

# **Operations-Based Knowledge Management**

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## **Abstract**

This paper is about knowledge management (KM) in Aircraft Engineering (AE). This industry is highly technology dependant; thus, enhanced KM in AE is a key success factor. This paper analyses KM literature, and offers insights into the existing KM practices in AE using a case study in the Saudi Arabian Aviation industry (SAAI). The KM practices were ascertained by interviewing senior aircraft engineers as well as through observations during one of the author's 6-year employment as aircraft engineer in the SAAI. Synthesis of these results with the KM literature identified gaps between the KM theory and current practices in AE. Finally, an operations-based knowledge management (OBKM) system framework was developed to address these gaps and overcome ineffectiveness in current practices.

## **Keywords**

Knowledge Management, Operations-Based Knowledge Management, Aircraft Engineering, Saudi Arabian Aviation industry.

## **1. Introduction**

Rising oil prices, intense competition and safety concerns are some of the issues that make aviation industry one of the toughest industries fighting for survival [1, 2]. Maintenance costs contribute to a major portion of the expenses. Due to its technology depended and knowledge intensive nature, sound knowledge management practices become crucial for success [1].

Despite this fact, it appears that due to strong pressure on prices and work load knowledge management takes a back seat [1]. Luckily, organizations increasingly realize the importance of aircraft engineering knowledge as an asset which has initiated the need for retaining the critical knowledge within the organization [3-5].

Most organisations in civil aviation industry including aircraft manufacturers, airlines and maintenance providers suffer from a loss of engineering knowledge due to job rotation, jobs reduction and retirements [2]. Moreover, freshly graduated or recruited engineers may require a lot of experience before they can fully function as an aircraft engineer. This may take up to two or more years of training (on the job training) and mentoring, making it very costly to train new aircraft engineers [2, 6, 7]. Also, incorrectly performed aircraft engineering activities lead to a high level of risk and are, therefore, constrained by the intensive safety regulations [1]. As a result, there is a need for effective knowledge management in the aircraft engineering field.

## **2. Operations-Based Knowledge Management**

In the knowledge management literature, most KM solutions appear to focus primarily on IT-based tools and systems [8, 9]. However in the past, a significant proportion of KM initiatives and projects seem to have failed partly due to their single focus on IT-based solutions [10, 11]. Recently, a growing number of researchers have argued that new approaches are needed to reduce the risk of failure of a KM initiative [10-13]. By placing the main focus on the IT-based solutions, insufficient attention is given to the other aspects of KM which, for example, neglects the impact of employees' willingness to share their knowledge [14].

According to a study by Edwards, Shaw & Collier [15], many organizations appear to be utilizing generic IT tools rather than their dedicated IT-tools for their KM approaches. This appears to be due to the insufficient consideration

of the contextual situations in the design of those tools. Whereas IT solutions should be tailored to carefully consider KM processes and contexts [9].

Successful KM initiatives ought to achieve balance between management leadership, process management and people management and supported by IT solutions [8-11]. Recent research has confirmed that leadership, process and people aspects are critical success factors for KM initiatives [4, 10, 16, 17].

One could argue that the current gap between IT-based KM approaches and people/process-based KM approaches is merely a result of different views shared by the group of KM practitioners and KM theorists [8, 11]. Many researchers view IT-based KM tools as a vehicle for KM initiatives while leadership, process and people management build the foundations [8, 10].

### **2.1 Leadership Aspect**

The effect of leadership activities on KM performance has been the focus of recent studies. For example, Politis [18] suggested that a “Knowledge-Enabled leader” is critical to an effective KM system. Likewise, Allen [4] identified the effect of the front-line management behavior on willingness of aircraft engineers to share their tacit knowledge. He found that positive management behavior (attitude) increased employees’ willingness to share their knowledge during situations of job transfer.

### **2.2 Process Aspect**

Process management has also been of interest of recent research into KM. Tat and Stewart [3] studied KM implementation processes in Malaysian Aviation Industry. They proposed a model to implement KM in that industry. This model consists of four stages; awareness cultivation, objective definition, strategy adoption and action implementation. Such research suggests that during implementation of KM initiatives, any necessary IT-tools should be designed based on needs of the KM processes, and the context of KM systems. Without the proper understanding of the current context of the organization and the KM processes, the design of any technology tools to support KM is prone to failure.

### **2.3 People Aspect**

KM systems rely for their successes on the involvement of, interaction with, and acceptance by people. Neglecting the people aspects will increase the chances of failure [1, 8]. This is evident by the recent increases in the number of researchers focusing on the people aspect of the KM systems. McNichols (2008) examined the inter-generational tacit knowledge transfer within aircraft engineering community. The researcher found two major themes that influence the knowledge transfer: (a) the relationship quality between knowledge sender and receiver and (b) the knowledge transfer enabling conditions. She recommended three strategies to maximize aircraft engineering knowledge transfer, consisting of building knowledge-sharing culture, establishing mentoring program and initiating team work.

### **2.4 Summary**

The above discussion highlights the need for a multi-disciplinary KM approach for deeper understanding of all KM aspects [19]. These aspects should be considered holistically in the design of KM systems.

A sound KM system design must incorporate the leadership, process and people aspects. The holistic Operation-Based Knowledge Management (OBKM) model suggested by the authors, in Figure 1, facilitates such a design. This approach consists of three layers: approaches to KM, aspects of KM, and the elements of these aspects.

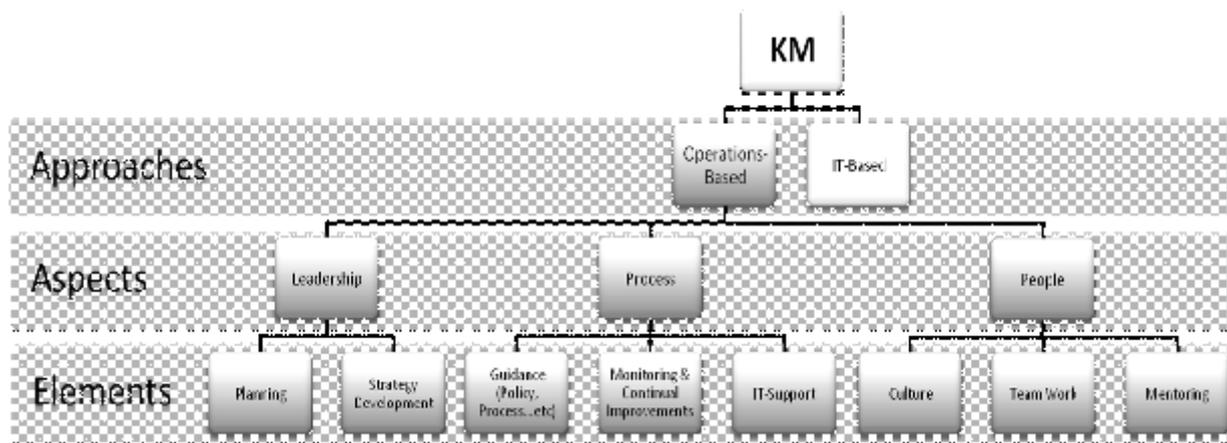


Figure 1: Holistic OBKM Model

### 3. Knowledge Management Current Practices in Aircraft Engineering

This section discusses KM current practices in aircraft engineering field in the SAAI. Preliminary research data was obtained through discussions and interviews with senior aircraft engineers, and personal observations of one of the authors during his six years of work experience as an aircraft engineer with one the companies in the SAAI. This organization is not only the largest private airline operator in the country but also represents the aircraft engineering best practices in the aviation industry. Accordingly, this organization will be used as a representative example of the SAAI. The findings from this preliminary study highlight the main characteristics of the KM in the aviation industry.

The main objective of the preliminary data analysis was to find out how aircraft engineers comprehend, explore, and deal with KM concepts and ideas, and how they manage aircraft engineering knowledge in practice. This is discussed in following sub-sections KM Awareness, KM Perception, and KM Culture.

#### 3.1 KM Awareness

As in other countries, SAAI faces the challenges of an aging work force. There is an increasing awareness that this will cause a problem due to a widening skills gap and knowledge loss. However, this does not seem to be complemented by the awareness that knowledge management concepts and methods may help mitigate the negative impact on the organization of such issues. Furthermore, knowledge management is mostly confused with information management. This appears to be the result of insufficient understanding of the KM concepts [1, 3, 5]. More importantly, it is becoming increasingly manifest that the aviation industry has failed to implement systems to successfully source, capture and share aircraft engineering knowledge. Consequently, sources of aircraft engineering knowledge are less obvious and its importance as a competitive advantage less apparent.

#### 3.2 KM Perception

While there is insubstantial awareness of the KM concepts in the industry, it is commonly believed that knowledge management is beneficial for the industry. The perceived benefits of better knowledge management include:

- Reduction of aircraft maintenance downtimes through knowledge sharing. Engineers will have broader knowledge base to perform their tasks and as a result the time needed to accomplish the task will be reduced.
- Reduction or elimination of silo behavior in handling expert knowledge. Consequently, this will mitigate the impact of experts retiring.
- Reduction of the learning curve of a new graduate or recruit to fully function as an aircraft engineer.

#### 3.3 KM Culture

The aviation industry is a highly regulated industry. It follows rigorous guidelines for data recording and reporting for any maintenance action, incident and accident [1, 2] to ensure the airworthiness of the aircrafts and for monitoring the quality of the outcome. This data is required to be accurate and readily available and accessible to

operators, engineers and maintainers [1]. Therefore, every organization in the industry needs to have systems to manage and distribute this recorded (explicit) knowledge.

In SAAI, such explicit knowledge is managed by IT systems which keep records and store aircraft engineering documentation. It is widely accepted that aircraft engineering explicit knowledge is relatively well managed in the aviation industry. In contrast, aircraft engineering tacit knowledge management seems to be rather underdeveloped. The learning environment in the aviation industry, especially between aircraft engineers, depends on a mentor-apprentice relationship or “tribal learning” [2]. This unique learning behavior where engineers learn tacit knowledge through experimenting, i.e. by following and imitating experienced engineers, “the tribal elders” [2], is also called on-the-job training. The absence of a senior engineer may endanger the whole process and will increase the learning curve, time and cost of such training. Rehiring retired engineering experts, for instance, as consultants is a reactive practice to mitigate the problem.

As described by Collison and Parcell [20], a knowledge sharing culture is a focal point in KM initiatives. In SAAI, it seems to be a norm to reward individual performance rather than team performance. This imposes a challenge to promoting a knowledge sharing culture. Another challenge is due to the wide-spread perception in SAAI that knowledge is a source of power. Thus, sharing knowledge means sharing power.

Finally, there are some additional points relevant to the consideration of KM culture in the SAAI. For example, like many other industries SAAI is male dominated. Perception of KM initiatives and systems by different genders may impose some challenges. For instance according to Ong and Lai [21], male and female employees may perceive e-learning systems differently. Therefore, any research must consider such possible gender-based defense mechanisms. In addition, Saudi Arabian culture is highly influenced by Islam. The effect of religious influence on KM, if any, needs to be taken into consideration and will be explored further in this research in the future.

### **3.4 Summary**

From the above discussion we can conclude that knowledge management appears to be immature in SAAI. Furthermore, aircraft engineering knowledge seems to be implicitly managed, in a more or less ad hoc manner. Through a comparison of the current practices in SAAI and KM theories, the following gaps have been identified:

- The level of knowledge management awareness among aircraft engineers is low.
- There is a perception that KM is beneficial. However, there is no common agreement on what are the KM intentions and objectives ought to be.
- The current modest KM practices, if they exist, are merely incidental to everyday operations, and not due to any deliberate focus on knowledge management.

## **4. The Proposed Operations-Based Knowledge Management System Framework**

Based on recent operations management systems literature [22-24], a management system framework was developed and proposed to overcome the gaps identified in the previous sections (Figure 2). This framework includes the leadership, people and process aspects which are further divided into several elements consisting of planning, strategic development, IT-Support, monitoring and continual improvement, guidance, culture, teamwork, and Mentoring.

### **4.1 Leadership Aspect**

This aspect entails the role of management in implementing and supporting KM initiatives. Planning and strategy development are the two main elements in this aspect. Those elements will drive the whole KM system toward business goals. This is achieved by aligning the KM strategies with the business strategies while providing the leadership support.

### **4.2 Process Management Aspect**

The process management aspect is included to ensure better process management to overcome the KM any challenges embedded in the organization’s systems. Guidance through policy, procedures, work instructions, monitoring and continual improvement, and IT-support systems form the main elements of this aspect. The contextually sensitive IT-support systems will serve the main OBKM needs. It includes systems to support explicit and tacit knowledge sharing.

### 4.3 People Management Aspect

This aspect serves as a mechanism to highlight the OBKM influences and challenges from the perspective of the knowledge sender and receiver. Its elements are culture, teamwork and mentoring, and due consideration of these elements will ensure that the effectiveness of knowledge transfer between aircraft engineers is maximised.

### 4.4 Summary

The proposed framework in figure 2, with its three layers and aspects, provides a holistic way to design effective knowledge management systems. While proposed within the context of the aircraft industry, the framework is generic enough to be of use within other industries as well.

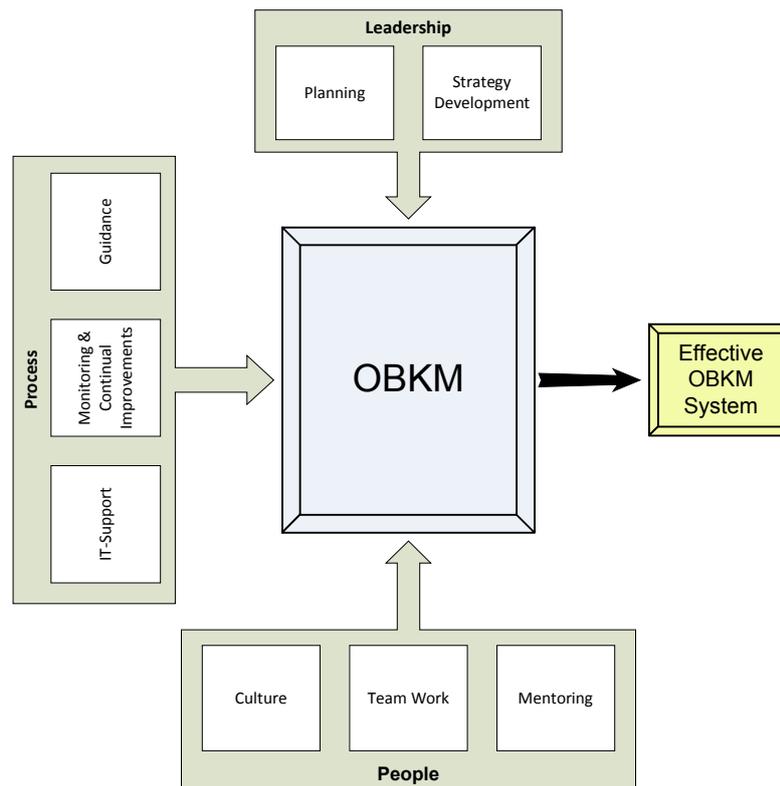


Figure 2: The proposed OBKM System Framework

## 5. Conclusion

This paper has presented some results of a study of knowledge management within SAAI, contrasted the practices therein with best practice as evident in the KM literature, and has proposed a holistic framework to address the gaps that have been identified between the practice and the theory. This framework, called the OBKM, enables consideration of all the aspects that have been identified as contributing to potential or actual failures of knowledge management initiatives within SAAI. The framework itself is generic enough for application within industries other than the aircraft industry. Future steps of this research will include a validation of the framework through workshops, interviews and possible pilot applications within SAAI.

## References

1. Harvey, D.J. and R. Holdsworth. *Knowledge management in the aerospace industry*. in *Professional Communication Conference, 2005. IPCC 2005. Proceedings. International*. 2005.
2. Shaw, G.P. and D.Y. Smith (2003) *Don't let knowledge and experience fly away: Leveraging scarce expertise to support ongoing competitiveness in the aerospace and defense industry*.

3. Tat, L.W. and H. Stewart, *Knowledge management in the Malaysian aerospace industry*. Journal of Knowledge Management, 2007. 11(1): p. 143-151.
4. Allen, S.R., *The effect of management actions on knowledge transfer within the aerospace industry*, in *College of Management and Technology*. 2010, Walden University. p. 163.
5. McNichols, D., *Tacit Knowledge: An examination of intergenerational knowledge transfer within an aerospace engineering community*, in *Organizational Leadership 2008*, University of Phoenix p. 289.
6. Emara, E., *Meeting With E.E.*, R. Zawawi, Editor. 2009: Jeddah, Saudi Arabia.
7. AlGhalbi, B., *Meeting with B.G.*, R. Zawawi, Editor. 2010: Jeddah, Saudi Arabia.
8. Swan, J., S. Newell, and M. Robertson. *Knowledge Management - When Will People Management Enter the Debate?* in *Hawaii International Conference on System Sciences*. 2000.
9. Freke, V., *Definitions, Reuse and Technology: How Context Impacts Technology Support for Knowledge Management*, in *School of Information and Communication Technology 2006*, Griffith University.
10. Tsui, E., *The role of IT in KM: where are we now and where are we heading?* Journal of Knowledge Management, 2005. 9(1): p. 3-6.
11. BenMoussa, C., *Moving Beyond Traditional Knowledge Management: A Demand-Based Approach*. Journal of Knowledge Management Practice, 2009. 10(3).
12. Davenport, T.H. and J. Glaser, *Just-in-Time Delivery Comes to Knowledge Management*. Harvard Business Review, 2002. 80(7): p. 107-111.
13. Keen, P. and M. Tan, *Knowledge Fusion: A Framework for Extending the Rigor and Relevance of Knowledge Management*. International Journal of Knowledge Management, 2007. 3(4): p. 1-17.
14. Swan, J., S. Newell, and M. Robertson. *Limits of IT-driven Knowledge Management Initiatives for Interactive Innovation Processes: Towards a Community-Based Approach*. in *Hawaii International Conference on System Sciences*. 2000. Hawaii.
15. Edwards, J.S., D. Shaw, and P.M. Collier, *Knowledge management systems: finding a way with technology*. Journal of Knowledge Management, 2005. 9(1): p. 113-125.
16. Wong, K.Y., *Critical success factors for implementing knowledge management in small and medium enterprises*. Industrial Management & Data Systems, 2005. 105(3): p. 261-279.
17. Holsapple, C.W. and K.D. Joshi, *An investigation of factors that influence the management of knowledge in organizations*. The Journal of Strategic Information Systems, 2000. 9(2-3): p. 235-261.
18. Politis, J.D., *The relationship of various leadership styles to knowledge management*. Leadership & Organization Development Journal, 2001. 22(8): p. 354-364.
19. Kakabadse, N.K., A. Kakabadse, and A. Kouzmin, *Reviewing the knowledge management literature: Towards a taxonomy*. Journal of Knowledge Management, 2003. 7(4): p. 75-91.
20. Collison, C. and G. Parcell, *Learning to Fly: Practical Lessons from one of the World's Leading Knowledge Companies*. 2001, Milford, CT: Capstone Publishing.
21. Ong, C.-S. and J.-Y. Lai, *Gender differences in perceptions and relationships among dominants of e-learning acceptance*. Computers in Human Behavior, 2006. 22(5): p. 816-829.
22. Akpolat, H., *Systematic Management Of Operational Risks – An Australian Study*. International journal of logistic and transport, 2010. 4(1): p. 7-14.
23. Pitinanondha, T., *Operational risk management (ORM) systems - An Australian study*, in *Faculty of Engineering*. 2008, University of Technology, Sydney: Sydney
24. Jayamaha, N., N. Grigg, and R. Mann, *A study of the validity of three major business excellence models in the Asia Pacific region*. Total Quality Management & Business Excellence, 2009. 20(11): p. 1213-1227.