

Knowledge Management Practices in Oman Construction Sector

Abdulaziz Almarshoudi, Subashini Suresh, and Suresh Renukappa

Abstract— Implementing the strategies of Knowledge Management (KM) in the construction industry in Oman can produce significant benefits, such as continuous improvement and the improved performance of construction projects. In addition, the need to understand the determinants of successful Knowledge Management cannot be underestimated in organisations in the Middle East; specifically, those which are members of the Gulf Cooperation Council (GCC). The accelerated development in recent years regarding the GCC countries, highlights the need for these nations and their organisations to empower themselves through Knowledge Management. Nevertheless, very little empirical research has been conducted to understand this phenomenon. This paper investigates the role of Knowledge Management in relation to reducing the Cost of Poor Quality in the construction industry in Oman. Data was collected via questionnaires and interviews with Omani construction engineers from public and private sector. The findings reveal that knowledge capture and knowledge sharing are paramount to the contributory factors to the Cost of Poor Quality in practice, which includes the cost of errors and omissions, cost of design changes and the cost of poor skills.

Index Terms— Knowledge Management, Cost of Poor Quality, Oman, Construction sector.

I. INTRODUCTION

Knowledge Management refers to obtaining information, capturing, managing and sharing it by involving people, cultures, processes and technologies [1]. According to Frost [2], Knowledge Management is the systematic management of an organization's knowledge assets for creating value and meeting tactical and strategic requirements. This method consists of the initiatives, processes, strategies and systems that sustain and enhance the storage, assessment, sharing, refinement, and creation of knowledge. The construction industry in Oman is a significant indicator of the development as it creates opportunities for investment across several related sectors. The construction industry plays an essential part in the growth of a country's economy and is vital in the development plans of nations [3]. Knowledge Management (KM) has become necessary in the construction industry to reduce the Cost of Poor Quality (COPQ). There are several contributory factors related to the causes of poor quality, such as poor skills, insufficient knowledge of processes and procedures, and poor planning and scheduling. Organisational success depends largely on managing

knowledge [4]. Consequently, it has become a vital part of organisational strategy. It is therefore important to examine the aspects relating to Knowledge Management and Organisational Strategy. In addition, organisations classify KM initiatives as part of their long-term strategy so that their organizational knowledge can be retained [5]. However, the novelty of Knowledge Management was recently-introduced in the Middle East, transferred by professionals and experts from the West. This delay in the emergence of Knowledge Management was due to the era of political unrest, social conflicts and economic bottlenecks occurring in Middle Eastern countries since the 1990s [6].

From the existing literature, several barriers have been identified for KM, for instance the lack of commitment by senior management. Senior management is extremely influential in the expansion of organisational structure, technological infrastructure and various decision-making processes [4]. These started with the Gulf War (Historical Events on 30th November), and did not end until the Arab Spring uprisings in the latter part of 2010 [8]. The economic development of Middle East states remains troubled with inadequate income distribution, poverty, high unemployment, and inadequate investments [6]. The region has been divided into sub-regional groups with a notable gap in terms of income, public expenditure, and purchasing power [8]. Owing to all these dilemmas and tensions surrounding the region, awareness on the essence of Knowledge Management has been completely disregarded [6].

There are many intangible benefits to Knowledge Management, according to Clark and Soliman [5]. They state that Knowledge Management assists with the improvement of performance in manufacturing, in terms of quality, time, speed and reliability, besides reducing production costs [9]. There are certain benefits related to Knowledge Management in the business sector that can generate sustainable competitive advantage [10]. The key benefits of Knowledge Management in the construction industry include innovation, performance improvement, improved construction project deliveries, facilitating knowledge transfer via various projects, in addition to a quick response to clients' needs and other external factors, and for instance engaged tacit knowledge and increase in value [11]. This study will investigate the importance of Knowledge Management in the construction industry in Oman. Furthermore, this paper determines the reasons and significance of KM to reduce COPQ in the construction industry in Oman.

II. RESEARCH METHODOLOGY

The method which is used to collect data and information concerning the purpose of making business decisions is termed ‘research methodology’. It may include previous research, a questionnaire, interviews and other research methods, and it could comprise both present and historical information [12]. This study has adopted mixed methodology; primary sources termed qualitative sources from the interviews and quantitative sources from the questionnaires, in addition to secondary sources via the literature review [12].

The questionnaire was administered through several public and private construction sectors in Oman from 2nd November to 14th November, 2017. Thereafter interviews were conducted; each interview took between 45-60 minutes. The researcher used Microsoft Excel to analyse the findings obtained from the questionnaires and interviews. Descriptive statistics was used for analyzing data obtained from questionnaires and thematic analysis was used for interview data.

Table I shows the involvement of participants from the public and private sector regarding the interviews and questionnaires.

TABLE I: PARTICIPANT’S DETAILS

	Private sector	Public sector	Total
Questionnaires	10	30	40
Interviews	2	3	5

A total of five interviews were conducted of which three are from public sector and two from private sector from construction sector in Oman. Moreover, research data was collected via the questionnaire from three public construction companies and one private construction company in Oman.

III. FINDINGS

The paper presents and discusses the findings on the optimisation of Knowledge Management to reduce the Cost of Poor Quality on construction projects. It discusses the findings on the contributory factors to the Causes of Poor Quality in practice, which includes the cost of errors and omissions, cost of design changes and the cost of poor skills. Prior to that Tables 2, 3 and 4 below reveals the qualitative and quantitative findings.

Table II illustrates the benefits and barriers pertaining to Quality Management in the public and private construction sectors in Oman. The quantitative sources identified several benefits of Quality management. These comprise, improved work outcomes, increased client satisfaction, save costs and deliver on time. Furthermore, it shows several barriers for example, in the public sector, the principal barriers to applying Quality Management are unskilled staff, poor project management execution and lack of regular assessment. Additionally, the challenges to employing Quality Management in the private sectors are numerous, such as, non-educated employees, insufficient time for discussing Knowledge Management during the project process and budget constraints. In the quantitative sources (questionnaire), the researcher has ranked in descending

order, from the highest to the lowest percentage (72%) regarding Knowledge Management in the construction industry in Oman.

TABLE II: BENEFITS AND BARRIERS OF QM

Interviews			
Private sector		Public sector	
Benefits	Barriers	Benefits	Barriers
Improve work outcomes.	Lack of management commitment.	Financial benefits.	Lack of communication.
Increase client satisfaction.	Limitations of the labour.	Increase experience. Complete on time.	Lack of awareness of QM.
Cost reduction.	Staff are not able to change the organisational mentality.	Improve labour skills.	Existing lack of suitable training.
Defect reduction.			Insufficient resources.
Delivery on time.	Lack of improvement of the quality of measurement.		
Save costs.			

Questionnaire
Benefits
(1) Improve product quality (40) 100%.
(2) Increase customer satisfaction (36) 90%.
(3) Increased competitive advantage (33) 83%.
(4) Increased staff motivation (33) 83%.
(5) Increase profitability (32) 80%.
(6) Improved cost efficiency (31) 78%.
(7) Improved reputation (29) 74%.

Contributory factors to the Cost of Poor Quality in the public and private sectors in Oman are identified in Table III. In the public sector, there are several factors pertaining to the Cost of Poor Quality, for instance, the lack of continuous follow-up by the consultant, low qualified staff with poor knowledge and inadequate knowledge of process procedures. Additionally, the factors related to the cost of poor quality the in the private sectors are multiple and comprise poor managerial auditing, poor financial auditing and lack of risk management skills. From the questionnaire, illustrate lack of incentives to motivate project staff is the highest contributory factor to the Causes of Poor Quality. The lowest contributory factors regarding the Causes of Poor Quality is the time constrained nature of projects.

Benefits and barriers of Knowledge Management public sectors and private sectors in Oman are identified in Table IV. The benefits for applying Knowledge Management are summarised from qualitative sources (interviews). For example, in the public sector, the main benefits are to meet client’s expectations, reduce mistakes and avoiding completion delay. While the barriers noted are lack of assessment, unskilled staff and lack of awareness and knowledge of project management. However, the benefits of KM in the public sector in Oman are avoiding completion delay, reducing mistakes, meet client’s expectations and handed over on time. In the private sector, the interviews reveal that the benefits concerning KM are reducing errors and omissions, gaining experience and avoiding losses on the project. The barriers to applying KM in the private sector are budget constraints, lack of educated employees and insufficient time for discussing KM during the project process.

TABLE III: CONTRIBUTORY FACTORS TO THE COST OF POOR QUALITY

Interviews	
Private sector	Public sector
Poor financial auditing.	Lack of continuous follow-up by the consultant.
Poor managerial auditing.	Lack of skilled labour.
Poor technical auditing.	Working with new concepts.
Lack of process standardisation.	Working with unfamiliar designs on construction processes.
Lack of document control tools.	No external auditing.
Poor communication plan.	Lack of learning from past experiences.
Public demand and changing specification by utility agencies.	The emergence and evolution of materials and designs.
Poor structural auditing prior to project implementation process.	Inadequate knowledge of process procedures.
Poor architectural auditing before implementation process of the project.	Poor planning and scheduling.
Lack of risk management.	Poor communication plan.
Various government laws that prevent the recruitment of some skilled nationalities.	Poorly qualified staff with inadequate knowledge.
	Poor communication management

Questionnaire
(1) Lack of incentives to motivate project staff (38) 95%.
(2) Lack of understanding of KM concepts by project staff (36) 90%.
(3) Lack of collaborative working by project organisations to create new knowledge (33) 83%.
(4) Lack of knowledgeable managers on projects (34) 80%.
(5) Time constrained nature of projects (24) 60%.

Nevertheless, the findings from the questionnaire show that there are several benefits for applying KM in the construction industry in Oman. Table IV illustrates that the highest significant benefit is the sharing of knowledge among project team members, whereas the lowest benefit is engaging experts to facilitate knowledge management on projects.

TABLE IV: BENEFITS AND BARRIERS OF KM

Interviews			
Private sector		Public sector	
Benefits	Barriers	Benefits	Barriers
Gaining experience and learning material.	Differences in mentalities and cultures in some countries hindering multinational companies from applying it correctly.	Reducing mistakes.	Lack of awareness and knowledge of project management.
Manage and direct project procedures.	Budget constraints.	Handed over on time.	Lack of assessment.
Avoid losses in the project.	Employees insufficiently educated in the field of specialisation.	Meet client's expectation s.	Lack of leadership.
Reduce errors and omissions.	Insufficient time to discuss Knowledge Management during the project process.	Avoid delay of completion.	Time constraints.
			Procurement strategy.
			Unskilled staff.
			Poor project management execution.

Questionnaire
Benefits
(1) Sharing of knowledge among project team members (35) 83%.
(2) Capturing lessons learnt at various stages of the project (34) 80%.
(3) Capturing knowledge from other projects for use on current project (34) 80%.
(4) Using mentoring programmes to facilitate knowledge transfer among staff (29) 78%.
(5) Engaging experts to facilitate Knowledge Management on projects (26) 72%.

IV. KM AND COPQ FINDINGS

According to [13], design checks and verifications are beneficial to identify mistakes. If lessons are not learned from previous projects and appropriate training, and skill development implementation is not provided, their usefulness is restricted. There is therefore a Knowledge Management aspect to Quality Management in reducing quality related costs. Although [14], made the point that in projects where poor quality management is implemented non-conformance costs may be significantly higher, [11] established that the costs of design-related change orders affect contract value [15]. Also, identified client change as one of the predictors of the cost of rework.

The questionnaire had asked the benefits of optimising Knowledge Management for reducing the causes of poor quality. The percentages of total respondents ranked between 80-100% agree about all the benefits. For example, the percentage for improving the quality of product was 100%, the percentage for increasing customer satisfaction was 90% and the percentage for increasing staff motivation was 85%. Moreover, the percentage related to improving cost efficiency and profitability was 80%. The analyses show that 85% of the respondents agree that Knowledge Management contributes to increasing the reputation and the competitive advantage of construction organisations. From the discussion above, the significant role of Knowledge Management in reducing the cost of poor quality with regards to increasing customer satisfaction, the quality of product and the reputation of construction organisations is evident.

In questionnaire, respondents were asked to rate the level of impact of Knowledge Management processes on the constituent elements of causes of poor i.e. design changes, errors and omissions, and poor skills, based on their own experiences on construction projects. The data analysis indicates positive impact of capturing lessons learnt at various stages of the project, in relation to reducing the cost of design changes on the capturing lessons learnt at various stages of the project is 85%. Furthermore, the positive percentage for capturing lessons learnt at various stages of the project on the impact of reducing the cost of construction errors is 83%. Additionally, the impact of capturing lessons learnt at various stages of the project for reducing the cost of poor skills is 73%. These results indicate that the capturing lessons learnt at various stages of the project have a significant positive impact on reducing the cost of design change, construction errors and poor skills.

In questionnaire, respondents were asked to identify the impact of capturing knowledge from other projects for use on current projects with the aim of reducing the cost of design changes, construction errors and poor skills. It is evident from the results of the questionnaire that the positive percentage of capturing knowledge from other projects for use on current projects to reduce the cost of design changes is 85%. Moreover, the positive percentage of capturing knowledge from other projects for use on current projects to reduce the cost of construction errors is 75%. In addition, this table identifies the positive percentage of capturing knowledge from other projects for use on current projects to reduce the cost of poor skills is 80%. Consequently, capturing knowledge from other projects for use on current

projects to reduce the causes of design changes is important to reduce the causes of design changes, construction errors and poor skills in the construction industry.

The next question was designed to identify the impact of sharing knowledge among project team members on reducing the cost of design changes, construction errors and poor skills. The results obtained from the questionnaire illustrate a positive percentage of sharing knowledge among project team members to reduce the causes of design changes is 85%. Furthermore, the positive percentage of sharing knowledge among project team members to reduce the cases of construction errors is 75%. The positive percentage related to sharing of knowledge among project team members in reducing the causes of poor skills is 80%. Therefore, it is apparent from discussion above that the sharing of knowledge among project team members is crucial regarding reducing the cases of design change, construction errors and poor skills.

The analysis of the next question indicates a positive percentage related to using mentoring programmes to facilitate knowledge transfer among staff on reducing the causes of design change is 74%. In addition, the positive percentage pertaining to using mentoring programmes to facilitate knowledge transfer among staff on reducing the causes of construction errors is 83%. The positive percentage related to using mentoring programmes to facilitate knowledge transfer among staff on reducing the causes of design change is 68%. It is obvious from the discussion above, that using mentoring programmes to facilitate knowledge transfer among staff can have an impact on reducing the causes of design change, construction error and poor skills in construction projects.

Furthermore, question was asked to identify the impact of engaging experts to facilitate Knowledge Management on projects with the aim of reducing the causes of design changes, construction errors and poor skills. The results of the questionnaire illustrate the impact of engaging experts to facilitate Knowledge Management on projects to reduce the cases of design change, shows a positive percentage, which is 73%. Furthermore, the positive percentage for the impact of engaging experts to facilitate Knowledge Management on projects to reduce the cases of construction errors is 73%. The positive percentage for engaging experts to facilitate Knowledge Management on projects to reduce the cases of poor skills is 70%. Therefore, engaging experts to facilitate Knowledge Management on projects is exceedingly important for reducing the cases of the design change, construction errors and poor skills during construction work.

The effectiveness of KM tools in reducing design changes and reduce poor skills. It was revealed that for design change the five highest ranking tools are: Knowledge Sharing Workshops, Peer Assistance, Blogs, Facebook and Email. This is an interesting set of results as they are all interlinked. They all relate to project team capturing, sharing and retaining valuable lessons learnt from on-going or concluded projects. Not surprisingly, these tools have revealed a high level of effectiveness in reducing design changes and associated costs on projects, according to the results.

The five KM tools in reducing poor skills revealed are: Post-Project Reviews, Competency Management, Peer

Assistance, Lessons Learnt Management Systems and Knowledge Sharing Workshops.

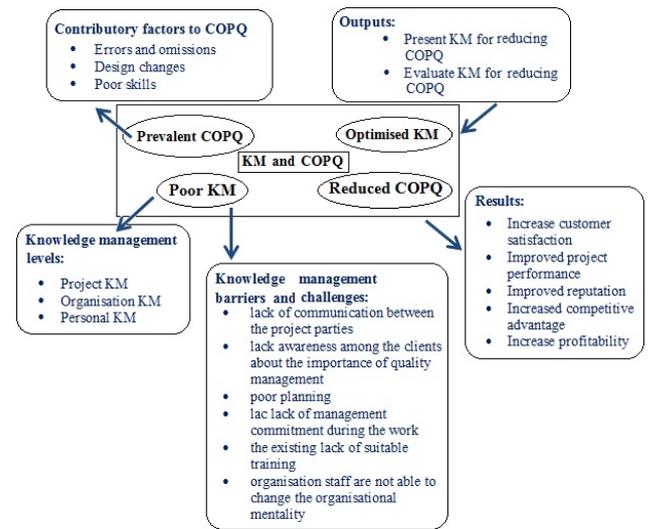


FIGURE I: FRAMEWORK FOR REDUCTION OF COPQ THROUGH KM

V. CONCLUSIONS

In today's fast-paced economy, an organisation's knowledge base is quickly becoming its only sustainable competitiveness. As such, this resource must be captured, protected, cultivated and shared amongst organisational members. Increasingly, however, competitiveness is to be gained by making individual knowledge available within organisation and transforming it into organisational knowledge. Organisational knowledge complements individual's knowledge, making it stronger and broader. The full utilisation of an organisation's knowledge base, coupled with the potential of individual's skills, competencies, thoughts, innovations, and ideas, will enable an organisation to compete more effectively in the future. In this paper, knowledge management practices are explored and reported in the context of the contributory factory (causes of design change, construction errors and poor skills) for COPQ in Oman construction sector and framework for reduction of COPQ through KM is presented (see Figure 1). It concludes that capturing lessons learnt at various stages of the project, capturing knowledge from other projects for use on current projects and sharing of knowledge among project team members is crucial regarding reducing the cost of design change, construction errors and poor skills.

It also revealed mentoring programmes to facilitate knowledge transfer among staff can have appositive impact on reducing the cost of design change, construction error and poor skills in construction projects. The emphasis is on the capture and share of tacit knowledge. There is an urgent need for improved awareness and understanding of the challenges and significance of knowledge. Some form of guidance (roadmap/framework) is perceived as a way forward to facilitate improved competitiveness in Oman construction industry through effective knowledge management initiatives.

REFERENCES

- [1] Z. Wahl, 2017. Knowledge Management in 2017, KMInstitute. [online] Kminstitute.org. Available at: <http://www.kminstitute.org/blog/knowledge-management-2017> [Accessed 27 Jul. 2017].
- [2] A. Frost, 2010. Knowledge Management Definition. [online] Knowledge-management- tools.net. Available at: <http://www.knowledge-management-tools.net/knowledge-management-definition.html> [Accessed 30 Jun. 2017].
- [3] R. Lakshmi, 2015. SSRG - Seventh Sense Research Group, International Journal of Engineering, Science, Technology, Humanities and Social Science. [online] Internationaljournalsrsg.org. Available at: <http://www.internationaljournalsrsg.org>
- [4] R. Olayinka, S. Suresh, E. Chinyio, 2015. "The impact of knowledge management in reducing the cost of poor quality – the case of UK construction industry", *Proceedings of the Institution of Civil Engineers - Management, Procurement and Law*, Vol. 168, No. 4, pp. 177-188.
- [5] A. A. ALSarhani, 2016. Knowledge Management in the public and private sectors organisations - The Road to Achieve Sustainable Competitive Advantage, Al-Rushd Library, Riyadh, Saudi Arabia
- [6] Y. K. Ammar, 2016, "Knowledge management practices in the middle east: challenges and trends", *International Journal of Innovation and Knowledge Management in Middle East and North Africa*, Vol. 5, No. 2, pp. 71-79
- [7] M. Ruthven, (2016): How to Understand ISIS. Retrieved 13 June 2016, from <http://www.nybooks.com/articles/2016/06/23/how-to-understand-isis/>
- [8] A. Al-Roubaie, and A. Al-Ameen, 2015. "Trade and knowledge creation in GCC Countries: the case for sustainable development". *International Journal of Innovation and Knowledge Management in the Middle East and North Africa*, Vol. 4, No. 1, pp. 1-13.
- [9] C. Armstead, 1999. "KM and process Performance", *Journal of Knowledge management*, Vol. 3, No. 2, pp. 143-154.
- [10] F. Soliman, and K. Spooner, 2000. "Strategies for implementing Knowledge Management. Role of Human Resources Management", *Journal of Knowledge Management*, Vol. 4, No. 4, pp. 337-345.
- [11] M. L., Todorović, D. Č. Petrović, M. M. Mihić, V. L. Obradovićand, S. D. Bushuyev, 2015. "Project success analysis framework: A knowledge-based approach in project management". *International Journal of Project Management*, Vol. 33, No. 4, pp. 772-783.
- [12] J. W. Creswell, 2014. Research Design Qualitative, Quantitative, and Mixed Methods Approaches. Thousand Oaks, CA: SAGE Publications
- [13] P. D. Love, D. J. Edwards, H. Watson, and P. Davis, 2010. "Rework in civil infrastructure projects: determination of cost predictors". *Journal of Construction Engineering & Management*. Vol. 136, No. 3, pp. 275-282.
- [14] J. Clark, and F. Soliman, 1999. "A graphical method for assessing knowledge-based investments", *Journal of Logistics and information Management*, Vol. 12, No. 1, pp. 63-77.
- [15] C. O'Dell, and C. J. Grayson, 1998. "If only we knew what we know: identification and transfer of internal best practices". *California Management Review*. Vol. 40, No. 3, pp. 154-174.



Abdulaziz Almarshoudi obtained civil engineering degree from the Higher College of Technology in Oman in 2010. He obtained master degree in the Construction Project Management from University of Wolverhampton UK in 2018. He is working in the Ministry of Municipalities in Oman as a Civil Engineer from 2011 to date.

Subashini Suresh has over 19 years of experience in research, teaching and practice in the area of Project Management and has worked in the area of Architecture, Engineering and Construction (AEC) sector in UK, USA, UAE, Nigeria, Ghana, Italy, Netherlands and India. Currently, she is a Reader of Construction Project Management at the School of Architecture and Built Environment, University of Wolverhampton. She holds a PhD in knowledge management. She received Rewarding Excellence Award for Innovation in Teaching and also for Blended Learning Tutor. She has published over 150 academic publications, which include 27 journal papers, 95 conference papers, four articles, eight book chapters, 15 reports and three books. Her key areas of interest are as follows: construction project management, knowledge management, building information modelling, health and safety, sustainability/green construction, emerging technologies, quality management, leadership in change management initiatives, organisational competitiveness, business process improvement, lean construction, risk management, and Six Sigma leadership.



Suresh Renukappa currently serves as a Senior Lecturer in the Faculty of Science and Engineering at the University of Wolverhampton. He holds a PhD in managing change and knowledge associated with sustainability initiatives for improved competitiveness. He has over 20 years of research, consultancy, project management and teaching experience in a wide range of business and management areas across industrial sectors in both developed and emerging economies. His research interests cover, but not limited to, sustainability strategies for competitive advantage; carbon reduction strategies; corporate social responsibility; smart cities development; leading change towards sustainability; knowledge management; public private partnerships; cloud computing; infrastructure asset management; and sustainable infrastructure investment and development. He has successfully executed more than 30 large projects and authored over 120 papers which have been published in journals, book chapters and conference proceedings.