The BP Macondo Project: An Analysis

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Executive Summary

Project management's (PM) prominence has experienced a dramatic rise due to the prevalence of project failures. This report examines the BP Macondo project, which precipitated the Deepwater Horizon Oil Spill of 2010, through the lenses of risk management, leadership and stakeholder management. Its purpose pertains to elevating the efficiency and safety of future projects.

BP neglected to effectively ascertain sources of internal project risk which engendered the deployment of an immediate risk response strategy to technical risk regarding the well's depth below the sea. However, the firm appropriately alleviated external risk through an efficacious acceptance strategy with adequate contingency planning.

The firm's culture paralleled a risk seeking organisation due to the continuance of preceding industrial disasters. The project steering committee emphasised time and cost as ultimate determinants of project success. Additionally, the functional PM structure, employed by the firm, crippled the ability of employees to communicate.

BP's stakeholder management overlooked the core determinants of its effectiveness – perpetual communication and involvement of stakeholders in decision-making. Stakeholders were pressed to comply with the firm's decisions, with their postulations frequently suppressed. In addition, the firm neglected to maintain continual communication with other stakeholders, resulting in an insufficient sealing of the well and the subsequent blowout.

To preclude the recurrence of these issues, this report offers several recommendations. Firstly, a comprehensive risk breakdown structure and fuzzy risk assessments should be introduced to address technical risk. Moreover, the stage-gate process will facilitate the mitigation of BP's risk seeking organisational culture.

The use of dedicated project teams remains critical to enhance communication. Finally, a stakeholder governance framework must be instituted to integrate stakeholder preferences into decision-making and as criteria in project success. These propositions shall enable BP to thwart the emergence of analogous errors. This remains particularly poignant due to the tragic loss of 11 lives in the sinking of the Deepwater Horizon.

1. Introduction

Interest in PM has grown exponentially throughout both extant literature and organisations (Thomas and Mengel, 2008; Ika, 2009). This is evidenced by a 1200% rise in membership of the Project Management Institute (PMI) since 1996 to 600,000 professionals in 2020 (Hall, 2012; PMI, 2020). PM refers to the process of managing the accomplishment of project objectives through the implementation of skills, tools, knowledge and techniques (Munns and Bjeirmi, 1996; PMI, 2017). According to KPMG (2019), over 80% of organisations struggle to consistently deliver projects within their defined criteria of time, cost and quality. Thereby, this considerably elevates the probability of project failure (de Wit, 1988; Atkinson, 1999; Mir and Pinnington, 2014). Lacerda, Ensslin and Ensslin (2011) further demonstrate the ostensible challenge in attaining project success, ascertaining that just 28% of projects succeed. Consequently, the salience of effective PM cannot be overstated.

The purpose of this report is to undertake an examination of the BP Macondo project, which culminated in the industrial disaster of the Deepwater Horizon Oil Spill of 2010 in the Gulf of Mexico. The scope of this analysis

pertains to the factors of risk management, leadership and stakeholder management owing to their centrality to this project's failure. Furthermore, this paper seeks to provide actionable recommendations to BP to enhance the performance and, ultimately, the success of future projects. In addition, these recommendations are intended to elevate safety procedures, which remains of utmost significance due to the tragic loss of life stemming from the Macondo project's failure (Graham *et al.*, 2011).

2. Risk Management

Project risk management infers a methodical process of identifying and managing sources of risk to facilitate their extenuation via risk elimination, control or minimisation (Qazi *et al.*, 2016). This is achieved through the implementation of practices and systems to ascertain, analyse, appraise and alleviate origins of project risk (Marcelino-Sádaba *et al.*, 2014). Risk constitutes a paramount consideration due to its inherent uncertainty and capacity to engender polarising positive or negative effects on project scope, time, quality or cost (Silvius and Schipper, 2014; Carvalho and Junior, 2015). Moreover, Nieto-Morote and Ruz-Vila (2011) contend that the primary concern of risk management involves prospective problems or issues influencing the completion of project deliverables or goals. Therefore, the role of the risk management process infers the control of events with potentially adverse effects. In addition, efficacious risk management correlates with project success (de Bakker, Boonstra and Wortmann, 2010). Consequently, its undertaking remains vital.

2.1. Internal Risk

BP, as the project owner, assumed overall responsibility for project risk (Amernic and Craig, 2017). Hence, the firm necessitated the development of an approach to alleviate project risk. The prevailing method of this relates to the employment of a four-phase process entailing risk identification, risk assessment, risk response development and risk response control (Nieto-Morote and Ruz-Vila, 2011). Despite its pervasiveness, it appears that BP neglected to engage with the process in an effective manner. Fundamentally, the firm disregarded the difficulty associated with drilling a deep-sea oil well, despite BP's relative inexperience with such depths (Steinberg, 2010). This may be ascribed to the lack of a major accident with wells of this type in the Gulf of Mexico throughout the petroleum industry (Tinsley, Dillon and Madsen, 2011). However, many minor incidents, maintaining the potential to instigate a disaster akin to that of the Deepwater Horizon, had occurred previously with solely good fortune ensuring any escaping gas avoided a source of ignition (Tinsley, Dillon and Madsen, 2011).

By employing Matheson and Menke's (1994) project portfolio grid, the project may be referred to as an oyster, wherein the commissioning organisation incurs considerable risk with high potential return on investment (Steffy, 2011). Specifically, technical risk concerning the depth of the oil field at 5.5km below the surface presented an immense challenge and constituted the central source of project risk (BP, 2010). Skogdalen and Vinnem (2012) and Bhandari *et al.* (2015) assert that deeper wells pose greater danger due to pressurised hydrocarbons at their depths which heighten the probability of a blowout. In addition, a blowout's occurrence elevates the prospect of an explosion and thus project delays or failure (Khakzad, Khan and Amyotte, 2013). Moreover, the deployment of a semi-submersible rather than a platform oil rig increased complexity owing to an absence of fixing to the seabed (Read, 2011). These rigs rely upon their own propulsion to maintain stability (Yadav *et al.*, 2014). Resultantly, when the Deepwater Horizon confronted an explosion and loss of engine power, the vessel

could no longer remain upright. Ultimately, this generated a fracture in the drilling pipe connecting the oil rig to the subterranean oil well and thereby prevented the emergency operation of the project's paramount risk mitigation mechanism – the blowout preventer (Park *et al.*, 2013).

In forming risk interventions, organisations maintain a portfolio of four core responses available in the process of risk response planning – avoidance, transference, mitigation and acceptance (Hillson, 2002). Further, to determine an appropriate risk response, it remains necessary to categorise the source of risk through the implementation of a risk breakdown structure (Zhi, 1995). The risk breakdown structure classifies risk predicated upon its origin relative to the project and articulates the specific risk events concerning each source (El-Sayegh, 2008). This categorisation of risk forms a paramount undertaking in the development of efficacious responses as a risk's origin negates certain actions (Schieg, 2006; Giannakis and Papadopoulos, 2016).

BP employed a risk transference strategy in assigning sources of technical risk, regarding cementing and drilling, to Transocean and Halliburton respectively (Skogdalen and Vinnem, 2012). Such a strategy remains most pertinent where the organisation to which the risk will be allocated maintains a greater capacity to manage that risk (Atkinson, Crawford and Ward, 2006). Owing to both firms' documented capabilities in these domains and BP's inexperience with deep water operations, this decision may be regarded as an appropriate risk management strategy (Read, 2011; Steffy, 2011). However, such an approach requires efficacious stakeholder management. This is evidenced by Marcelino-Sádaba *et al.*, (2014) who contend that outsourcing project tasks necessitates unambiguous communication and attentive monitoring and control mechanisms. Despite this, BP outsourced project activities with inherent risk that the firm failed to identify (Park, Park and Ramanujam, 2018). Specifically, the firm neglected the potential for the blowout preventer to fail and to ascertain the complexity of deep-water drilling (Kim, 2017). Ultimately as evidenced by the U.S. Chemical Safety and Hazard Investigation Board (2016), BP failed to engage in effective risk identification procedures which resulted in the failure of the project.

2.2. External Risk

The Gulf of Mexico maintains an innate risk of hurricane occurrence (Klotzbach *et al.*, 2018). This risk was realised in 2009 during the Macondo project, wherein BP's Marianas oil rig experienced severe damage stemming from Hurricane Ida (Freudenburg and Gramling, 2012). Despite this, the firm demonstrated effective risk response development in its contingency planning to employ the Deepwater Horizon oil rig. As hurricane risk comprises an unavoidable risk of external origin, this precludes the implementation of avoidance, transference or mitigation strategies (Bing *et al.*, 2005). Therefore, BP accepted the risk and crafted an appropriate risk response mechanism. This acceptance of risk involves a recognition that the risk either must be incurred or that it cannot be successfully circumvented (Giannakis and Papadopoulos, 2016). In addition, the strategy infers a process of contingency planning to respond to the consequences of the risk in its latent occurrence (Hillson, 2002).

Despite the apt management of external sources of project risk, BP neglected the extreme complexity and therefore uncertainty associated with internal sources of risk. Furthermore, the firm's lack of engagement with traditional mechanisms of risk management is attributable to an immediate response strategy wherein upon realisation of risk, an intervention was crafted (Curlee and Gordon, 2011). Consequently, the organisation's risk management procedures may be regarded as insufficient.

3. Leadership

Leadership constitutes a critical element in PM due to its capacity to motivate project team members and generate a productive working environment (Anantatmula, 2010). Furthermore, this extends to ensuring efficacious communication exists between the project team and both internal and external stakeholders (Mir and Pinnington, 2014). Leadership plays a profound role in project success due to its ability to engender elevated team performance (Yang, Huang and Wu, 2011). Simultaneously, in the absence of effectual leadership, projects confront an elevated probability of failure (Nixon, Harrington and Parker, 2012). Poor leadership constituted the predominant source of errors and oversight in the Macondo project (Graham *et al.*, 2011). Thus, its analysis is of preeminent importance in ascertaining the underlying reasons for the project failure.

3.1. Organisational Culture

Chief executive officers are central in shaping an organisation's culture (Schneider, Ehrhart and Macey, 2013). Moreover, Amernic and

Craig (2017) postulate that a firm's executives maintain an entrenched influence in an organisation's orientation towards project safety. As the project sponsor, BP's executive team possessed significant influence in the project's implementation (Helm and Remington, 2005). This can be attributed to the critical function of project sponsors as suppliers of project resources (Kloppenborg, Tesch and Manolis, 2014). Concerningly, prior to the Macondo project, BP's organisational culture posed a considerable issue (Steinberg, 2010). Executives persistently demonstrated apathy towards risk management which resulted in two major accidents, namely the BP Prudhoe Bay Oil Spill and the BP Texas City Refinery Explosion (Jennings, 2010). Furthermore, the firm consistently pursued high risk projects which thereby prevented the attainment of a balanced project portfolio (Steffy, 2011). This indifference towards safety illuminated the project sponsor's cost focus which proved fundamental in the failure of the Macondo project.

3.2. Project Management Structure

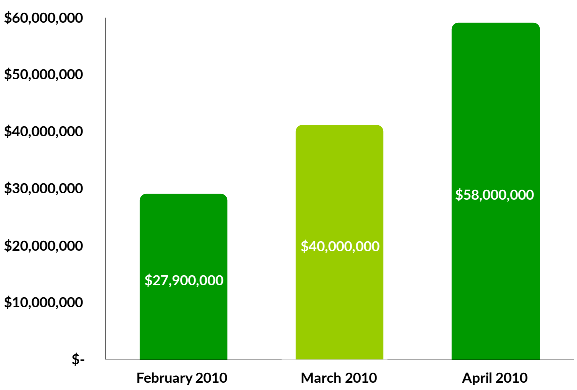
Prior to the project's failure, BP completed an alteration in the management structure of its projects (Buchanan and Huczynski, 2016). This involved a shift from the utilisation of dedicated project teams to a functional structure wherein employees working in operations maintained alternate reporting relationships to those in engineering (See Appendix 2) (Ingersoll, Locke and Reavis, 2012). Furthermore, the employment of this structure reduced the capacity of project managers to respond to uncertainty encountered in project execution (Miterev, Mancini and Turner, 2017). Conspicuously, the deployment of such an organisational structure impeded the capacity of NASA engineers to communicate their concerns and resulted in the tragic loss of the Space Shuttle Challenger (Seeger, Sellnow and Ulmer, 1998; Leveson *et al.*, 2009).

The alteration of PM structure established two team leaders, in operations and engineering respectively, for BP's Gulf of Mexico operations (Ingersoll, Locke and Reavis, 2012). This elicited communication issues between the teams in responding to nascent risk (Mejri and De Wolf, 2013). Critically, immediately preceding the disaster, members of the BP operations team expressed apprehension regarding the engineering team's decision to deploy a mere six centralisers to prevent the deformation of the drilling pipe when sealing the well (Steffy, 2011). This judgement sharply contrasted with BP modelling which suggested the implementation of 21 centralisers (Kim, 2017). This further reinforces the firm's omnipresent prioritisation of cost reduction throughout the project. Furthermore, the alteration in PM structure stifled the ability of individuals to prevent an ultimately catastrophic decision.

3.3. Decision-making

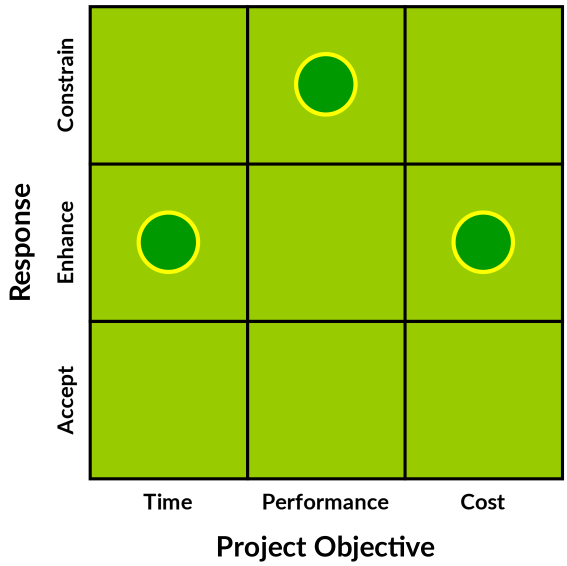
Subsequent to the deployment of the Deepwater Horizon, BP executives enforced a reduction in project scope to meet the predetermined time and cost requirements of the project (Steinberg, 2010). Preceding its introduction, BP incurred a three-month postponement to the project which resulted in the avoidance of safety protocols to expedite completion (Freudenburg and Gramling, 2012). Moreover, each day that the project suffered a delay, BP accrued an additional $500,000 of costs (See Figure 3.1.) (Read,

Figure 3.1. Project Cost in Excess of Budget



2011). This exemplified the firm's sharp concentration upon the elements of the iron triangle as indicators of project success (See Figure 3.2.).

Figure 3.2. Project Priority Matrix



The iron triangle articulates the three principal constraints that project managers confront – time, cost and scope (Atkinson, 1999). An alteration of one facet exerts an influence on at least one of the other variables (Khang and Myint, 1999; Tareghian and Taheri, 2006). Thus, BP's reduction in project scope sought to reduce the project's duration. Despite its pervasiveness, Pheng and Chuan (2006) and Toor and Ogunlana (2010) argue that the breadth of the iron triangle remains excessively narrow, owing to its omission of technical, managerial and business performance, and stakeholder appreciation. Moreover, Atkinson (1999) contends that a disproportionate prioritisation of the measures of time, cost and scope undermines the centrality of stakeholder management. Pertinently, this phenomenon transpired in BP's relations with Transocean and Halliburton (See Section 4).

Furthermore the inadequacy of BP's risk assessment mechanisms originated from the espoused values of management which involved a bias towards reducing time and cost at the expense of project quality (Buchanan and Huczynski, 2016). This could be observed in the discernible dearth of managerial supervision of critical testing immediately prior to the emergence of the blowout (Norazahar *et al.*, 2014). In addition, Kutsch and Hall (2010) postulate that leaders exhibited deliberate ignorance to complexity. Resultantly, critical factors including that of risk management were trivialised and rendered a vacuous administrative task. This remained palpable in the project steering committee's display of overconfidence bias in assuming excessive levels of risk (Kaplan and Mikes, 2012). Conclusively, the actions of BP management generated a hubristic culture which destined the Macondo project for failure (Sadler-Smith *et al.*, 2019). Consequently, rather than supporting project success the actions of project leaders undermined the ability and performance of team members.

4. Stakeholder Management

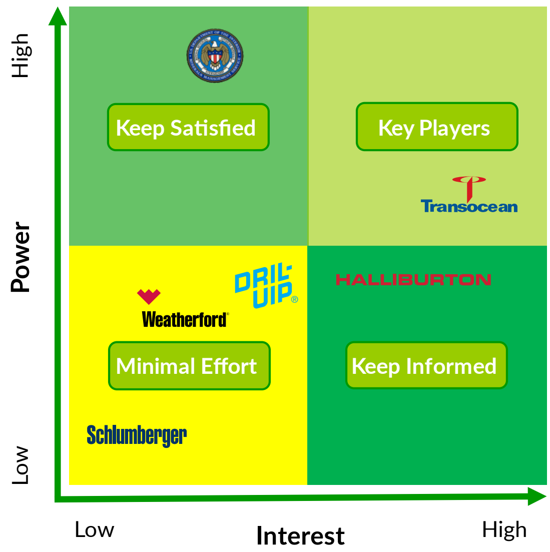
Stakeholder management refers to the process of accounting for and integrating the conflicting requirements of a project and its stakeholders (Fassin, 2012). Its purpose is to ensure alignment exists between the expectations and goals of the project owner and the various stakeholders with interests in the project (Carvalho and Junior, 2015). Due to the level of outsourcing and the potentially adverse effects of oil extraction on a myriad of stakeholders, stakeholder management represented a vital undertaking in the Macondo project (Nelson, 2008). Central to efficacious stakeholder management lies timely communication, and the provision of opportunities for information input (Yang *et al.*, 2011; Mok, Shen and Yang, 2015). Despite their imperative nature, these facets comprised underpinning determinants of the Macondo project's failure.

4.1. Ignorance to Stakeholder Viewpoints

Communication forms a pivotal source of project failure (Sauser, Reilly and Shenhar, 2009). This is evidenced by de Oliveira and Rabechini Jr (2019) who argue that poor stakeholder communication elucidates most project failures. Furthermore, Carvalho and Junior (2015) postulate that the primary concern of stakeholders relates to risk management. However, BP's stakeholder management undermined this principle. This was evident in the pressuring of Transocean employees working aboard the Deepwater Horizon to implement an inferior method of sealing the well, referred to as the long string (Read, 2011; Ingersoll, Locke and Reavis, 2012). To ascertain an appropriate stakeholder management strategy, it remains pertinent to discern the level of power and interest that each disparate stakeholder maintains in the project (Olander and Landin, 2005). This may be achieved through the deployment of the Mendelow (1981) matrix which classifies the influence of stakeholders (See Figure 4.1.). As Transocean may be categorised as a stakeholder with high interest but moderately high power to influence the project, BP necessitated the implementation of an approach in which Transocean was closely managed.

The long string design deployed by BP, circumvented the use of seals surrounding the drilling pipe which facilitated a reduction in project cost of $10 million (Steffy, 2011; Ingersoll, Locke and Reavis, 2012). The decision to utilise this method conflicted with

Figure 4.1. Mendelow (1981) Matrix



the views of stakeholders as in the absence of effective cementing of the borehole, a blowout could occur (Steinberg, 2010; Reader and O'Connor, 2014). A key stakeholder, in oilfield solutions firm, Halliburton, which provided the project's cementing services, conveyed uncertainty regarding the capacity of the long string methodology to secure the well (Gyo Lee, Garza-Gomez and Lee, 2018). The firm's testing indicated that the procedure could not reliably cement the well (Reader and O'Connor, 2014). This ambiguity was coupled with Halliburton's use of nitrogen foam cement which necessitated additional centralisers to ensure its efficacy. This postulation was reinforced by other stakeholders including Transocean. But, BP neglected to consider these stakeholder perspectives.

4.2. Lack of Open Perpetual Communication

Despite the failure of Halliburton's laboratory testing of the cement mixture when employed with the long string method, the firm declined to communicate its findings with BP (Reader and O'Connor, 2014). This may be ascribed to BP's preceding dysfunctional stakeholder management involving the pressuring of suppliers to meet excessive cost and time requirements, including the inadequate testing and modification of the blowout preventer (Bea, 2011). This ultimately resulted in the ejection of Schlumberger, a contractor commissioned to undertake logging of the well's cementing to ensure its adequacy (Bureau of Ocean Energy Management, 2011). This departure occurred due to BP's avoidance of running the cement bond log. Fundamentally, this exemplified BP's approach to stakeholder management.

4.3. Absence of Stakeholder Decision-making Involvement

Collaboration with and inclusion of all stakeholders remains pertinent in the identification and generation of responses to project complexity (Thamhain, 2013). Despite its importance, BP failed to incorporate stakeholder input into decision-making. Employees referred to the project as the 'well from hell' due to the presence of perpetual technical problems (Tinsley, Dillon and Madsen, 2011). But, these concerns were rejected, with 46% of employees indicating that they feared potential dismissal if they asserted apprehension regarding the project's safety (Graham *et al.*, 2011). Furthermore, despite the verdict of BP project managers to utilise six centralisers, the firm in fact maintained supplementary centralisers aboard the Deepwater Horizon. However, excluding Halliburton from this process ensured they remained unused. Therefore, BP employees assumed these centralisers were inappropriate (BP, 2010). The outcome of this decision, in the ensuing blowout, emphasises the salience of stakeholder management to project success.

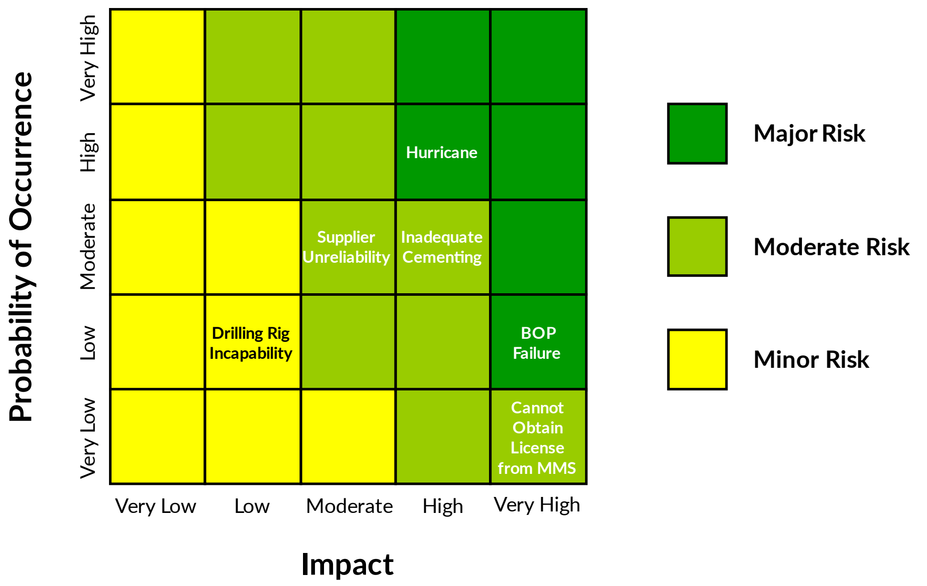
5. Recommendations

5.1. Recommendation 1: Institute Risk Identification & Assessment

Fundamentally, a catastrophic approach to risk management, involving the crafting of responses upon the realisation of risk, resulted in the failure of the Macondo project. Thus, it is critical that BP revaluate its risk management strategy and effectively ascertain all sources of project risk prior to project execution. Principally, the firm must leverage the predominant method of risk management, through the deployment of the risk management process (Hillson, 2002;

Marcelino-Sádaba *et al.*, 2014). In the initial phase of risk identification, the utilisation of a risk breakdown structure (See Appendix 1) is central to the categorisation and thereby ascertainment of the various origins of project risk (El-Sayegh, 2008). Resultantly, its through a fuzzy risk severity matrix (See Figure 5.1.) (Markowski and Mannan, 2008). Due to the inherent complexity in evaluating risk values pertaining to the technical risk surrounding deep-water wells, the deployment of fuzzy risk assessment is

Figure 5.1. Fuzzy Risk Severity Matrix



implementation facilitates an illustration of the total risk exposure of the project and an exhaustive mutually exclusive record of project risk (Holzmann and Spiegler, 2011). Thamhain (2013) contends that the use of this risk management mechanism would have pinpointed risks that BP's approach failed to detect, preventing the disaster.

Furthermore, an appropriate assessment of risk remains paramount to discern the probability of a risk's occurrence and its potential impact upon the project (Kaplan and Mikes, 2012). This may be implemented appropriate (Nieto-Morote and Ruz-Vila, 2011). This can be attributed to the associated impreciseness of the traditional risk management process in contending with such risk typologies (Markowski and Mannan, 2008). Fuzzy risk assessments refer to the initial use of linguistic and interval judgements of risk values rather than a fixed risk value assignment (Abdelgawad and Robinson Fayek, 2010). By exploiting fuzzy methodologies, BP may incorporate qualitative measurements into the risk assessment process and infer a more accurate risk value following a process of defuzzification (Miri Lavasani *et al.*, 2011). This involves the weighted averaging of all linguistic inputs into a specific quantitative output through a prescribed model (Markowski and Mannan, 2008). Despite its effectiveness in contending with risk for which data remains scarce, the method should be avoided for other sources of project risk (Abdelgawad and Robinson Fayek, 2010). Ultimately, an accurate assessment of risk enables efficacious response development, a domain in which BP maintains proficiency due to its successful management of external risk.

5.2. Recommendation 2: Reorient Organisational Culture & Project Management Structure

BP's decision to pursue project completion following the occurrence of a myriad of 'kicks' exhibited an escalation of commitment to a project destined for failure. An escalation of commitment involves an inherent human predilection towards loss avoidance (Staw, 1981). Thus, frequently when projects experience initial impediments, investment is elevated in an attempt to increase the probability of future success (Kaplan and Mikes, 2012). Conversely, ExxonMobil ceased its Blackbeard project in 2006 owing to consternation regarding the firm's capacity to manage the risk accompanying the deep-sea well, resulting from a 'kick' (Mouawad, 2010; Skogdalen and Vinnem, 2012). Moreover, the conclusion followed a $187 million spend and 30,000 feet of drilling (ExxonMobil, 2010). To circumvent an escalation of commitment and thereby remediate the firm's risk seeking organisational culture, the stage-gate process may be integrated (Kaplan and Mikes, 2012). This involves the use of stages of work completion, and gates wherein it is decided to continue or terminate the project (Cooper, 2008). Pertinently, upon its evaluation at each gate, the project must meet set criteria to ensure continuation (Cooper, 2014). Furthermore, it remains salient to alter BP's PM structure towards dedicated project teams. Such a shift engenders superior communication among team members (Gray and Larson, 2018). Additionally, the decentralisation of decision-making associated with dedicated project teams improves the agility of resource allocation, stakeholder management, and thereby the value generated by a project (Too and Weaver, 2014).

5.3. Recommendation 3: Augment Stakeholder Engagement

Inherently, stakeholder needs are difficult to identify and manage (Mir and Pinnington, 2014). This complexity is augmented by the idiosyncratic requirements of disparate stakeholders (Atkinson, Crawford and Ward, 2006). BP must strive to elevate stakeholder trust following the failure of the Macondo project, which has been compounded by two significant preceding failures. However, this constitutes a challenge as stakeholder trust is predicated upon the perceived value congruence of the stakeholder with the project (Earle, 2010). Fundamentally, in generating the criteria defining project success it remains critical to attain agreement from all stakeholders (Ika, 2009). Evidently, this failed to occur, as BP centred its objectives upon the factors of time and cost. Hence, all stakeholder perspectives must be considered when crafting key performance indicators (Mir and Pinnington, 2014). Consequently, this enhances project decision-making and risk management by mitigating uncertainty (Atkinson, Crawford and Ward, 2006; Thamhain, 2013). This was evidenced by the contentions of Halliburton and Transocean in the Macondo project.

Moreover, the deployment of a governance framework enables the ascertainment of accountabilities, roles and responsibilities for all project stakeholders. This facilitates transparency and cohesion in the decision-making process (Badewi, 2016). Such a model demands the unambiguous definition of the aforementioned elements before the initiation of a project (Too and Weaver, 2014). In addition, these parameters may be established within supplier contracts to ensure their application (Eisenhardt, 1989). Consequently, this provides an array of guiding principles which minimise stakeholder conflict.

6. Conclusions

Conclusively, the Macondo project represents a systematic failure in PM. Fundamentally, an apathy towards risk management, involving the generation of immediate responses to emerging risk, manifested a series of perilous events which were exacerbated by ineffective stakeholder management, an inappropriate PM structure, a risk seeking organisational culture and poor leadership. Although the failure of the Macondo project represented a significant financial cost of $145 billion, the most poignant cost of all involved the fateful loss of 11 lives (Gyo Lee, Garza-Gomez and Lee, 2018). Thus, it is critical that lessons are learned to ensure the safety of future projects and resultantly, the prevention of analogous errors.

This paper has provided several actionable recommendations to ensure this occurs and that the performance of future projects is augmented. First, a greater emphasis upon risk identification and assessment remains paramount, through the implementation of an exhaustive risk breakdown structure and fuzzy risk assessment to contend with technical risk. Second, the stage-gate process may be instituted to ameliorate a risk seeking organisational culture. Third, an alteration in PM structure towards dedicated project teams is essential to optimise communication. Finally, stakeholders must be involved in the crafting of project objectives and decision-making to ensure project success, which should be supported by a governance framework. Ultimately, the execution of these recommendations shall enable BP to maximise project safety and efficiency in its future endeavours.

Glossary

Blowout: A blowout refers to an uncontrolled surge of hydrocarbons to the surface following a kick (Abimbola, Khan and Khakzad, 2014).

Blowout Preventer: A blowout preventer is a device intended to sever the connection between an oil rig and the oil well below in the event of a blowout (Reader and O'Connor, 2014).

Centraliser: Centralisers are mechanical devices which ensure the rigidity and integrity of the drilling pipe connecting the well to the rig when cementing a borehole. In their absence or ineffective utilisation, a blowout may occur as hydrocarbons can flow from the wellbore due to an inadequate sealing of the well (Graham *et al.*, 2011).

Kick: A kick infers a sudden flow of hydrocarbons into a wellbore (Abimbola, Khan and Khakzad, 2014).

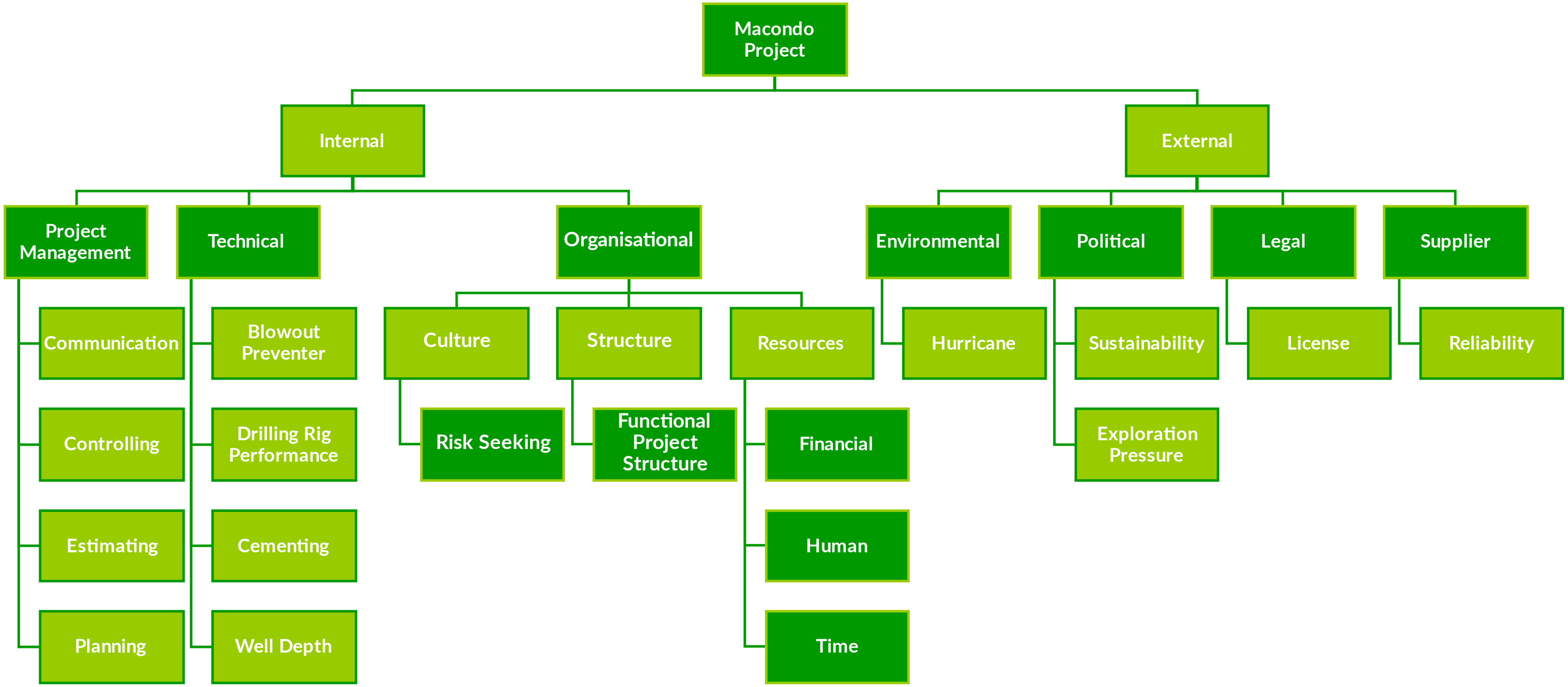
Long String: A method of sealing a well involving the descending of a casing string from the top of the well. This method necessitates high quality cementing to prevent a blowout due to the presence of only two barriers (Bea, 2011).

Tieback: An approach to securing a well with four impediments to a blowout, due to further fixing to the edges of the wellbore (BP, 2010).

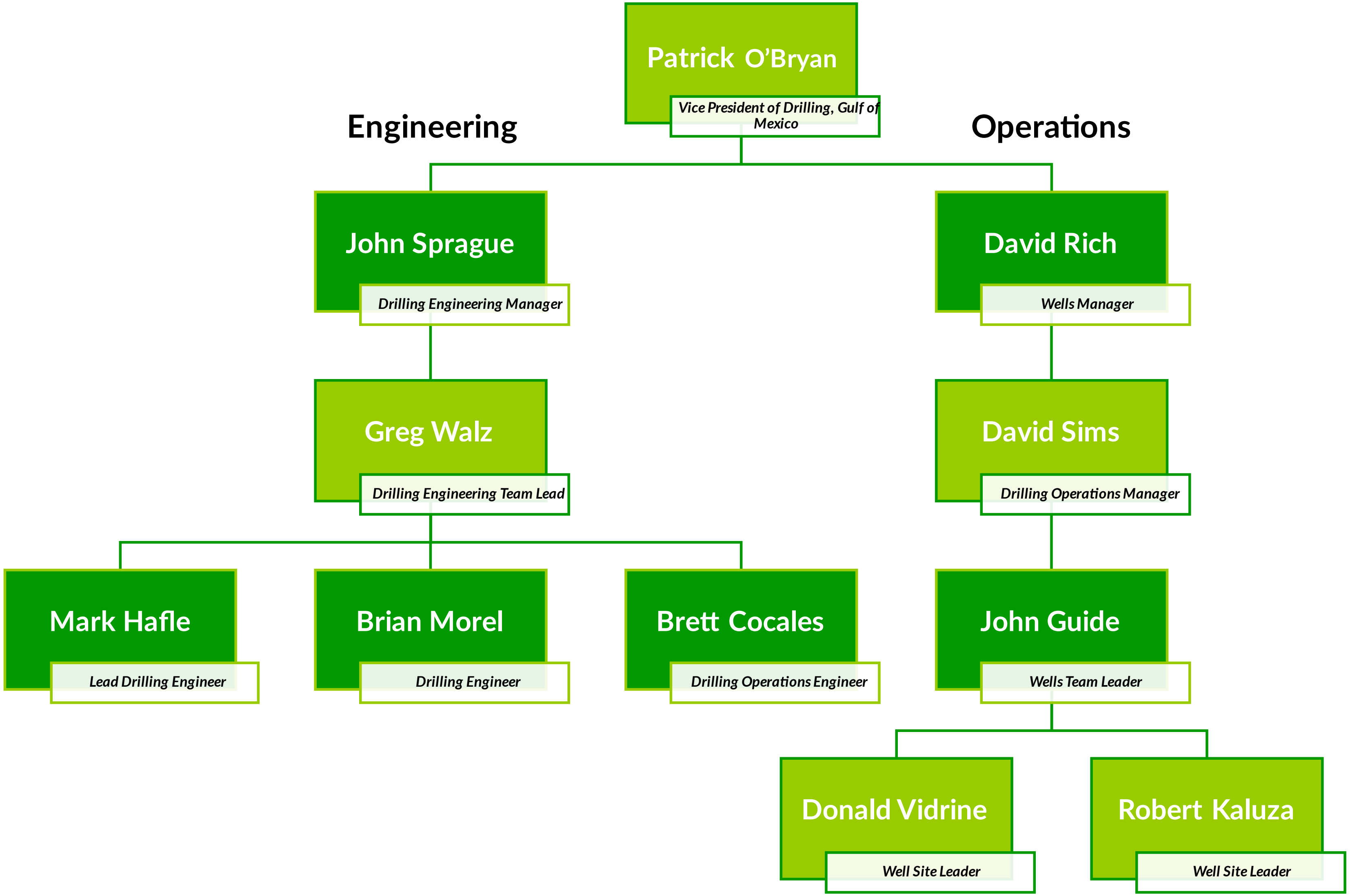
Wellbore: A cavity drilled to reach subterranean hydrocarbons (Miri Lavasani *et al.*, 2011).

Appendices

Appendix 1: Risk Breakdown Structure



Appendix 2: Functional Project Structure



Appendix 3: Risk Response Development

Risk	Category	Probability	Impact	Trigger	Response
Blowout Preventer Failure	Technical	2	5	Computer sensors and failure of device to respond	**Mitigate:** continually test device's efficacy
Inadequate Cementing	Technical	3	4	Cementing log	**Mitigate:** communicate closely with Halliburton and Schlumberger
Hurricane	External	4	4	Computer sensors on rig	**Accept:** develop contingency of additional rig
Drilling Rig Incapability	Technical	2	2	Inability to reach well	**Transfer:** outsource to Transocean
Supplier Unreliability	External	3	3	Delays and cost overruns	**Mitigate:** close communication
Failure to Obtain Drilling License from MMS	External	1	5	Inability to extract hydrocarbons	**Accept:** diversify project portfolio

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