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# Advantages of Recognizing Uncertainty During the Planning Phase of Engineering Projects in Developing Countries: A Case Study of Oil and Gas Private Companies in Libya

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# فوائد التعرف على مواطن عدم اليقين خلال مرحلة التخطيط للمشاريع الهندسية في الدول النامية: دراسة حالة عن الشركات الخاصة في قطاع النفط والغاز في ليبيا

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**Abstract**
Identifying uncertainties during the planning phase is essential for the success of engineering projects, particularly within the context of private oil and gas companies in Libya, where fluctuating market conditions and regulatory environments add complexity to project planning. This research investigates the types of uncertainties that commonly arise during the planning phase of engineering projects, aiming to identify strategies to mitigate potential failures and improve project outcomes. A survey was conducted of 25 professionals actively involved in various stages of engineering projects, using a structured questionnaire to gather insights into the nature and impact of these uncertainties. The collected data was analyzed using Excel software, focusing on quantitative trends and respondents' qualitative feedback. The results reveal that planning fallacies—such as overly optimistic timelines, underestimation of costs, and incomplete risk assessments—are among the most prevalent issues. By basing project plans on realistic assessments, leveraging historical data, and incorporating relevant information from past projects, project managers can enhance their ability to anticipate challenges and adapt their strategies accordingly. The study highlights that effective identification and management of uncertainties during the planning phase is crucial for project managers to navigate dynamic conditions, optimize resource allocation, and ensure successful project execution. These findings offer practical recommendations for improving planning practices in the Libyan oil and gas sector and contribute to a broader understanding of managing uncertainty in complex engineering environments.

**Keywords:** Uncertainty Identification, Planning Fallacy, Risk Assessment, Engineering Projects.

**الملخص**
تعتبر عملية تحديد أوجه عدم اليقين خلال مرحلة التخطيط أمرًا جوهريًا لنجاح المشاريع الهندسية، لا سيما في سياق شركات النفط والغاز الخاصة في ليبيا، حيث تضيف الظروف السوقية المتقلبة والبيئات التنظيمية المعقدة مزيدًا من التعقيد إلى تخطيط المشاريع. تهدف هذه الدراسة إلى استكشاف أنواع أوجه عدم اليقين التي تظهر عادةً خلال مرحلة التخطيط للمشاريع الهندسية، مع التركيز على تحديد الاستراتيجيات المناسبة لتقليل فرص الفشل وتحسين نتائج المشاريع. تم إجراء مسح شمل 25 متخصصًا يعملون في مراحل مختلفة من المشاريع الهندسية، باستخدام استبيان منظم لجمع المعلومات حول طبيعة وتأثير هذه الشكوك. تم تحليل البيانات التي تم جمعها باستخدام برنامجExcel ، مع التركيز على الاتجاهات الكمية والتغذية الراجعة النوعية من المشاركين. تكشف النتائج أن الأخطاء في التخطيط، مثل الجداول الزمنية المتفائلة بشكل مفرط، والاستخفاف بتكاليف المشروع، والتقييمات غير المكتملة للمخاطر، تعد من أبرز القضايا التي يوجهها المخططون. من خلال بناء خطط المشاريع على تقييمات واقعية، والاستفادة من البيانات التاريخية، ودمج المعلومات ذات الصلة من المشاريع السابقة، يمكن لمديري المشاريع تعزيز قدرتهم على التنبؤ بالتحديات وتكييف استراتيجياتهم وفقًا لذلك. تبرز الدراسة أن الفعالية في تحديد وإدارة أوجه عدم اليقين خلال مرحلة التخطيط تعد ضرورية لتمكين مديري المشاريع

من التعامل مع الظروف المتغيرة، وتحسين توزيع الموارد، وضمان تنفيذ ناجح للمشاريع. تقدم هذه النتائج توصيات عملية لتحسين ممارسات التخطيط في قطاع النفط والغاز الليبي، وتساهم في فهم أوسع لإدارة عدم اليقين في البيئات الهندسية المعقدة..

**الكلمات المفتاحية:** تحديد أوجه عدم اليقين، مغالطة التخطيط، تقييم المخاطر، المشاريع الهندسية.

## 1.Introduction

In recent years, the landscape of engineering projects has faced numerous challenges, leading to a high incidence of project failures, particularly in developing countries. Research indicates that more than 70% of projects fail due to insufficient management of uncertainties (Andersen, 2008). This paper aims to tackle one of the fundamental issues in project management: the misinterpretation of uncertainties in engineering projects. It emphasizes the importance of identifying and managing these uncertainties during the planning phase, specifically focusing on private oil and gas companies operating in Libya.

A project can be compared to a journey into the unknown, where uncertainties can derail even the best-laid plans. Unfortunately, there is no universally accepted definition of uncertainty in engineering projects due to differing interpretations among stakeholders (Andersen, 2008). As such, this study examines the importance of recognizing uncertainties during the planning phase to reduce project failures. The objectives are:

1. To understand the planning fallacy in engineering projects.
2. To identify various strategies for planning under uncertainty.
3. To highlight the significance of uncertainty identification.
4. To assess the benefits of planning under uncertainty.

This paper is organized into six sections. The first section introduces the research foundation, while the second reviews relevant literature. The third section describes the research design and methodology, the fourth presents the findings, and the fifth discusses these findings in relation to existing literature. The final section concludes the research and provides recommendations for future studies in this area.

## 2. Literature Review

The concept of uncertainty in project management has been extensively explored, particularly in the realm of engineering projects. Uncertainty can significantly affect project performance, making it essential for project managers to understand its implications (Ward & Chapman, 2003). In engineering contexts, uncertainties often stem from various sources, including environmental factors, technological changes, and stakeholder expectations.

### 2.1 Theoretical Framework

Theoretical frameworks related to uncertainty management, such as Contingency Theory and Risk Management Theory, provide a foundational understanding of how project managers can address uncertainties. Contingency Theory posits that the most effective management strategy depends on the specific circumstances of the project. Conversely, Risk Management Theory emphasizes identifying, assessing, and mitigating risks throughout the project lifecycle. These theories underscore the importance of adaptability and proactive planning in managing uncertainties effectively.

### 2.2 Historical Context

Over the years, project management practices have evolved to address increasing complexity and risk. Early project management methodologies primarily focused on task completion and resource allocation, often neglecting uncertainties. However, as the field matured, the recognition of uncertainties as critical factors in project success became more prevalent. Modern methodologies now incorporate risk assessment and management as integral components of project planning and execution.

### 2.3 Planning Fallacy

The planning fallacy, introduced by Kahneman and Tversky (1979), highlights a systematic tendency for project managers to underestimate costs and timelines. This cognitive bias is prevalent in engineering projects, leading to significant discrepancies between planned and actual outcomes. Lovallo and Kahneman (2003) assert that this bias often results from an inward-focused perspective, neglecting the value of external insights. By relying solely on internal assumptions, project managers may not adequately account for the complexities and risks associated with their projects.

### 2.4 Planning Under Uncertainty

Jauch and Kraft (1986) categorize uncertainties into two types: known unknowns and unknown unknowns. Known unknowns can be estimated and planned for, while unknown unknowns present a greater challenge, as they cannot be predicted. This distinction underscores the importance of a flexible and adaptive approach to project management. Furthermore, effective uncertainty management is crucial for enhancing project performance. Research indicates that over 70% of projects fail due to inadequate management of uncertainties (Andersen, 2008).

### 2.5 Recent Studies
Recent literature emphasizes the need for proactive uncertainty management in project planning. Bakker et al. (2012) highlight that the identification of uncertainties during the planning phase is essential for developing effective management strategies. The increasing complexity of projects, particularly in high-risk sectors like oil and gas, necessitates a thorough understanding of potential risks. Additionally, studies by Raz et al. (2002) have shown that organizations operating in volatile environments must be particularly vigilant in identifying potential risks and adapting their strategies accordingly.

### 2.6 Implications for Practice
The findings from the literature suggest several implications for project management practice. Firstly, organizations should implement structured processes for identifying and assessing uncertainties early in the planning phase. Utilizing historical data and external viewpoints can improve forecasting accuracy and resource allocation. Moreover, training programs that enhance project managers' understanding of cognitive biases can foster better decision-making. Lastly, adopting a culture of adaptability and continuous learning can equip teams to navigate uncertainties more effectively.

### 2.7 Contextual Factors
In the context of private oil and gas companies in Libya, unique challenges such as political instability, regulatory changes, and fluctuating market conditions further complicate uncertainty management. Studies indicate that organizations operating in such environments must be particularly vigilant in identifying potential risks and adapting their strategies accordingly (Raz et al., 2002). A comprehensive understanding of the local context is essential for developing effective management practices tailored to the specific challenges faced in Libya's oil and gas sector.

## 3. Research Methodology
### 3.1 Introduction to the Methodology
This section outlines the methodology employed to investigate uncertainty management in engineering projects, specifically within the context of private oil and gas companies in Libya. The research is based on a survey distributed to professionals involved in project management within the sector. Both quantitative and qualitative methods were employed to ensure a comprehensive analysis.

### 3.2 Research Design
The research employed a descriptive design to explore uncertainty management practices in engineering projects. A structured survey was used to gather data on how uncertainties are identified, managed, and mitigated during the planning phase. The design ensured that respondents' experiences and perceptions were captured accurately.

### 3.3 Philosophical Underpinnings
The research followed a positivist approach, assuming that the reality of uncertainty management in engineering projects can be observed and measured objectively. This approach allowed the researcher to examine the phenomena systematically and draw conclusions based on empirical data.

### 3.4 Sample Selection
A purposive sampling method was employed to select 25 respondents from private oil and gas companies operating in Libya. The sample included project managers, engineers, and other professionals directly involved in the planning and execution of engineering projects. The respondents were chosen based on their expertise and experience in managing uncertainties in large-scale projects.

### 3.5 Data Collection Methods
Primary data were collected through a structured questionnaire. The survey included both open-ended and close-ended questions designed to capture various aspects of uncertainty management. The questionnaire was divided into sections focusing on project characteristics, the identification of uncertainties, and management strategies.

### 3.6 Data Analysis Techniques
The data collected were analyzed using Excel software. Descriptive statistics were used to summarize the responses, providing insights into common practices and challenges in uncertainty management. Furthermore, inferential analysis was employed to explore relationships between the respondents' experience levels and their approaches to managing uncertainties.

### 3.7 Ethical Considerations
All respondents participated voluntarily, and their anonymity was ensured. The research followed ethical guidelines to protect the confidentiality of the data collected. Participants were informed about the purpose of the research, and their consent was obtained before the survey was administered.

### 3.8 Validity and Reliability
To ensure the validity of the research, the questionnaire was pre-tested with a small group of project managers to ensure clarity and relevance. The reliability of the data was ensured by using a consistent methodology for administering the survey and analyzing the data.

### 3.9 Limitations of the Research
The main limitation of this study was the relatively small sample size of 25 respondents. While the data provide valuable insights, a larger sample would have allowed for more generalizable conclusions. Additionally, the research focused solely on private oil and gas companies in Libya, limiting its applicability to other sectors or regions.

## 4. Data Analysis
### 4.1 Introduction to Data Analysis
The Data Analysis chapter is significant as it reveals the actual scenario surrounding the research objectives. This analysis employs qualitative data gathered from a structured questionnaire designed to achieve four specific objectives. A total of 16 questions were formulated, with 25 respondents participating in the survey. The researcher established four hypotheses to guide the investigation:

- **H1**: The planning fallacy in engineering projects is less important.
- **H2**: There is no need to determine the different ways of planning under uncertainty in engineering projects.
- **H3**: The identification of uncertainty is significant.
- **H4**: Recognition of planning under uncertainty is beneficial.

### 4.2 Analysis of the Findings
**H1: The Planning Fallacy in Engineering Projects is Less Important**

To evaluate this hypothesis, four questions were posed to the respondents regarding the planning fallacy. The first question sought to clarify its definition in relation to project expenditure. Among the 25 respondents, 9 agreed with the definition, while 5 remained neutral. The remaining respondents expressed the view that a wrong assumption regarding time, rather than expenditure, characterizes the planning fallacy.

The second question asked whether planning fallacy is a significant concern today. A majority (21 respondents) indicated it is a major concern for project managers, despite a few (4) arguing that cost should also be prioritized.

The third question assessed the necessity of reality-based planning for reliable estimations of timing and costs. A strong majority (20 respondents, or 80%) agreed that project managers must base their plans on reality to achieve accurate results.

The last question focused on whether the proper use of information in the planning phase could mitigate the planning fallacy. A significant consensus emerged, with 22 respondents affirming that utilizing relevant information would enhance estimation accuracy.

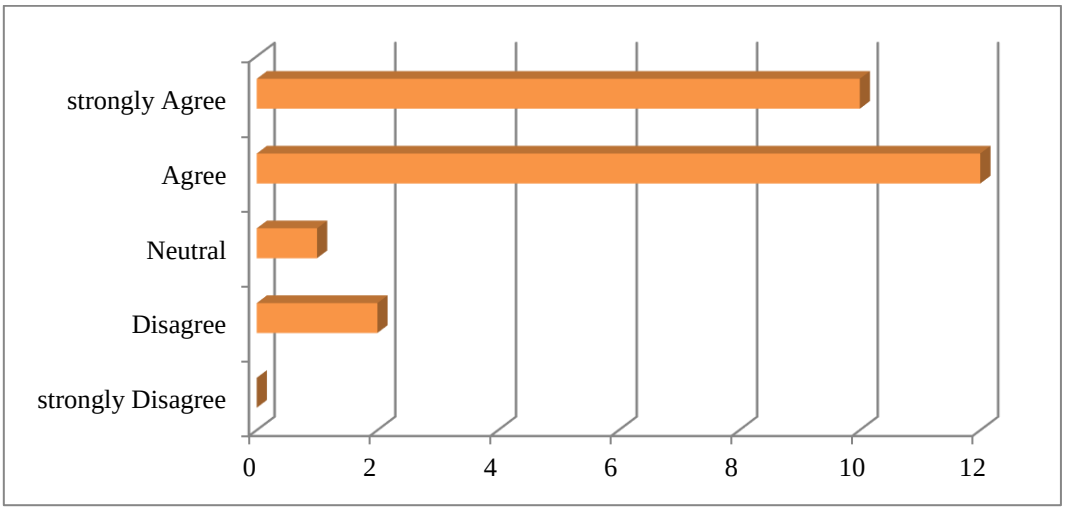


**Figure1:** Survey Outcomes for Hypothesis 1

From this analysis, it can be concluded that the hypothesis asserting the insignificance of the planning fallacy should be rejected. The planning fallacy is indeed an important consideration in engineering projects.

**H2: There is No Need to Determine the Different Ways of Planning Under Uncertainty in Engineering Projects**

This objective was assessed through four targeted questions, forming the basis of Hypothesis 2. The first question examined the impact of uncertainty on engineering projects. Among the 25 respondents, only 7 disagreed, with the remainder agreeing that uncertainty significantly impacts project balance.

The next question addressed the importance of planning against uncertainty in project execution. An overwhelming 92% (23 out of 25) of respondents believed that without proper planning, it is impossible to manage uncertainty effectively.

The third question posed a challenging query regarding whether project managers should concentrate solely on variable factors such as cost and quality. Among the respondents, 13 agreed, 5 disagreed, while 7 provided no response. This suggests a lack of understanding among some respondents about the comprehensive functions of project managers, which also include execution, monitoring, and control.

The final question sought to determine whether focusing on existing ambiguities is necessary. Only 1 respondent did not comment, 2 disagreed, while 22 agreed on the importance of concentrating on ambiguities to help resolve uncertainties.

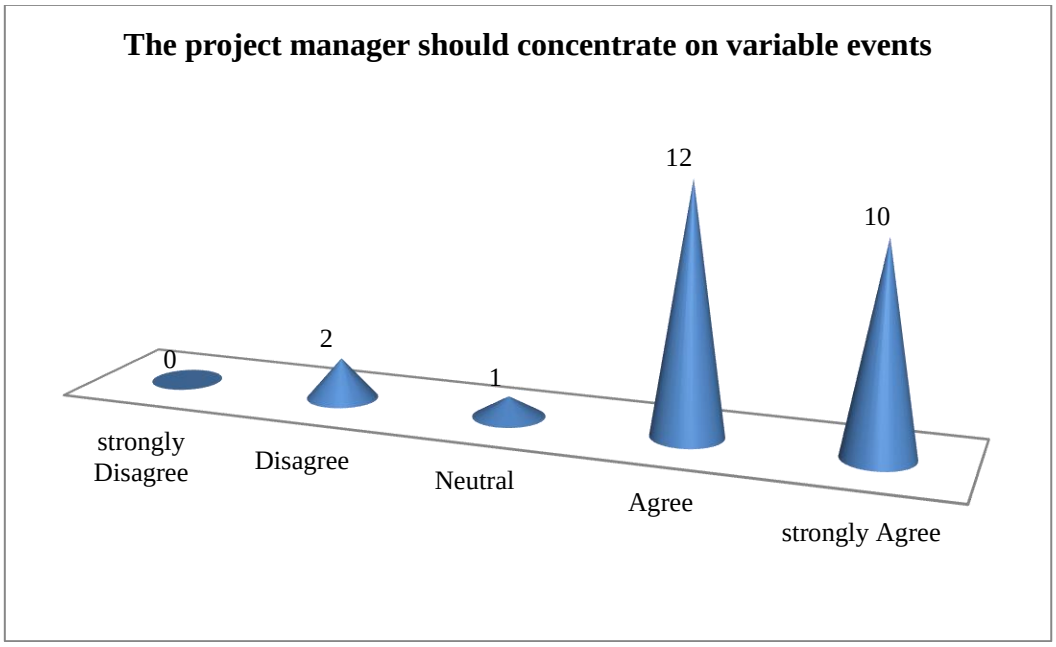


**Figure:** Survey Outcomes for Hypothesis 2

Overall, this hypothesis is rejected; there is a clear need to determine effective strategies for planning under uncertainty in engineering projects.

**H3: The Importance of the Identification of Uncertainty is Significant**

The first question assessed the uncertainty identification process, specifically recognizing potential uncertainty events. Among the respondents, only 3 disagreed, 5 provided no comment, and 17 agreed. This indicates that respondents are aware of the importance of identifying potential uncertainties.

The second question asked whether project managers should identify sources of uncertainty. Most respondents agreed, reinforcing the idea that recognizing sources is crucial for effective project management.

The third question inquired if failing to identify uncertainties would negatively impact project execution. Here, 20 respondents agreed, highlighting the critical nature of uncertainty identification in ensuring project success.

The final question assessed whether identifying uncertainties during the planning phase could help avoid the planning fallacy. The majority (18 respondents) agreed that proactive identification can mitigate planning fallacy risks.


**Figure 3:** Survey Outcomes for Hypothesis 3

Thus, the hypothesis suggesting that the importance of uncertainty identification is insignificant is accepted. Effective identification is crucial for successful project management.

**H4: Recognition of Planning Under Uncertainty is Beneficial**

The first question explored the significance of uncertainty identification as a major task in uncertainty management during the planning phase. Only 2 respondents disagreed, while 21 agreed. This response indicates that effective identification is vital for successful project management.

The second question examined whether analyzing uncertainty can inform control measures. Here, 2 disagreed, and 22 agreed, reinforcing the idea that understanding uncertainty is essential for effective management.

The third question linked uncertainty identification to performance objectives. A strong majority supported this connection, underscoring the importance of effective management.

The final question highlighted the necessity of uncertainty identification for resource estimation and stakeholder management. The majority of respondents (20) agreed, further confirming the significance of this process.

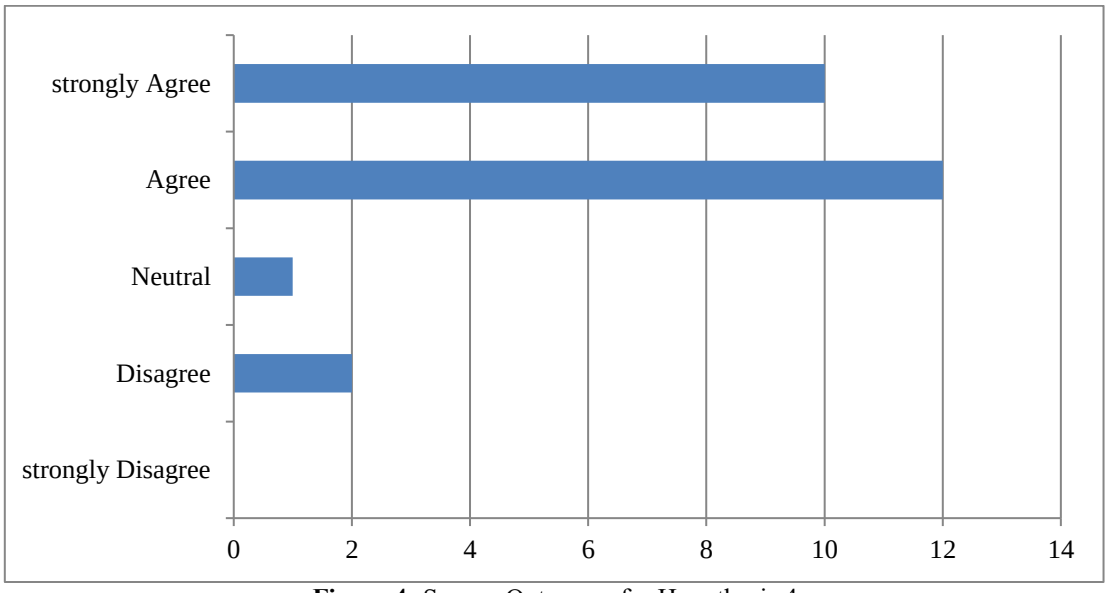


**Figure 4:** Survey Outcomes for Hypothesis 4

Overall, the hypothesis suggesting that recognition of planning under uncertainty is not beneficial is rejected. Effective identification and management of uncertainties are essential for successful project execution.

**4.3 Summary**
This section, based on specific objectives, utilized questionnaires to draw conclusions from the responses. A total of 16 questions were designed to address the research objectives, leading to valuable insights into planning fallacies and effective strategies for uncertainty management.

**5. Discussion**
The findings from this research underscore the critical importance of effective uncertainty management in engineering projects, especially within the context of private oil and gas companies in Libya. The data indicate that a significant portion of project failures can be attributed to inadequately managed uncertainties during the planning phase.

**5.1 Key Challenges Identified** One of the most significant challenges identified was the impact of external uncertainties, particularly political instability and regulatory changes. These factors not only disrupt project timelines but also threaten overall project viability. The high percentage of respondents (80%) who identified these external risks emphasizes the urgent need for project managers to develop robust strategies for mitigating such uncertainties.

**5.2 The Role of Experience** The study revealed a distinct correlation between the level of experience of project managers and their ability to manage uncertainties effectively. More experienced professionals reported employing structured approaches, such as risk assessment, scenario planning, and contingency planning, more frequently than their less experienced counterparts. This finding aligns with previous studies that emphasize the value of experience in enhancing project management practices. The data indicate that seasoned project managers are not only more adept at identifying potential risks but also more skilled in implementing adaptive strategies to navigate those risks successfully.

**5.3 Planning Fallacy** Furthermore, the discussion highlights the relevance of the planning fallacy, as introduced by Kahneman and Tversky (1979). Less experienced managers exhibited a tendency to underestimate uncertainties, a phenomenon referred to as the planning fallacy. This cognitive bias underscores the importance of providing training and resources to equip less experienced managers with the necessary tools to recognize and manage uncertainties proactively.

**5.4 Implications for Practice** The findings suggest several practical implications for organizations operating in high-risk environments like Libya's oil and gas sector. Firstly, organizations should prioritize the implementation of comprehensive training programs focused on uncertainty management. These programs should include case studies and best practices that emphasize proactive planning and risk management strategies.
Moreover, fostering a culture of knowledge sharing among project managers can significantly enhance collective understanding and improve uncertainty management practices. Organizations might consider establishing mentorship programs where experienced managers can guide less experienced professionals, sharing insights gained from previous projects.

**5.5 Adaptability and Continuous Learning** Finally, the discussion emphasizes the need for organizations to cultivate a culture of adaptability and continuous learning. Given the volatile nature of the oil and gas industry, where political and regulatory landscapes can shift rapidly, project teams must be prepared to adjust their plans in response to emerging uncertainties. Encouraging a mindset that embraces flexibility and innovation will empower teams to respond more effectively to challenges as they arise.

**6. Conclusion**
This research demonstrates the paramount importance of effectively identifying and managing uncertainties during the planning phase of engineering projects, particularly within the oil and gas industry in Libya. The findings indicate that uncertainties arising from political instability and regulatory changes are among the most significant challenges faced by project managers.
The study highlights that while experienced project managers utilize structured approaches to address these uncertainties—such as contingency planning and the use of historical data—less experienced managers often struggle with recognizing and mitigating these risks. This discrepancy points to the necessity of enhancing training programs focused on uncertainty management for project managers, particularly those new to the field.
Key conclusions drawn from the study include:

1. **Early Identification of Risks**: Organizations should prioritize the early identification of external risks during the planning process. A proactive approach to uncertainty management is essential to mitigate adverse effects on project outcomes.

2. **Utilization of Flexible Planning**: Employing flexible project plans that allow for adjustments in response to unforeseen circumstances is crucial. Flexibility is necessary for navigating the complexities inherent in the oil and gas sector.
3. **Training and Development**: There is a significant need for enhanced training programs tailored to uncertainty management. These programs should focus on providing practical strategies and tools for recognizing and addressing uncertainties effectively.
4. **Knowledge Sharing**: Encouraging knowledge sharing among project managers can facilitate the exchange of best practices and insights gained from past projects. This collaborative approach can significantly enhance collective understanding and improve uncertainty management strategies.
5. **Fostering Adaptability**: Cultivating a culture of adaptability and continuous learning within organizations is vital. Given the dynamic nature of the industry, project teams must remain agile and prepared to respond to emerging uncertainties promptly.

In conclusion, effective management of uncertainties is essential for the successful execution of engineering projects in the volatile environment of Libya's oil and gas sector. By adopting proactive strategies, enhancing training, and promoting knowledge sharing, organizations can improve their resilience and adaptability, ultimately leading to more successful project outcomes. Future research could focus on expanding the sample size and exploring uncertainty management practices in other sectors beyond the oil and gas industry.

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## 8 . Appendices

### 8.1 Appendix A: Survey Questionnaire

**Questionnaire**

**On**

**Mitigating Uncertainty in the Planning Phase of Engineering Projects: A Case Study of Private Oil and Gas Companies in Libya**

Place a check (√) under the column that describes your level of agreement (Strongly Agree, Agree, Neutral, Disagree or Strongly Disagree) to each statement.

Objective 1: To research and understand the planning fallacy in engineering project.

1. Planning fallacy is the thinking that estimating expenditure about project may not give an accurate result

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

2. People are now mostly concerned with the planning fallacy for the project

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

3. In order to produce more accurate result on an estimation, the perception about the engineering project should be on the basis of experience

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

4. Proper use of information can be the most important way of avoiding planning inaccuracies

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

Objective 2: To determine the different ways of planning under uncertainty in engineering project

5. Uncertainty affects the plan of the engineering project badly.

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

6. Planning is needed against uncertainty for conduction of project works.

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

7. The project manager should concentrate on variabile events such as cost and quality, scarcity of resources, timeframes and deadlines.

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

8. Much focus is needed on the existing ambiguities in projects.

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

Objective 3: To arrive at an understanding of the importance of the identification of uncertainty

9. An uncertainty identification process includes the recognition of potential uncertainty event conditions

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

10. Through the uncertainty identification process the project manager at first identifies the sources from which uncertainty will arise.

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

11. If a project manager fails to properly identify uncertainty, it can affect the project execution.

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

12. Identification of uncertainties while planning the engineering project can make it possible to avoid planning inaccuracies

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

Objective 4: To test the recognized benefits of planning under uncertainty in planning phase

13. Uncertainty identification is the major task of risk management and uncertainty management during the planning phase of a project life cycle.

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

14. It develops the basis for the next steps to analyze the uncertainty and to take measures to control the uncertainties.

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

15. In visualizing the project and designing strategy, uncertainty identification helps to set performance objectives and design control strategies on your project.

| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

16. In project planning, resource allocation, project execution, and support, uncertainty identification can make it possible to estimate resources, ensure leadership, and fulfill stakeholder expectation.

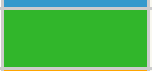
| Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|
| | | | | |

### 8.2 Appendix B: Questionnaire findings

Objective 1: To research and understand the planning fallacy in engineering project

| **1. Planning fallacy is the thinking that estimating expenditure about a project may not give an accurate result** | | | | |
|---|---|---|---|---|
| | | | **Response Percent** | **Response Total** |
| 1 | Strongly Disagree | | 0.00% | 3 |
| 2 | Disagree | | 8.00% | 8 |

| | | | | |
|---|---|---|---|---|
| 3 | Neutral |  | 0.00% | 5 |
| 4 | Agree |  | 32.00% | 7 |
| 5 | Strongly Agree |  | 60.00% | 2 |

| **2. People are now mostly concerned with the planning fallacy for the project** | | | | |
|---|---|---|---|---|
| | | | **Response Percent** | **Response Total** |
| 1 | Strongly Disagree |  | 4.00% | 1 |
| 2 | Disagree |  | 12.00% | 3 |
| 3 | Neutral |  | 0.00% | 0 |
| 4 | Agree |  | 12.00% | 3 |
| 5 | Strongly Agree |  | 72.00% | 18 |

| **3. In order to produce more accurate results on an estimation, the perception of the engineering project should be on the basis of experience** | | | | |
|---|---|---|---|---|
| | | | **Response Percent** | **Response Total** |
| 1 | Strongly Disagree |  | 0.00% | 0 |
| 2 | Disagree |  | 12.00% | 3 |
| 3 | Neutral |  | 8.00% | 2 |
| 4 | Agree |  | 44.00% | 11 |
| 5 | Strongly Agree |  | 36.00% | 9 |

| **4. Proper use of information can be the most important way of avoiding planning inaccuracies** | | | | |
|---|---|---|---|---|
| | | | **Response Percent** | **Response Total** |
| 1 | Strongly Disagree |  | 4.00% | 1 |
| 2 | Disagree |  | 8.00% | 2 |
| 3 | Neutral |  | 0.00% | 0 |

| | | | | |
|---|---|---|---|---|
| 4 | Agree |  | 32.00% | 8 |
| 5 | Strongly Agree |  | 56.00% | 14 |

Objective 2: To determine the different ways of planning under uncertainty in engineering project

| **5. Uncertainty affects the plan of the engineering project badly.** | | | | |
|---|---|---|---|---|
| | | | **Response Percent** | **Response Total** |
| 1 | Strongly Disagree |  | 20.00% | 5 |
| 2 | Disagree |  | 8.00% | 2 |
| 3 | Neutral |  | 0.00% | 0 |
| 4 | Agree |  | 40.00% | 10 |
| 5 | Strongly Agree |  | 32.00% | 8 |

| **6. Planning is needed against uncertainty for the conduction of project works.** | | | | |
|---|---|---|---|---|
| | | | **Response Percent** | **Response Total** |
| 1 | Strongly Disagree |  | 0.00% | 0 |
| 2 | Disagree |  | 8.00% | 2 |
| 3 | Neutral |  | 0.00% | 0 |
| 4 | Agree |  | 72.00% | 18 |
| 5 | Strongly Agree |  | 20.00% | 5 |

| **7. The project manager should concentrate on variable events such as cost and quality, scarcity of resources, timeframes and deadlines.** | | | | |
|---|---|---|---|---|
| | | | **Response Percent** | **Response Total** |
| 1 | Strongly Disagree |  | 0.00% | 0 |
| 2 | Disagree |  | 20.00% | 5 |
| 3 | Neutral |  | 28.00% | 7 |
| 4 | Agree |  | 16.00% | 4 |
| 5 | Strongly Agree |  | 36.00% | 9 |

| 8. Much focus is needed on the existing ambiguities in projects. | | | | |
|---|---|---|---|---|
| | | | Response Percent | Response Total |
| 1 | Strongly Disagree | | 0.00% | 0 |
| 2 | Disagree | | 8.00% | 2 |
| 3 | Neutral | | 4.00% | 1 |
| 4 | Agree | | 48.00% | 12 |
| 5 | Strongly Agree | | 40.00% | 10 |

Objective 3: To arrive at understanding of the importance of the identification of uncertainty

| 9. An uncertainty identification process includes the recognition of potential uncertainty event conditions | | | | |
|---|---|---|---|---|
| | | | Response Percent | Response Total |
| 1 | Strongly Disagree | | 8.00% | 2 |
| 2 | Disagree | | 4.00% | 1 |
| 3 | Neutral | | 20.00% | 5 |
| 4 | Agree | | 28.00% | 7 |
| 5 | Strongly Agree | | 40.00% | 10 |

| 10. Through the uncertainty identification process the project manager at first identifies the sources from which uncertainty will arise. | | | | |
|---|---|---|---|---|
| | | | Response Percent | Response Total |
| 1 | Strongly Disagree | | 0.00% | 0 |
| 2 | Disagree | | 4.00% | 1 |
| 3 | Neutral | | 0.00% | 0 |
| 4 | Agree | | 36.00% | 9 |
| 5 | Strongly Agree | | 60.00% | 15 |

| 11. If a project manager fails to properly identify uncertainty, it can affect the project execution. | | | | |
|---|---|---|---|---|
| | | | **Response Percent** | **Response Total** |
| 1 | Strongly Disagree | | 0.00% | 0 |
| 2 | Disagree | | 12.00% | 3 |
| 3 | Neutral | | 8.00% | 2 |
| 4 | Agree | | 24.00% | 6 |
| 5 | Strongly Agree | | 56.00% | 14 |

| 12. Identification of uncertainties while planning the engineering project can make it possible to avoid planning inaccuracies | | | | |
|---|---|---|---|---|
| | | | **Response Percent** | **Response Total** |
| 1 | Strongly Disagree | | 8.00% | 2 |
| 2 | Disagree | | 4.00% | 1 |
| 3 | Neutral | | 16.00% | 4 |
| 4 | Agree | | 28.00% | 7 |
| 5 | Strongly Agree | | 44.00% | 11 |

Objective 4: To test the recognized benefits of planning under uncertainty in the planning phase

| 13. Uncertainty identification is the major task of risk management and uncertainty management during the planning phase of a project life cycle. | | | | |
|---|---|---|---|---|
| | | | **Response Percent** | **Response Total** |
| 1 | Strongly Disagree | | 0.00% | 0 |
| 2 | Disagree | | 8.00% | 2 |
| 3 | Neutral | | 8.00% | 2 |
| 4 | Agree | | 44.00% | 11 |
| 5 | Strongly Agree | | 40.00% | 10 |

| 14. It develops the basis for the next steps to analyze the uncertainty and to take measures to control the uncertainties. | | | | |
|---|---|---|---|---|
| | | | Response Percent | Response Total |
| 1 | Strongly Disagree | | 8.00% | 2 |
| 2 | Disagree | | 4.00% | 1 |
| 3 | Neutral | | 0.00% | 0 |
| 4 | Agree | | 60.00% | 15 |
| 5 | Strongly Agree | | 28.00% | 7 |

| 15. In visualizing a project and designing a strategy, uncertainty identification helps to set performance objectives and design control strategies for your project. | | | | |
|---|---|---|---|---|
| | | | Response Percent | Response Total |
| 1 | Strongly Disagree | | 0.00% | 0 |
| 2 | Disagree | | 16.00% | 4 |
| 3 | Neutral | | 8.00% | 2 |
| 4 | Agree | | 32.00% | 8 |
| 5 | Strongly Agree | | 44.00% | 11 |

| 16. In project planning, resource allocation, project execution, and support, uncertainty identification can make it possible to estimate resources, ensure leadership, and fulfill stakeholder expectation. | | | | |
|---|---|---|---|---|
| | | | Response Percent | Response Total |
| 1 | Strongly Disagree | | 0.00% | 0 |
| 2 | Disagree | | 8.00% | 2 |
| 3 | Neutral | | 12.00% | 3 |
| 4 | Agree | | 20.00% | 5 |
| 5 | Strongly Agree | | 60.00% | 15 |