Implementation Strategy of Knowledge Management System: A Case of Air Drilling Associates

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***Abstract*— Just as companies in the oil and gas industry, Air Drilling Associates (ADA) also feel the urgency to utilize Knowledge Management to facilitate resilience in a dynamic and competitive business environment. By the end of 2016 ADA introduces the ADA Knowledge Base, a Knowledge Management System, for employee to be utilized as a platform for sharing experiences and learning. However, up to one year since its introduction, the employee participation rate in ADA Knowledge Base is still low. A strategy is required for the implementation of a Knowledge Management System that is part of support for Knowledge Management. This study conducted by using Soft System Methodology approach and Knowledge Management theory. Respondents such as upper management, middle management and staff from the organization has been interviewed. The result defined three steps and sixteen activities for the company to implement the Knowledge Management System.**

Keywords—Knowledge Management, Knowledge Management System, Implementation Strategy, Soft System Methodology

I. INTRODUCTION

Several companies in the oil and gas industry have realized that knowledge management implementation is needed as a key strategy to address global competition and to improve competence in meeting business challenges [1]. The operational processes and equipment between each oil and gas companies is not too much different [1]. So, the competition in this industry precisely lies in the application of technology and the use of knowledge at the right time through the right people and the right place in the right way.

Air Drilling Associates (ADA) as one of the companies engaged in the oil and gas industry, feel the same urgency. This company is one of the largest drilling service providers for the oil and gas energy industry. The limited number of similar service providers makes ADA quickly become the leader of the oil and gas industry in the countries where they operate including USA, Canada, Iceland, Indonesia, the Philippines, New Zealand and Papua New Guinea. Nevertheless, the company's management recognizes the importance of updating business strategies to survive and secure the market.

With diverse educational backgrounds and work experience of the employees, the company considers it important to ensure that every operational employee has a uniform knowledge of their services. As stated in the organization document regarding quality guidance, the company should ensure that employees have the appropriate knowledge, skills, experience and behavior to meet business objectives and customer needs both in the short and long term. The employee turnover rate, especially the operational employees in charge of the project, which is quite high during the last three years also becomes the management consideration in deciding to develop a system to manage the experience and knowledge of the employees. It is also expected that the experience of each employee does not go with the employees when they no longer work for the organization.

One of the efforts taken to achieve this is by developing Standard Operating Procedure (SOP) for each service. The organization also develops a web-based knowledge management system named ADA Knowledge Base. However, it is unfortunate that since its introduction, the employees' participation rate on the Knowledge Base, especially in contributing and sharing experience is still low. This is measured by comparison between the number of articles published in the system with the number of projects in the organization. This comparison is measured and presented in one of the meetings, to record the End of Well Report (EoWR) which is the experience and learning of each well drilling operations into the ADA Knowledge Base.

Then underlying formulation of question in this research which is how the implementation strategy of knowledge management system that can be applied in the environment of Air Drilling Associates. This paper has a systematic writing where sections 2 and 3 illustrate the literature study and methodology. The results of the analysis and discussion of the study are described in Sections 4. The implications of the study and conclusions are given in Sections 5 and Section 6.

II. LITERATURE STUDY

Knowledge management is a systems approach to identifying, validating, capturing and processing knowledge

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and then organizing knowledge elements into knowledge assets for business function and decision-making operations [3]. Knowledge management handles some organizational issues such as diminishing employee experience, disruption in human resources balance due to mergers and acquisitions, and unplanned skill needs. Knowledge management is the activities of discovering, collecting, sharing and applying knowledge to enhance the impact of knowledge on achieving the goals of an organization [4]. Knowledge management also defines as a systematic and integral approach that makes it possible to identify, manage and share knowledge within an organization, and to connect people to create new sets of useful knowledge for organizational purposes [5]. From a business point of view, knowledge management of an organization is used to achieve business value and generate a competitive advantage. From the three descriptions can be concluded that knowledge management is the process of managing knowledge by capturing, collecting and sharing, used to achieve organizational goals.

A. *Knowledge Management Foundations*

The foundation of knowledge management is an organizational aspect that supports knowledge management practice in the short and long term. Hence, the successful implementation of knowledge management system is strongly influenced by the existence of knowledge management foundation in an organization. Table 1 shows the relationship of each aspect of the foundation with each associated attribute identified from the knowledge management foundation theory by Irma Becerra-Fernandez and Rajiv Sabherval [4].

TABLE I. KM FOUNDATIONS AND THE ATTRIBUTES

Attributes
Infrastructure
Organization Culture
[OC1] Encouragement for creation and sharing knowledge
[OC2] Understanding the value of KM practice
[OC3] Management support for KM at all levels
[OC4] Reward system for KM practices
Organization Structure
[OS1] Organizational hierarchical structure
[OS2] The organizational structure can facilitate knowledge management through the Community Practices
[OS3] Specific structures and roles that support knowledge management
IT Infrastructure
[ITINF] The existence of IT infrastructure to support capabilities provided in four important aspects: reach, depth, wealth, and aggregation
Common Knowledge
[CK1] Common language and vocabulary
[CK2] Recognition of individual knowledge domain
[CK3] Knowledge mapping
[CK4] Organization's ability to recognize the value of new information from the external environment
Physical Environment
[PE1] Availability of physical facilities as knowledge-sharing locations; meeting room, open workspace
Mechanism
[MEC1] Organizational or structural tools used to promote knowledge management
[MEC2] Defining Standards and policies
[MEC3] On-the-job training, face-to-face meeting, employee training, initiation process for new employees
Technology
[TECH] Development of information systems to facilitate knowledge exchange, and information repositories

III. METHODOLOGY

A. *Soft System Methodology*

This research used qualitative research with soft system methodology approach. Soft system methodology consists of seven stages in a cycle [6] ; (1) Define the problem (2) Create the rich picture (3) Define the root definition of the relevant system. Root definitions should be formulated appropriately to understand the essence of the relevant system and adapt CATWOE (Customers, Actors, Transformation processes, World views, Owners, and Environmental constraints) factors (4) Construct the concept of root definitions into the conceptual model (5) Compare the model with the real world to explore the situation (6) Formulate changes from situations that are the issues being addressed (7) Implement the change process.

B. *Data Collecting*

The data was obtained by interview. Interviews were conducted with top management, mid management, and operation staffs. The top management interviews are directed to the President Director and the Air Drilling Associates Director. Interviews on mid management are conducted with employees at the Manager's level, regarding the understanding of the organization's mission and strategy vision and operational project coordination. Operational interviews are addressed to office staff and field operational staff as users.

Based on previous literature study we constructed the indicators for KM Foundation attributes in Table 1. Then, analysis conducted by following seven steps of soft system methodology. An implementation strategy Knowledge Management System will be formulated from the results of the analysis.

IV. ANALYSIS AND RESULTS

Development strategy of applying knowledge management system in Air Drilling Associates by using Soft System Methodology with the following stages:

A. *Define the problem*

1) *First Analysis (Intervention)*

The first step in the introduction of problematic situations is defining three parties that play important role within the problem. The three parties are:

- Client: employee of Water Drilling Associates. The Knowledge Base is a knowledge management system

used to support knowledge management activities in ADA with an aim to facilitate employees in finding solutions to problems in their daily task.

- Practitioner: is a person or group of people who conduct the study with the Soft System Methodology.
- Owner Issues: The party acting as the owner of the issue is a person or group of interested persons or affected by the situation or the impact of the result of an improvement effort on the problematic situation.

2) Second Analysis (Social)

The introduction of real-world situations, especially the social aspect is essential to understand the general social situation. There are three social elements of concern in this stage [13]:

- Roles: As a company, Air Drilling Associates provides facilities for employees to carry out knowledge management practice as an effort to improve operational performance.
- Norms: Norm is the expected behavior associated with the role. To implement knowledge management, the organization developed knowledge base system to facilitate its employees in finding solutions to problems in their daily task.
- Values: Referring to the Quality Manual document, where the company must ensure that employees have the appropriate knowledge, skills, experience and behavior to meet business objectives and customer needs for both in the short and long term, the management that represented by a CEO, instructed the operational division to record End of Well Report (EoWR) of each well drilled into the Knowledge Base. The purpose is to help each EoWR in learning the drilling activities in other wells.

3) Third Analysis (Politics)

The third step in the defining the problem is by incorporating the political situation. This analysis focuses on the study of issues of power affecting the sustainability of the organization. These issues are divided into two categories:

a) Disposition of power

- The highest authority in the organization is hold by a Chairman
- An organizational structure is designed to define the roles and responsibilities
- A CEO has authority over all operational decisions in all operational areas worldwide through Operational Directors in each region
- Operational areas are divided into three regions. Each region is managed by a Director of Operations
- Operational Director oversees the varying number of Project Managers in each region, depending on the business units and services available in the relevant region

b) Nature of power

- The Project Manager has the authority to control the operational activities, to conform to the client's requests and as per the company's quality of service standards.
- The Project Manager could encourage employees to follow instructions from the superior
- The Director of Operations has the authority to monitor and assess the performance of operational activities through the Project Manager.

B. Describe the problem in the form of rich picture

Rich picture is a tool for expressing important relationships in a situation as well as to provide something that can be presented as a basis for discussion [13]. Figure 1 illustrates the relationship and implementation issues of management information systems in Air Drilling Associates.

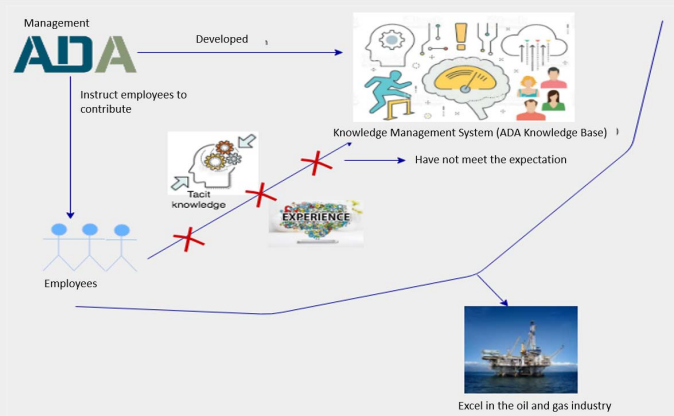

Fig. 1. Rich Picture of the Problem

C. Define Root Definition and CATWOE (Customers, Actors, Transformation processes, World views, Owners, and Environmental constraints)

A root definition is a literal statement of a system relevant to the real-world situation in which the transformation process in an organization is reflected. Related to this transformation process, inside a root definition it must describe the what (P), how (Q) and why (R). The root definition formulation that includes the three factors is:

"A system for improving the utilization of knowledge management systems (P) by implementing knowledge management system implementation strategies (Q) to achieve the utilization of knowledge management systems in accordance with management provisions in order to provide the best services to clients and achieve competitive advantage in the oil and gas industry (R)."

To test the root definition of the PQR formulation, CATWOE analysis was performed. It is intended to review the root definition to be really describes a system of relevant activities. This analysis is shown in Table II.

D. Developing a Conceptual Model

The first step is to evaluate the current knowledge management practices in in organization. This information is collected from interviews and observation in the identification of things related to knowledge management. Table 3 shows the current knowledge management activities in ADA based on interviews and observations. Following the root definition that has been compiled in the previous section and current practices of knowledge management activities presented in Table 3, we compiled them into a conceptual model which is presented in Figure 2. There are twelve activities to be performed.

Once validated by the expert, this conceptual model will form the basis of the formulation of the application of the knowledge management system. In drafting a conceptual model, the authors follow the steps suggested by [13].

TABLE II. CATWOE ANALYSIS

Aspect	CATWOE Analysis
Customer	All employees of Air Drilling Associates
Actors	All employees of Air Drilling Associates
Transformation	Knowledge management systems that have not been well implemented (I) -> Apply a knowledge management system implementation strategy (T) -> Recommended knowledge management system (O)
Worldview	Providing the best services to clients to achieve competitive advantage in the oil and gas industry through the utilization of knowledge management
Owners	All employees of Air Drilling Associates
Environmental Constraints	Employee contributions that do not match the expectations of the board of directors

TABLE III. TABLE 1 CURRENT KM PRACTICE

Current Condition
Infrastructure
Organization Culture
Employees have been accustomed to sharing knowledge and experience
Employee has sought knowledge from external sources
Not yet have procedures governing communication between departments/divisions
There is no specific budget allocation for knowledge management activities
Support from management to improve knowledge management activities is required the involvement of all parties, socialization and incentives
There has been no assessment of employee participation on ADA Knowledge Base
Organization Structure
There is no special division that regulates and controls the activities of knowledge management and utilization of system
Each division has a closed discussion group
IT Infrastructure
ADA adopts cloud computing. By subscribing to the Cloud computing service model, the Software as a Service (SaaS) and Platform as a Service (PaaS) company employs the resources provided by the service provider
Common Knowledge
Categories of expertise based on competence and division
Mechanism
Socialization related to the utilization of knowledge management system only at the beginning of implementation
KMS is not integrated with other systems
Lack of employee skills in putting ideas into writing
Lack of employee confidence in sharing
There has been no reciprocity for participating staffs
Technology
Discovery process in ADA Knowledge Base is still manual

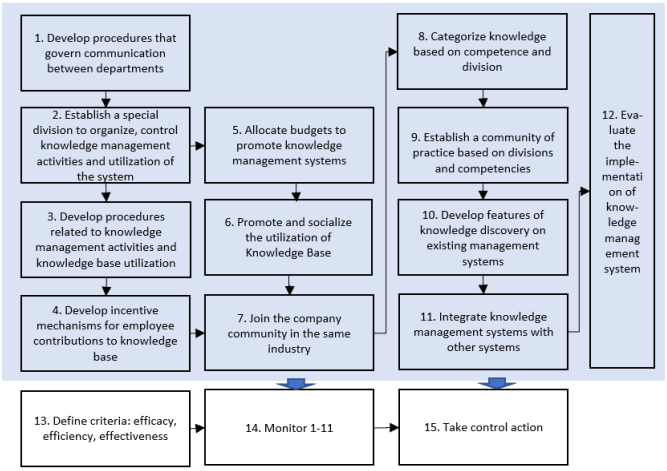

Fig. 2. Conceptual Model

E. Compare the model with the real world to explore the situation

The twelve activities in the conceptual model are used to discuss real-world problematic situations by comparing them conceptually with real-world problematic situations. Table 4 describes the comparison.

F. Validate the implementation strategy

Furthermore, the conceptual model that has been compiled is validated by the expert. The result of the validation process are as follows:

- Before applying knowledge management system, it is necessary to identify the current knowledge management practices in the company. The first is not required because communication procedures should be included in standard operational procedures integrated between departments.
- Formulating KPIs as a form of compensation of employee contributions to ADA Knowledge Base.
- The seventh activity does not provide significant benefits because each company in the related community will not discuss the lessons learned or the knowledge and experience they have gained during carrying out a project within the community in question. This is because knowledge is considered a corporate asset that must be protected.
- The fourth activity can be omitted, because it is part of the third activity

- Conducting training as part of socialization.
  - Adding an activity for preparing system requirements to support knowledge management activities.
  - Continuous improvement of knowledge management governance is required to improve knowledge management practices.

Figure 3 shows the revised version of the conceptual model.

G. Implement the change process.

Adopting the Regulation of State Minister of Administrative Reform and Bureaucratic Reform Number 14 of 2011 on Guidelines for Implementation of Knowledge Management Program, knowledge management system implementation strategy in Air Drilling Associates is divided into three phases, namely Planning, Implementation and Evaluation. This strategy can be seen in the Figure 3. The first stage is a planning that consists of three activities. Identification of knowledge management practices can use the results from Tables 3 and Table 4 and can also be re-analyzed by the implementation team. The second stage is an implementation that contains activities carried out for the development of concepts, systems and integration with other existing systems. The last stage of evaluation is to ensure the quality standards of each activity as well as improvements that can enhance the quality.

V. IMPLICATIONS

The practical implications of this research can be used by ADA and organizations in the Oil and Gas industry. The results of the conceptual model identification state that the organization should develop procedures and rules related to knowledge management practices including reward mechanisms in the process of sharing knowledge. In addition, the establishment of a special division that regulates knowledge management practices is deemed to be necessary. One form of management commitment is the provision of budget in the implementation of knowledge management also needs to be considered.

TABLE IV. THE COMPARATION OF CONCEPTUAL MODEL AND CURRENT PRACTICES

Activity	Current Practice	Actors	Result
1	Not yet have procedures governing communication between departments / divisions	Management	The existence of written documents in the form of procedures that regulate communication between departments / divisions
2	There is no special division that regulates and controls the activities of knowledge management and utilization of knowledge management systems	Management	A special division to regulate and control knowledge management activities and utilization of knowledge management system (ADA Knowledge Base)
3	Lack of employee skills in putting ideas into writing. Lack of employee confidence in sharing	Formed Knowledge Management Division	The existence of written documents in the form of procedures related to knowledge management activities and utilization of ADA Knowledge Base
4	There has been no reciprocity for participating royals	Formed KM Division	The existence of written documents in the form of incentive mechanism to contribute employees to ADA Knowledge Base
5	There is no specific budget allocation for knowledge management activities	Formed KM Division	There is a special allocated budget for promoting knowledge management systems
6	Socialization related to the utilization of knowledge management system only at the beginning of implementation	Formed KM Division	Promotion and socialization program
7	Seek knowledge from external sources	Management	Being part of the oil and gas industry community
8	Categories based on competencies and divisions are formed among employees subjectively	Management	Categories of knowledge
9	Each division has a closed discussion group	Management	Community of Practice
10	Discovery process in ADA Knowledge Base is still manual	Management	Automated knowledge discovery process
11	Knowledge management system is not integrated with other systems	Management	Easier access to knowledge management systems
12		MP Division is formed	Supervised knowledge management system implementation

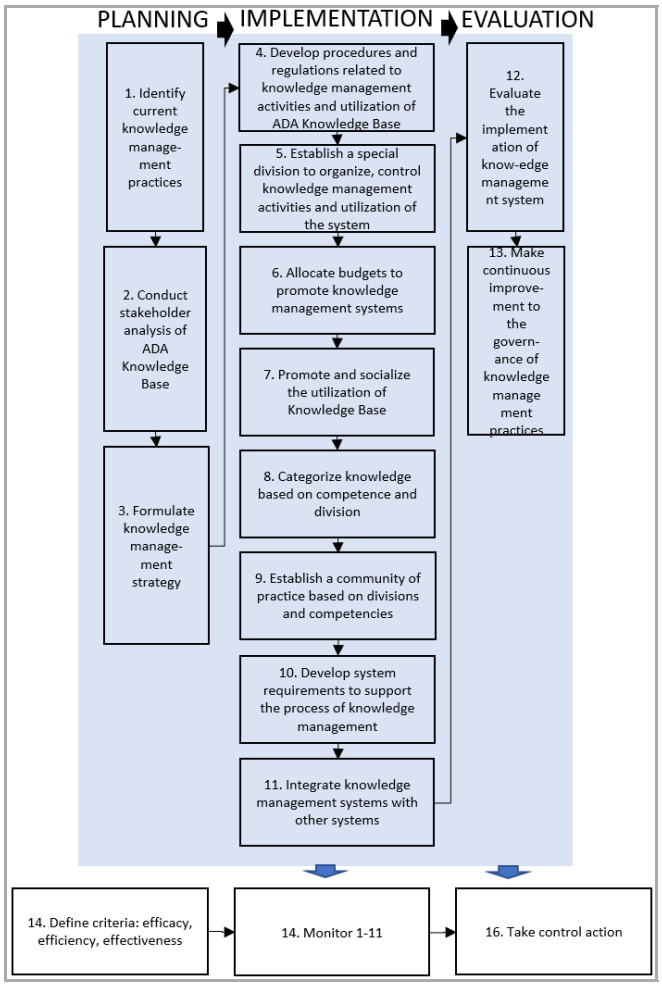

Fig. 3. Revised Conceptual Model

VI. Conclusion

The purpose of this research is to formulate the implementation strategy of knowledge management system that can be applied in the environment of Air Drilling Associates. Based on analysis and result, the implementation strategy for the organization are categorized in three steps which are planning, implementation and evaluation.

Planning steps conducted as the preparation of the implementation steps. In the implementation steps, the organization will be defined and developed the concept and build the knowledge management system. However, the practices of involving in other communities from other company seem to be difficult since every company perceived their knowledge as an important asset. The third step is evaluation that conducted to evaluate the implementation of ADA Knowledge Base and make continuous improvement to the governance of knowledge management practices

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