How can a Lessons Learned Strategy be successfully designed and implemented within a technical engineering environment?

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Abstract

The most common expression of knowledge management is the sharing of lessons learned (Earl-Carnes & Breslau 2002). Many organisations are attempting to implement a lessons learned process, however are unsatisfied with the effectiveness of the system. This project explores the difficulties of designing and implementing a successful Lessons Learned (LL) strategy within a technical environment. Action research was conducted to analyse this issue employing interviews, surveys and observational analysis. The fundamental findings of the project include several key factors influencing the success of the strategy, namely the importance of the human element, the organisational culture, the support required from management, the integration of the process into standard business proceedings and lessons must result in actionable items.

1. Introduction

Professional knowledge held by engineers is critical for organisations. This knowledge relates to how they apply their professional expertise to the roles they undertake, but also how they draw on past experience when working on new projects or in different contexts. In recent years there has been a recognition that organisations need to encourage their employees to see this sharing and exchange of expertise as important parts of their professional roles (Debowski, 2006; Bustin & Woodward, 2007). This is particularly true in engineering, where large scale projects, project viability, safety or sustainability of project outcomes can be placed at risk. However, there are many challenges in managing and accessing technical expertise given the pace of work, the dynamic nature of the workforce and ongoing pressure on busy professionals to move to the next task rather than reflecting over past actions. While the value of exchanging and documenting professional knowledge is recognised, the conditions that encourage successful professional exchange of that expertise are still being identified. In recent years, organisations have focused on capturing this learning by documenting the Lessons Learned (LL) by their professionals. These approaches aim to avoid repeating past mistakes and ensure use of best practices. The goal is for organizations to achieve continuous improvement and gain a competitive advantage in the industry, as "Good Lessons Learned Systems are important to achieving a sustained competitive advantage in the commercial market place" (Rogers, Dillon & Tinsley 2006).

In recent years, technological solutions have become more prevalent, and have prompted greater consideration of how to encourage the transfer of knowledge across different professional members. A survey of 74 firms found that LL systems occurred most commonly in oil and gas, military, and engineering and construction organisations (KNOCO, 2009).

However, the majority of those organisations were dissatisfied with the effectiveness of their systems. The development of a system will not, in itself, lead to the successful documenting and sharing of the lessons professionals have learned. Organisations also need to consider the human factors that are central to a successful LL process (Voit & Drury 2006; Weber et al. 2008). This is an emerging field that is still being developed. Recent research (e.g. Energy, 1997; Weber et al., 2008) has started to clarify the different stages that need to be undertaken to ensure a successful system is established and then adopted by professionals. The basic elements of the system development include *identification, documentation, validation, storage and utilisation* of Lessons Learned (Energy 1997; Weber et al. 2008). In addition to employing these necessary elements there are many management, cultural, human factor and motivational issues that must be addressed if a LL process is to be successfully implemented (KNOCO 2009; Voit & Drury 2006; Energy 1997).

This research project explores this issue in an engineering context, demonstrating some of the difficulties that organisations can experience in both capturing and sharing the knowledge gained during a technical project. It explores the process of designing a Lessons Learned strategy and the tactics that are required to overcome the barriers that limit professional adoption of the practice. The project was aimed at identifying the factors that would encourage professional engineers to see this system as important and integral to their role.

The research was undertaken at Woodside Energy Ltd, a leading oil and gas firm based in Western Australia. Woodside had recognised the critical need to document and capture the past learning of its engineers, but experienced difficulties in creating an effective system and process. The LNG Development Department within Woodside had been working on several Lessons Learned projects simultaneously with the aim of developing an effective Lessons Learned Strategy. The project was undertaken to expand and align current efforts to develop a corporate level initiative. Woodside recognised the potential of an effective LL process in increasing the efficiency and productivity of Woodside's normal business activities.

2. Action Learning Project

When conducting this research, no clear solution or process was readily apparent when designing the project focus. Instead, the project had to be developed iteratively using an action learning research approach, with the outcome of a stage influencing the next stage of the research process. Descombe (1998) discusses that action research is employed for solving practical issues in 'real world' situations. He discusses the 'cycle of research' where research involves a feedback loop in which findings are implemented and then evaluated to guide the further research. Action research also involves participation of those affected to encourage collaboration and professional learning (Descombe 1998).

A particular method that can be used in Action Research is ethnographic research. Originally developed by anthropologists to study a society, group or culture in depth, this research involves observation and integration into the community to observe and share the same experiences as those who are being studied (Genzuk 2003). Genzuk (2003) reports that classic ethnographic research employs interviews, observation, and document analysis as the main forms of data collection techniques. These collection techniques can contribute various kinds of data that comprise narrative descriptions, observations, quotations, descriptions, and excerpts of documents. An ethnographic approach was possible for this research, as the project was undertaken while working for Woodside Energy Ltd's head office, thus offering an opportunity to gain data, test theories and observe the outcomes of each project phase.

Five distinct stages of research were conducted:

Stage 1: Problem Scoping – After reviewing knowledge management processes within the LNG Development department, an expert steering group identified a key priority area as the Lessons Learned process. They were concerned that few engineers were using the existing system despite its potential value. The agreed research question was therefore determined as being: "*How can a Lessons Learned Strategy be successfully designed and implemented within a technical engineering environment?"*

Stage 2: Stakeholder Identification and Mapping – The various stakeholders who might be impacted by the LL system were identified as the first stage in evaluating the Lessons Learned context. Stakeholders were defined by the project team as any individual or party who would be affected by changes to the Woodside Lessons Learned process. Stakeholder mapping assisted in analyzing stakeholders' influence and interests. Internal and external stakeholders were identified by brainstorming sessions within the project team, and during interviews and discussions with LL stakeholders.

Stage 3: Stakeholder Consultation – Semi-Structured Interviews – From the initial list of internal stakeholders the project team identified the stakeholders who were considered to be Subject Matter Experts (SME's) on the topic of Lessons Learned within Woodside. Semi - structured interviews were conducted with 15 of the 30 identified SME stakeholders to discuss the experiences stakeholders had in accessing or sharing LL, the challenges they saw and their insights into effective approaches to LL. The semi structured interviews focused on several different themes including past experiences as both a sharer and learner, future innovations, the Woodside culture, motivational factors, the value of LL and Woodside support/fit. The results of the interviews were analyzed by collating qualitative answers and categorizing them into themes. Responses with the highest frequency of occurrence were identified as the most important themes.

Stage 4: Survey of Woodside Community - The analysis of the qualitative responses from the semi-structured interviews identified several focus areas that were considered important to the success of a LL strategy. These were then followed up with a survey to validate those areas identified. Woodside employees were invited to complete an online survey, leading to 150 completed responses. The survey focused on five main areas that stemmed from stages 1 – 3 and the literature: the perceived value of a LL strategy, accessibility of LL, the level of existing sharing, barriers to sharing LL and motivational factors for participating in a LL strategy. Likert response scales and open-ended questions were employed. The results were analysed by studying the frequency, range and central tendency of responses.

Stage 5: Evaluation of existing Strategy and Effective Options for Implementation – The final stage of the process involved compiling all the results from the previous stages and linking these results with the current literature. A recommendations report was then produced.

3. Results

This paper presents the results of Stages 4 and 5 of the study. The perceived value of a LL process within Woodside was discussed at two levels: the value a LL process would offer for the respondent in their role, and the value a LL process would add to Woodside. The results in Table 1 indicate that the majority of the respondents believed that a LL process is 'Very Valuable' to their own job tasks and 'Very Valuable' to Woodside. The responses suggest that employees are aware of the benefits a LL process can have on an organization, irrespective of whether they believe that the process is beneficial to their own needs. This suggests that the rollout of a LL process would be widely supported by the Woodside employees. The survey shows that there is a readiness to employ a LL process.

Perceived Value	To Respondent's Role n=150		To Woodside n=150	
	n	%	n	%
Not Valuable	5	3	1	1
Somewhat Valuable	30	20	18	12
Valuable	45	30	41	27
Very Valuable	69	46	90	60
N/A	1	1		0

Table 1: Perceived value of LL Strategy

An issue identified during problem scoping was accessibility of the existing LL systems, which were largely unknown to those interviewed. Respondents of the survey confirmed that only 34% would be able to locate LL relevant to their current role. Furthermore 63% of respondents had never been advised of the existence of a LL database or repository.

Professional exchange of knowledge was examined to identify the extent of sharing across different operational groups and the mechanisms by which sharing occurred. As Table 2 illustrates, 73% of respondents did report learning from other departments. However, 24% reported that they had never shared their knowledge and 7% only share lessons once a year.

Frequency	Responses	%
Na	36	24
Yearly	11	7
Quarterly	38	25
Monthly	49	33
Weekly	2	9
Daily	14	1

Table 2: Frequency of Sharing of LL (n=150)

Method of Sharing:	Responsess	%
Email	66	42
Informal Discussion	81	52
Workshops	15	10
Scheduled Meetings	43	28
Other	20	13
NA	35	22

Table 3: Methods of Sharing (n= 150

The methods by which respondents shared LL across different groups are depicted in Table 3. The survey highlighted that a large proportion of Woodside Employees share LL, however these are conducted predominantly through informal methods. The most widespread form of sharing LL was through informal discussion, with 52% of respondents identifying this as the primary method they employ. The second most frequent method of sharing was through unstructured/informal emails (42%).

Respondents were asked to identify barriers that impeded their participation in a LL process. The suggested barriers are shown in Table 4, with the sixth response of Not Applicable.

Barrier Description	Responses	%
Process to capture and disseminate Lessons Learned is not well defined	90	60%
Unaware of a process that outlines how to capture and disseminate Lessons Learned	82	55%
Lack of time	78	52%
No motivational factors to complete process	44	29%
No support from managers	19	13%
Not applicable to me	12	8%

Table 4: Barriers to participating in a LL process (n = 150)

Sixty percent of respondents identified the largest barrier to participation as the *Process to capture and disseminate Lessons Learned is not well defined*. 55% of the respondents indicated that they were *Unaware of a process that outlines how to capture and disseminate Lessons Learned*. These results suggest that at least 60% of the respondents are obstructed from participating in the LL process because they cannot find a clearly defined procedure on how to complete the LL process. "Lack of time" was also a significant barrier with 52% of respondents agreeing. Lack of time can result from schedule drivers and a lack of definition around allocating time to project accounts.

The survey examined motivational factors that would encourage employees to participate in a LL process. Participants were asked to identify their perceived level of motivation relating to different factors that might encourage LL engagement. A Likert Scale ranging from No Motivation(1) to Highly Motivated(4) was employed. The results were analysed using mode, median and the inter-quartile range.

Motivation Factors	Median	Mode
Understanding of the process	3	3
Feedback of the changes to standards or processes that were made as a result of capturing a Lessons Learned and the benefits that resulted	3	3
Rewards for contributing Lessons Learned, such as movie tickets, dinner vouchers	2	2
Linked to KPI's/Performance Agreement	3	3
Support and Encouragement from Management	3	3
Clearly defined process	3	3
Support from a dedicated Lessons Learned department that oversees the process and facilitates AAR to capture Lessons Learned.	3	3
Audit tracking system monitoring progress of Lessons Learned (ie changes to standards/processes)	3	3

Table 5: Motivational factors identified by respondents (n = 150)

The strongest motivators for the respondent group were identified as *a clearly defined process, an understanding of the process, support from management and feedback of the changes and resulting benefits of a lesson learned*. A large majority (greater than 70%) of the respondents perceived that the level of motivation they would receive from these factors would range from Motivated to Highly Motivated. Token rewards like movie tickets were seen as less motivating.

4. Conclusions and Future Work

The five key findings of the project are discussed below:

The Human Factor Element - The majority of literature dedicated to LL focuses on the design of systems, rather than making the connection between sharing lessons and the human element. This is arguably the reason for the failure of many of these systems. A key theme in the culture of engineering is the preoccupation with designing humans out of systems rather than into them (Schein 1996). The ultimate elegant solution to an engineer is one that always works and works automatically, without human intervention. This theme was observed within Woodside with the constant drive for a system solution; this issue could be the reason for the failure of so many KM systems in technical organisations. Effective LL programs facilitate partnerships between colleagues, with the common goal of increasing organisational knowledge by enabling employees to adopt lessons already learned (Voit & Drury 2006). For a LL strategy to be succesful it needs to facilitate and support the human-to-human collaboration process.

Cultural Adoption - Organisations need to adopt a learning culture. Incentives must be developed to achieve a cultural change so that the organization actively seeks to identify lessons, learns from these lessons and encourages exchange across colleagues. The paramount design factor of a lessons learned program is to create a supportive organisational culture that promotes engagement in the process and values continuous improvement (Voit & Drury 2006).

Management Support - A necessary requirement for the success of a LL process is the constant involvement from senior management and clear expectations that the process will be applied. To reinforce the LL process, managers must allow employees time and encouragement to perform their LL responsibilities while monitoring usage. Ownership and

accountability of the LL Program from senior management is essential if it is to provide any value to an organisation(Voit & Drury 2006; KNOCO 2009).

Integration into Standard Business Practice - Management processes must be designed to incorporate the identification, capture, dissemination and use of lessons as part of the standard business process (Earl-Carnes & Breslau 2002). The capturing of LL needs to be an ongoing activity, the identification of lessons needs to occur right through the life of the project as the majority of the learning occurs in the middle of the project (Earl-Carnes & Breslau 2002). The achievement of this integration is closely related to the organisational culture.

LL Must Produce an Actionable Item – It is essential that a LL strategy responds to lessons with actions, as a lesson only has value if it can be used to create more value (Energy 1997). Voit & Drury (2006) state that "the effectiveness of a lessons learned system is measured by a recipient's review and adoption efficiencies". Where possible, significant lessons learned need to be institutionalized in a management process or technical standard to encourage reuse.

Further research includes the implications for training, inductions, facilitation of the process, performance management, measuring efficiency and project review practices. Additional studies might explore the roll out of suggested recommendations and obstacles encountered.

5. Acknowledgements

I would like to recognise the contributions to this thesis from Rob Pitman, Andy Watt, Neil Kavanagh, Jennie Fitzharding, Emily Novatsis and Karl Noelte from Woodside Energy Ltd. I would also like to thank the Woodside Subject Matter Expert Stakeholders who were involved in the interview process and Woodside respondents to the survey.

6. References

Descombe, M 1998, *The Good Research Guide*, Open University Press, Buckingham.

Earl-Carnes, W & Breslau, B 2002, 'Lessons Learned: Improving Performance Through Organisational Learning', *IEEE 7th Human Factors meeting*. Available from: Google Scholar.

Energy, USDo 1997, *The DOE Corporate Lessons Learned Program*, Department of Energy. Available from: Department of Energy. [3/7/2010].

Genzuk, M 2003, 'A Synthesis of Ethnographic Research', *Center for Multilingual, Multicultural Research, University of South Carolina*. Available from: Google Scholar. [17/8/2010].

KNOCO 2009, *The Status of Lessons Learning in Organisations*, KNOCO. Available from: www.knoco.com. [2/7/2010].

Rogers, E, Dillon, R & Tinsley, C 2006, 'Avoiding Common Pitfalls in Lessons Learned Processes that Support Decisions with Significant Risks', *IEEE*, vol. 1256, no. 2. Available from: IEEE - UWA Access. [6/7/2010].

Schein, EH 1996, 'Three Cultures of Management: The Key to Organizational Learning', *Sloan Management Review*, vol. 38, no. 1, pp. 9-20. Available from: EBSCOhost. [12/7/2010].

Voit, JR & Drury, CG 2006, 'Supporting Vicarious Learning With Collaborative Lessons Learned Programs', *Systems, Man and Cybernetics, Part A: Systems and Humans, IEEE Transactions on*, vol. 36, no. 6, pp. 1054-1062.

Weber, R, Aha, D, Muñoz-ávila, H & Breslow, L 2008, *An Intelligent Lessons Learned Process*, Navy Centre for Applied Research in Artificial intelligence. Available from: Google Scholar. [16/5/2010].