantitative methods because they require probability and impact assessment for the project's most crucial risks (Ahmed et al, 2001). The analysis requires the exact data needed to perform qualitative risk analysis at this stage.

e. Plan Risk Responses: The goal of this process is to create strategies that enhance opportunities while minimizing threats to project goals. Each risk response requires a designated owner who will oversee the implementation of agreed-to and funded risk response activities.

PMI (2006) recommends three possible risk responses for each threat:

a. Implement preventive measures to eliminate potential threats before their occurrence
b. Lower threat probabilities along with their impacts while simultaneously boosting opportunity probabilities with their impacts
c. For the remaining (residual) risks
d. Develop contingency plans for implementing risk response actions when the risk event occurs.
e. Fallback plans should be established in case contingency plans fail to deliver results effectively: Fallback plans.

f. Monitor and Control Risks: The process of risk management involves putting risk response plans into action while tracking identified risks and monitoring residual risks and new risks alongside evaluating the effectiveness of risk process across the project duration. The risk management process involves choosing alternative approaches and establishing contingency or fallback plans along with corrective actions and project management plan modifications. At this stage, you need the Risk Register, Project Management Plans, Work Performance Information, and Performance Reports. The risk assessment and audit techniques together with variance and trend analysis status meetings and reserve analysis serve as the fundamental tools for this process.

Strategies for Negative Risks or Threats

a. Avoid: Project or alternative replacement needs to be reappraised when risks have such severe consequences that they cannot be managed through other strategies. Risk elimination through cause identification and removal of the source of the threat (e.g., Work package removal or personnel elimination). The complete elimination of risk occurs through two methods: When a contractor fails to bid for a project and when the owner decides not to fund it (Baker et al. 1999).
b. Transfer: According to Potts (2008), the risk should be passed on to those who can handle it. A threat negative impact along with its ownership gets transferred to a different party when implementing this approach through insurance purchases and performance bonds and guarantees and warrantees. The construction industry primarily responds to risk through this method according to Dada (2010). He further stated the industry is not capable of handling the issue of risk on its own. The knowledge about construction project insurance premiums is insufficient to remove all risks but providing some cost coverage is also important (Tummala & Burchett, 1999). Darnall and

Preston (2010) explained that risk shifting and negative impact transfer a suitable solutions for risks that are outside project management's direct control such as political matters and workforce strikes.

In addition, it means that the probability and/or effect of a negative risk event is within an acceptable threshold limit. Different measures have been recommended to minimize the effects of risk inherent in construction projects after they have been identified (Denerberg et al., 1974; Perry and Hayes, 1985; Norris et al., 1992; Thompson and Perry, 1992). Among these, the following are mentioned:

a. Contingency Sum: Perry and Hayes (1985), defined contingency sum as the sum of money set aside to help in the event of increased costs or delay. The inclusion of these in construction project estimates is to help minimise the impact of risk and uncertainty in construction projects. However, in most cases, the amount set aside is usually done by application of a percentage of the capital cost. It may not be fit for all projects to include a certain percentage. To address this, Dada and Jagboro (2007), in their study, suggested a framework for the determination of contingency additions which is not the conventional and arbitrary approach. This was through the use of the procurement method used as the basis for contingency addition.

b. Insurance Policy: Every business requires insurance coverage. It is required by law. Deneberg et al. (1974), defined insurance as the business of transferring risk using a contract. It is defined as a formal agreement whereby an insurer, for a specified premium, agrees to reimburse the policyholder for any loss that may occur due to certain events during the policy period. Odeyinka (2000), in his study on the role of insurance in construction management, found that the most popular policy used is the all-risk policy. The all-risk policy covers all the possible risks that may occur in construction excluding only those listed in the exclusion clauses (Denerberg et al., 1974). The policy has been seen to be more effective in covering all the unexpected losses that are likely to occur in construction works and the preference placed on it is because it is convenient, easy to settle and covers a wide range of risks (Odeyinka, 2000).

**The applicable types of insurance are;**

- Liability Insurance: They are frequently used in the context of building construction projects including contractors`public liability policies and consultants` professional indemnity policies. It is important to appreciate that if an insurance policy is of this nature, then the legal duty of the insurer is owed to the client and not to the 'claimant'. According to Ahmed and Yahaya (2010), the insurer is, in theory, not liable at all until the insured person has been found liable to the victim by a court or arbitrator. Nevertheless, in practice, the insurer will be brought in as soon as legal proceedings are initiated against the client; if the action is deemed worth defending, the insurer may well take over the actual running of the case.
- Loss Insurance: This type of insurance policy is not for covering a person's legal liability to others but for losses that directly befall the person. In the construction industry, such cover is needed by a client who has the risk of the contract works being damaged. There is an important general principle of the law regarding loss insurance which is called subrogation. This principle means that in the event of a loss that has been caused by someone else's default, such as a breach of contract or tort, the loss insurer pays the client and then the insurer has the right to take over the legal rights that the insured could have enforced against the third party person who is responsible. Thus, the insurer will seek, in the name of the client, to sue the third party to recover the amount paid out to the client.
- Construction Insurance under JCT 98: This defines which party shall bear which type of risks or damages that may occur while building work is being done. It then requires that the contractor obtain insurance against those risks. The main clause regarding third-party risks is clause 20, that requires the contractor to indemnify the employer for specific types of liabilities that may arise from or in connection with or as a result of the performance of the works.
- Professional Indemnity Insurance: This is an insurance policy for the professionals in charge of the design and construction team such as Architects, Builders, specialist engineers, and quantity surveyors to cover them against professional negligence loss. These policies are usually purchased through a scheme offered by the relevant professional body and are thus quite diverse. It is also important to understand that most professional indemnity insurance policies have limits, and once the financial limits are reached, the professionals' money is at risk.
- Contingency Plan: This is a component of a project plan that describes actions to be taken only if the negative consequence of a risk event occurs (Norris et al., 1992). This tool is not popular in the Nigerian construction industry as revealed by the survey conducted by Dada (2010).
- Bonds and Guarantees: This is an arrangement whereby the performance of a contractual duty that one person (A) owes to another (B) is secured by a third party (C). D is usually referred to as the principal while B is referred to as the beneficiary; and C is the bondsman, surety, or guarantor. The second kind of protection consists of bonds, which are usually provided (as a cost) by a financial institution like a bank or an insurance company. These companies

have been practicing the provision of bonds to the construction industry for many years. However, the courts have time and again criticized these specialists for continuing to draft their bonds in a language that is old-fashioned, ambiguous, and full of pitfalls for the layman.

c. Accept: Passive acceptance is reactive and involves only recording the risks while active acceptance may include creating a contingency reserve of money, time, or other resources to manage the risks. This only requires documentation, not necessarily action.

Exploring positive Risks or Opportunities

a. Exploit: Patel A., Jayeshkumar R., and Bhavsar J. (2013) define this strategy as one that aims at eliminating the uncertainty of a particular upside risk by making the opportunity happen. It means increasing the project or work to ensure that the opportunity is realized.
b. Enhance: This entails increasing the likelihood of a positive risk producing appropriate impacts.
c. Share: This entails allocating the ownership of risks.

## 4. RESEARCH METHODS

Primary and secondary data were collected for this research. The primary data were obtained from respondents through a well-structured questionnaire that was distributed through mail. The questionnaire examined the risk management strategies used in the construction industry with emphasis on the Oil and Gas sector, including the frequency of their usage. Secondary data collection methods were adopted, which included a review of construction journals, newsletters, articles, and web sources. A total of 90 questionnaires were designed and administered to construction stakeholders in the sector, taking into cognisance the oil-producing areas of the country and ensuring that responses were received from relevant construction professionals. 75 questionnaires were obtained from respondents, but only 73 were deemed fit for use, which represents 81% of the distributed questionnaires.

Likert`s scale method was used as a basis for the scoring of responses. The respondents were asked to choose from a five degree linkert scale of “Strongly Agree”, “Agree”, “Somehow”, “Disagree” and “Strongly Disagree”. Arbitrary values of “1” to “5” were also assigned to the scale.

## 5. DATA PRESENTATION AND ANALYSIS

**Table 1:** Background of Respondents

| Category | Classification | Mid-Value | Frequency | Percentage |
|---|---|---|---|---|
| Years of Experience | | | | |
| | 1-5 | 3.00 | 5 | 6.85 |
| | 6-10 | 8.00 | 25 | 34.25 |
| | 11-15 | 13.00 | 12 | 16.44 |
| | 16-20 | 18.00 | 15 | 20.55 |
| | 21-25 | 23.00 | 10 | 13.70 |
| | 26-30 | 28.00 | 6 | 8.21 |
| **Total** | **73** | **100** | | **Mean = 14.21** |
| **Type of Organisation** | | | | |
| | Contracting | | 39 | 53.42 |
| | Consulting | | 34 | 46.58 |
| **Total** | | | **73** | **100** |
| **Professional Affiliation** | | | | |
| | NIOB | | 30 | 41.10 |
| | NSE | | 15 | 20.55 |
| | NIA | | 13 | 17.81 |
| | NIQS | | 10 | 13.70 |
| | CONTRACTOR | | 5 | 6.84 |
| **Total** | | **73** | **100** | |

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Table 1 above shows that the mean of 14.21 shows that the average years of experience of respondents is more than 11 years, which shows that they have enough construction experience to give a valid response. 53.42% of the respondents are into contracting, while 46.58% are into consulting. 30% of the respondents are NIOB members, 15% are NSE members, 13% are NIA members, 10% are NIQS members, while 5% are contractors.

**Table 2:** Risks Associated with Construction Projects

| Risk Category | MS | Ranking |
|---|---|---|
| Financial | 4.25 | 1 |
| Physical | 3.51 | 2 |
| Political | 3.51 | 2 |
| Technical | 3.50 | 3 |

From Table 2 above, Financial risk has the highest mean score value of 4.25. It is followed by Physical, Political and Technical risks with mean score values of 3.51, 3.51 and 3.50. This result is in line with an earlier survey conducted by Dada (2010), which should that the construction industry experience turbulent period as a result of economic and political crises.

**Table 3:** Construction Risks Frequency of Occurrence

| Risks Category | MS | Ranking |
|---|---|---|
| Financial | 3.25 | 1 |
| Technical | 3.25 | 1 |
| Political | 2.51 | 2 |
| Physical | 2.51 | 2 |

**Table 3** shows that financial risks with MS of 3.25 occur more frequently compared to Technical, Political and Physical risks with MS of 3.25, 2.51 and 2.51 respectively.

**Table 4:** Techniques for Managing Construction Risks

| Risk Management Techniques | MS | Ranking |
|---|---|---|
| Contingency Plan | 4.51 | 1 |
| Contingency Sum | 4.01 | 2 |
| Bonds and Guarantees | 3.75 | 3 |
| Enhance | 3.51 | 4 |
| Insurance Policy | 3.51 | 4 |
| Share | 3.00 | 5 |
| Exploit | 2.75 | 6 |

From Table 4, the contingency plan with an MS of 4.51 ranks high among the risk management techniques used in Nigeria. This is contrary to an earlier survey made by Dada (2010), which shows that its knowledge is not common in the country. Other techniques are contingency sum, bond and guarantees, enhance, insurance policy, share, and exploit with MS of 4.01, 3.75, 3.51, 3.51, 3.00, and 2.75, respectively.

**Table 5:** Efficiency of the Techniques for Managing Construction Risks

| Risk Management Techniques | MS | Ranking |
|---|---|---|
| Contingency Plan | 4.51 | 1 |
| Bonds and Guarantees | 3.77 | 2 |
| Contingency Sum | 3.01 | 3 |
| Enhance | 2.77 | 4 |
| Insurance Policy | 2.75 | 5 |
| Exploit | 2.51 | 6 |

| | | |
|---|---|---|
| Share | 2.01 | 7 |

Table 5 above shows that contingency plan with an MS of 4.51 is the most efficient way of managing construction risks. The sudden swing from previous surveys which shows it was not well adopted and the result of this survey can be attributed to the recent emphasis on the practice of project management in construction which properly handles it. Other efficient techniques are bonds and guarantees, contingency plan, enhance, insurance policy, exploit, and share with mean scores of 3.77, 3.01, 2.77, 2.75, 2.51, and 2.01 respectively.

## 6. SUMMARY OF FINDINGS

The result of this study shows that financial risks have great effects on construction projects with a high degree of occurrence as shown in table 2 and table 3. Political factors also affect construction practices. From Table 4, the contingency plan ranks high among the techniques for managing construction risks and also has the highest degree of occurrence as shown in Table 5. Bonds and guarantees and contingency sums closely follows contingency plans as risk management strategies.

## 7. CONCLUSION AND RECOMMENDATIONS

Risk is inherent in every construction project and there is a need to properly manage the perceived risks for the safe and efficient delivery of the construction process. If risks are not taken care of during the construction process, it leads to rework, waste of time and money, and client dissatisfaction. This survey has shown that when risks are identified, a response plan should be set to tackle them since the most effective approach is a contingency plan, followed by bonds and guarantees and a contingency sum. This study has also contributed to the existing body of knowledge on construction risk management and recommends that every construction project should be analysed for the inherent risks and properly handled.

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