Deepwater Well Design, Competency – Management of Risks

Yngvar Duesund[i] and Ove T Gudmestad[ii]

Abstract

It is important that management understands the overall risks involved in drilling a deepwater well and that they understand what it takes to make a robust deepwater well design. Is this issue all a matter of competency?

The competency of a company's drilling team, whether the team has the right persons for the job or previous success has made them complacent "making short cuts", should be questioned in case of problems and equally so by those who verify the well design and approve the non-conformances.

More than twenty years of drilling experience doesn't necessarily mean that a person is competent to enter new territories in deepwater drilling. For example a pilot who has been flying a Boeing 737 has to take on extensive training before a sufficient level of competency is reached to fly a Boeing 777. Bearing in mind the statement of Capt Chesley Sullenberger (with 40 years of experience as pilot) who landed the US Airways flight 1549 on Hudson River on January 15, 2009:

"I can speak for the entire crew when I tell you we were simply doing the job we were trained to do."

Sullenberger had trained beyond standard requirements. We know that an expert makes most decisions intuitively, based upon previous experience and training. But how will a good decision be made when a new unexpected situation occurs that has not been experienced or trained for? Referring to the Berkeley Professors Hubert and Stuart Dreyfus' concept of "Beyond Expertise" [1]:

"*A related alternative road to mastery presents itself to experts whose skill demands that they sometimes must respond to novel situations without time for deliberation. Such an expert, if motivated to excel, not only will assess the situation spontaneously and respond immediately, but will experience elation if the assessment and response is successful and dissatisfaction if it seems to him disappointing.*"

When an organization/team is very successful a kind of complacency will ride the organization/team and important issues may easily be overlooked, reference to BP's Macondo well and the Norwegian Contractor's Sleipner incident.[2] It is only a professional management team and very competent personnel who will continuously manage to deal with unexpected issues. We will in this paper discuss what characterizes a professional team and competent personnel. It must also be recognized that a professional team must be given the opportunity to act as such within the organization and the limits of its responsibility and authority. An organization where the top management only accepts reports of successes can never learn from failures or near misses.[3]

[i] Special Advisor to Citris, University of California Berkeley, Berkeley, California.
[ii] Professor of Marine Technology at University of Stavanger, Stavanger, Norway.

1. Introduction

The composition, competency and integration of a team have a significant effect on its success. When management assigns tasks to individuals they assume that the person has the competency and will have hands on the work to be carried out. In the oil and gas industry there are long traditions how a drilling team is composed and there isn't much difference from one oil company to another how the work is organized, however, risk assessment, planning, and contractual issues may vary considerably and so the performance.

In the Middle East a drilling team spent 56 days to drill and complete a well while another one spent 132 days drilling in the same geological formation, both team using the same drilling rig. Why did one team perform more than twice as good as the other? The major reason was that the successful team performed risk assessment and planning very seriously and hence, they could deal with all logistical challenges, interfaces, and change management. This team had the necessary competent personnel with excellent communication skills and knew the risks and challenges to overcome. Their work was considered at the time as best practice in that region. The result was outstanding and other companies wanted to copy the way they organized the work, but so far no other team have managed to be equally successful. The manner the teamwork was carried out and how communication and cooperation with contractors was dealt with made the big difference and those are factors that cannot be easy to paste and copy, i.e., the personal "touch" can never be copied. But careful planning and a humble approach to new challenge should be a trait for all teams to handle acceptable risk and be prepared for unexpected events.

When a drilling team is faced with a situation they didn't contemplate and there are none operating procedures for handling it, then full management attention should be required. If critical, the top management of the organization should be informed. The decision whether to stop a risky operation or not should be taken by the most competent personnel, i.e., a person or persons who have experienced and handled similar situations. Top management or the regulatory body will normally not have the competency required to handle an unexpected operational issue, but they can contribute, ensuring that best resources and information are made available.

2. The Professional Team

A competent team has the know-how dealing with the tasks in hand,, i.e., the team members possess certain measurable skills, sound education, good intuitive judgment, experience, an ability to apply related knowledge to solve problems and a responsible attitude. The stakeholders will trust a professional team based on competence proven on previous track records of the individuals. A newly composed team must have the ability to be a learning team. Referring to M. P. Senge[4]:

> *"Organizations learn only through individuals who learn. Individual learning does not guarantee organizational learning. But without it no organizational learning occurs."*

The excellent drilling team mentioned above was a learning one that produced results beyond all expectations. They continuously improved their skills building on the individuals' strength.

In most organizations there is always an issue finding the right person for the task. Who is available, what should be prioritized, who knows who etc. The leader must therefore:

- Have a clear understanding of risks and change management,
- Establish clear roles and responsibilities,
- Follow a rigorous selection process of team members,
- Take on experienced and functional leaders,
- Ensure alignment of the team with outside functions,
- Establish a system and a formal methodology of working and good reporting routines,
- Handle interfaces with other organizational functions, authorities, contractors and suppliers etc.
- Communicate situations in real time to superiors

Figure 2.1 below illustrates a typical team process in the oil and gas industry.

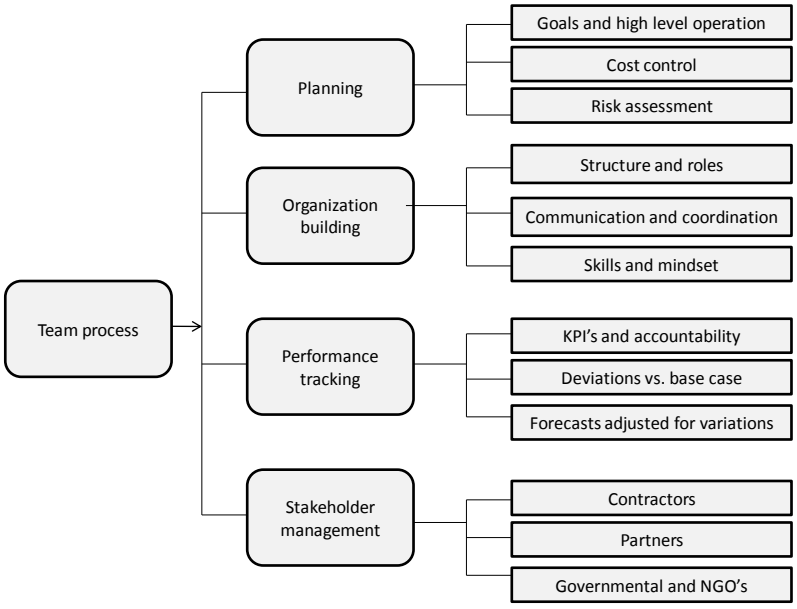

Figure 2.1 - Team process in the oil and gas industry.

2.1 Handling unexpected events

The team's ability to handle unexpected situations is very much dependent on its ability to communicate situations in real time and how the team has been trained for emergency preparedness and whether it has established necessary contingency planning (ISO/PAS 22399,[5] see Figure 2.2 below). A system for detecting incidents in real time should be in place, i.e., an electronic log including levels of alert pending seriousness of the incident that can be viewed by competent personnel.

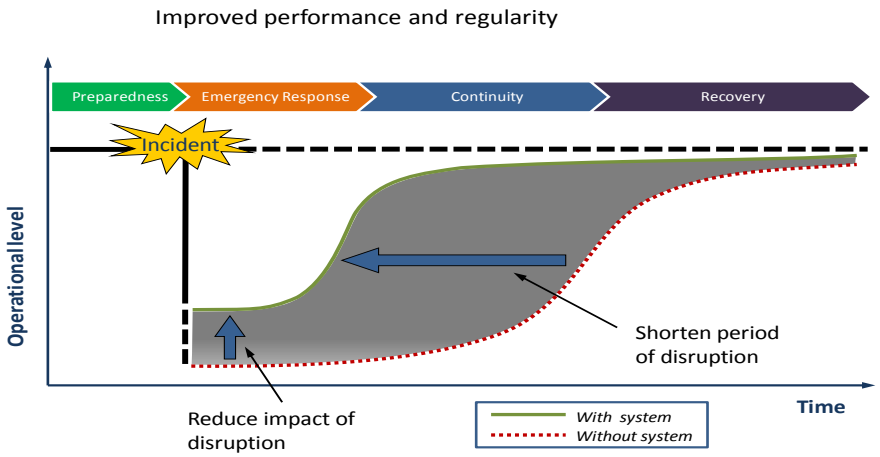

Figure 2.2 - A holistic management process.

The team's ability to handle unexpected situations is dependent upon ability to communicate, on training and on whether contingency planning is established.[6]

Referring to James and Wotten's research,[7] this has demonstrated that the interaction between technology and other nontechnology resources influences performance. Information technology can play a clear role detecting early warnings in order to prevent incidents escalating into crisis.

The team's performance and its ability to make decisions will be pending upon the working environment. In order to learn from experience, people need sufficient feedback about the accuracy and consequences of their judgments. This works well when the uncertainty is low. In the case of deepwater drilling there has been less opportunity to learn from experience. High task uncertainty (resulting from uncertainty in the external environment and uncertainty introduced by the information system) leads to poor cognitive performance.[8] Ultimately, it is the team leader competency to analyze and act before, during, and after an incident occur that determines the outcome. For large capital projects it has been proven that success rate is very much depended upon the Project Leader's competency.[9]

Do note that people tend to discount the possibility of unprecedented risks. Because all the swans they have seen are white, they assume black swans do not exist. A black-swan event is beyond the realm of normal expectations and tends to be discounted, even by experts.[10]

2.2 Design – Risk Assessment

For deepwater wells with high pressure and high temperature there are no clear design criteria regarding the robustness of pressure barriers. Best practice is often from the latest well that has been drilled and completed. Authority regulations worldwide are basically made on hindsight and are generally not performance based and hence, all the major oil companies fulfill the general authority requirements. The oil and gas industry recognizes the challenges of securing pressure barriers, though many have experienced "near misses". The authorities in general, have not made changes to well design requirements for operating in deep water. It appears that the regulators have an "out of

sight, out of mind" attitude to risks that seldom happen and have little competence with respect to the pressure barrier issue The Oil and Gas industry is well aware of that there are no recognized methods for "top-kill" other than drilling another appraisal well; hence, this is an acceptable risk by the industry. Who represents the best competency regarding well design? Is that the Oil and Gas Company, the drilling contractors, or the consultants?

When performing risk assessment the team will generally recognize worst case scenarios, but how will this ensure that the team is staying focused and pay attention to important details in everyday operations? Again, this will depend very much on the team leader competency.

When incident occurs it is often situations or issues that the designers did not contemplate, and for which there is therefore no possibility of having a "Standard Operating Procedure". This requires that the operators think and act independently. Their skills and experiences determine the success of handling the unexpected situation.

2.3 Outsiders looking in

A drilling team will be exposed to Quality Audits, Design Reviews, Peer-reviews, and third party verifications. Who perform these activities and what competency do they represent? For the Sleipner A, the concrete substructure that sunk during a controlled ballast test operation, August 1991, none of these outsiders managed to detect what was wrong with the design, even though the weaknesses of past design of other substructures were known and described in design basis documents. Was this due to lack of engineering acumen in these audit, review, and verification teams? In general the large consulting companies who perform verification or certification activities do not take on any responsibility what happens to the item being verified. So, do the oil and gas companies and regulators buy flawed insurance? How do you ensure that the right competency is present for the tasks to be performed and what price are you willing to pay?

The Interim Final Rule to Enhance Safety Measures for Energy Development on the Outer Continental Shelf[11] requiring submittal of certification by a professional engineer that the casing and cementing program is appropriate for the purposes for which it is intended under expected wellbore pressure. The professional engineer's competence requirement is not stated.

2.4 Key Personnel competency

A drilling team will be composed of a group of specialized drilling engineers, who should fulfill competence requirements with respect to education (theoretical background to understand the situation), experience (practical experience from solving difficult situations) and communication skills (ability to solve any upcoming questions as team work).

The team must be given authority to carry out the work in a professional way by being given the funds and time needed to do the work. A pressure on costs or schedule could easily result in shortcuts (like impatience to wait for the cement to cure) or skipping tests that costs money. Cooperation with auditors and persons who perform verifications is important

We will suggest that the team be composed of a group having the following competence requirement:

- The manager; experienced, preferable with a university degree, good track records and good communication skills, knows the overall criticalities.

- The supervisor; experienced, subject acumen, good planning skills, knows the criticalities.
- The engineer; deep understanding of the tasks in hand and knows the risks involved.
- The operator; well trained and experienced sees and reports deviations immediately.
- The auditor must be equally competent as the personnel being audited

The person(s) who verify should generally have a competence level that is beyond the personnel performing the tasks. Regardless of the team competence, however, the team cannot be expected to function adequately should there be pressure from the top company management to carry out the work in an unprofessional way, such as demanding shortcuts to be taken. "If you will not do as we request, you are on the next helicopter to land."

2.5 Build-up of competence

An organization must build up their competence in a strategic way. The novices must learn from the experienced thus ensuring that the organization has a long learning experience. There is a huge difference between 30 years of experience that can be shared and 1 year of experience repeated 30 times (different individuals). An efficient way to share experience is the identification of mentors for newcomers, ensuring that information is delivered to next generation "hands on."

How can a team of committed managers with individual IQ's above 120 have a collective IQ of 63? The discipline of team learning confronts this paradox.[12] When teams are truly learning not only do they produce extraordinary results, but the individuals members are growing more rapidly than could have occurred otherwise. Regularly training to be prepared to handle unexpected situation should be a "must" for personnel being exposed to critical situations. Bear in mind the reality that a driver who obtained a license may not be the one you would like to drive your car or even who you would employ as a driver. A certificate or a license is no guarantee for excellent performance.

The oil and gas industry has the last decade been marred with "retirement/severing packages" offered to senior personnel in the companies. Latest example is when Statoil acquired Norsk Hydro's oil and gas division. All personnel above 58 years of age were offered very generous "pension packages" regardless of the criticality of their competence to the organization. The transfer was quickly executed (probably to show strength to the capital market) and 2100 people left the company at a total costs of 1.3 B US$.[13] The consequence was that a large number of less experienced personnel were left idle without sufficient guidance that is considered to have caused considerable uncertainty in the organization.

3. Conclusions

To ensure that the organization behaves like a high reliability organization,[14] an organization that is conducting relatively error free operations over a long period of time making consistently good decisions resulting in high quality and reliability operations, competence is required.

Deepwater well design and operation is a high "cutting edge" technology in which the predominant factor is learning by doing. It appears that some operating teams and organizations have not changed sufficiently to successfully address the challenges from operating on the continental shelf to deepwater.

Competence (both theoretical and experience) is considered critical to an organization and in particular in the teams formed when planning and executing deep water drilling. Furthermore, it is of utmost importance that the competent team be allowed to utilize their competence to avoid that corners are cut. The team members must recognize their strength and weaknesses and any lack of team competency must be acquired.

Stakeholders' competency must be recognized and one should have realistic expectations to regularities bodies.

There is little research on offshore competency handling critical operations and crisis.

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