Implementation of 5S Lean Methodology in Reviewing Competencies in a Higher Education Institution

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Abstract
The potential of applying Lean Management in Higher Education Institutions has increased significantly in last few years leading to tremendous savings. Reviewing and updating competencies' curriculum matrix is one of the critical and complicated processes that consume time and effort. Consequently, there has been a quest for a scientific and sustainable approach to effectively manage this review. This paper presents a novel approach of implementing Lean (5S) methodology in reviewing technical competencies required for the graduates of the Military Technological College in the Sultanate of Oman. The 5S framework has been imbedded into an action plan using the PDCA (Plan, Do, Check, and Act) Deming's cycle. As a result, the method applied has helped in sorting out the actual required competencies, the team has identified the required (new, amended, and deleted) competencies in all of the targeted Engineering Departments, in addition, the major wastes within the overall process were identified and the future review process was standardised and documented.

Keywords: Kaizen, SDCA, PDCA, 5S, Lean, MTC, Competencies, Curriculum Matrix, Higher Education

Introduction

The sophistication of equipment and machine learning technology has accelerated the global economic race competition. In forthcoming era, leading edge organisations will be forced to give the preference in recruitment to the specialised hands-on skills personnel. Therefore, vocational competencies based on updated required skills and knowledge are going to play major role in achieving the required students' attributes of Higher Education (HE) institutions.

Military Technological College (MTC) – Oman has taken a step further as a leading organisation in this field. It delivers academical technical and vocational competencies needed by graduates using three integrated approaches (i.e., academic programmes, Training Needs Analysis (TNA) programmes, and integration of the TNA programmes with the academic programmes) [1]. This has led to have a very complicated competencies' curriculum matrix mapping for MTC engineering departments, that obviously triggered searching for a scientific and sustainable approach to manage such a review process.

Overview and Review Scope

MTC has been established to become a Centre of excellence through its substantial provision of education and training for Ministry of Defense (MoD) and civilian technicians and engineers in the Sultanate of Oman. The College aims to become amongst the best in the filed of military and applied non-military technical education and training. This has driven its mission as the place of delivering vocational trade, specialists, undergraduate and postgraduate engineering programs in a high quality learning and training environment [1].

The college comprises of five engineering departments, namely Systems, Aeronautical, Marine, Civil and Quantity Survey, and Geomatics. The Geomatics department is a recent addition that has not been considered during the implementation stage of this study. In the course of the review process, the number of competencies taken into account is as follows: 371 for Systems Engineering, 54 for Aeronautical Engineering, 111 for Marine Engineering, and 78 for Civil and Quantity Survey Engineering [4].

The plan was to develop a review process aimed at a comprehensive review of competency descriptors' documents, focusing specifically on the following sections: elements and performance criteria, required skills and knowledge, resources required to demonstrate the competencies, and the assessment strategies. However, the process was intentionally designed to be flexible, allowing for the removal of existing competencies or the addition of new ones in response to changes in technology and stakeholder requirements.

Methodology

Lean is a management philosophy and methodology that originated in manufacturing sector but has since been applied across various industries. It is centered on the concept of maximising customer value while minimising waste [5]. In essence, lean thinking seeks to optimise processes by eliminating unnecessary steps and increasing processes efficiencies [3]. Research indicates that the initial implementation of Lean management in higher education occurred in 2003 [2].

Numerous tools and techniques are available within the realm of Lean methodology (e.g., value stream mapping, value engineering, kanban, etc.). In the context of this study, a strategic choice has been made to incorporate the 5S housekeeping Lean tool. This Japanese tool utilize five keywords, all beginning with the letter S, as its basis. Sort (Seiri), Set in order (Seiton), Shine (Seiso), Standardise (Seiketsu), and Sustain (Shitsuke), and it has been seamlessly integrated into a PDCA (Plan-Do-Check-Act) Deming cycle using Kaizen mode (i.e., starting the first cycle with Standardise instead of Plan); Figure 1 shows Cycle-1 TNA5S review conceptual model. This deliberate integration aims to enhance the efficiency and effectiveness of the review process mechanism by systematically addressing and improving the competencies descriptors elements described earlier through clear documentation and well-established accessibility of the required information from different stakeholders.
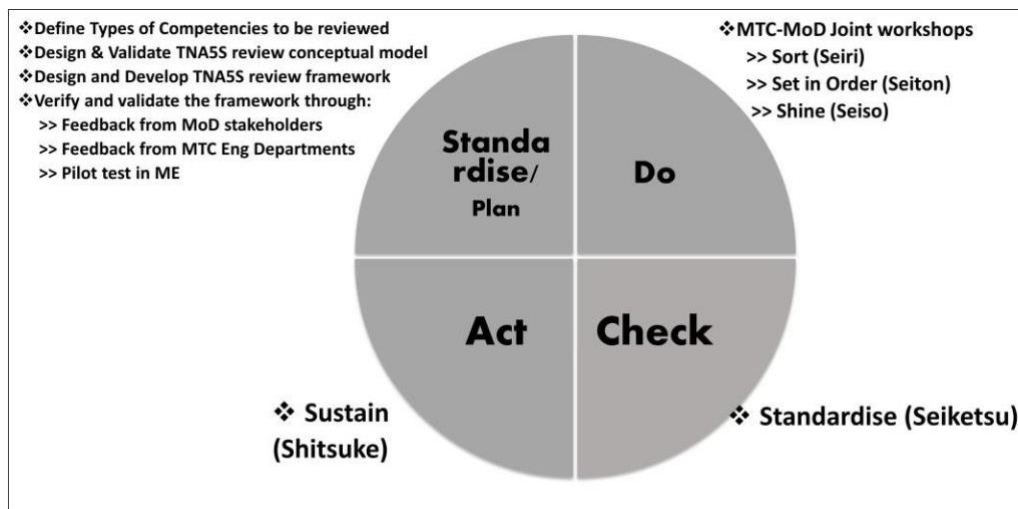

Figure 1: Cycle-1 TNA5S review conceptual model.

During *Standardise* step of Cycle-1 of the TNA5S review conceptual model, types of competencies to be reviewed were defined. The designed model underwent validation by a Lean practitioner, ensuring its conformity to Lean principles. The TNA5S review framework was then meticulously developed and successfully underwent a verification and validation process, necessitating only minor adjustments. A pilot test was conducted in coordination with Marine Engineering department.

In the subsequent *Do* phase, a comprehensive plan was developed and executed in a collaborative workshops forum involving all stakeholders (i.e., MoD specialists, MTC engineering departments' concern lecturers and instructors, and random selected participants from MTC graduates). The primary objective was to delineate vocational competencies from other types (*Sort*). The *Set in Order* aspect was employed to categories mandatory competencies separately from complementary ones which will systematically impact the proficiency levels students must attain before graduation. The process concluded with removing unnecessary elements, conducting proofreading, and updating the documents (*Shine*).

Following the *Do* phase, efforts were directed towards ensuring the planned implementations were executed as intended. This included confirming that competency descriptors for all Engineering departments adhered to a unified format and complied with established policies

and regulations (*Standerdise*). The final task involved obtaining Check/evaluation approval, as a prerequisite to progress to the subsequent step.

In the *Act* phase, insights and lessons gleaned from the process were comprehensively discussed and documented. These insights are instrumental in refining the Plan step for the next cycle of the review (*Sustain*), as illustrated in Figure 2.
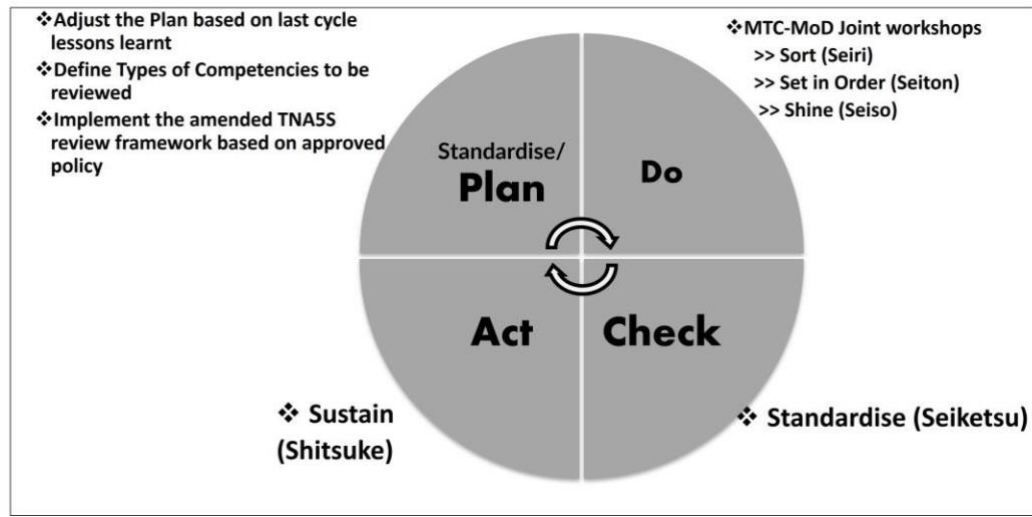

Figure 2 Cycle-2 TNA5S review conceptual model.

Findings

Despite the fact that the implementation of the new review mechanism has resulted in enhanced efficiency and effectiveness of the overall process and significant reduction in review lead time, Figure 3 highlighted the comprehensive review findings pertaining to incorporated new (22 competencies), modified (173 competencies), and deleted (2 competencies) descriptors.
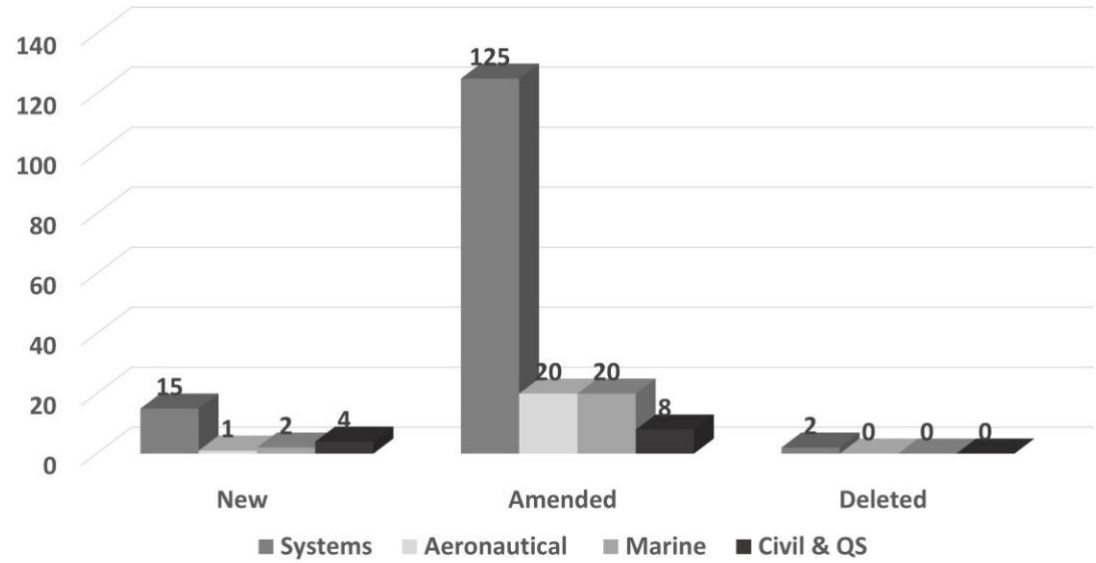

Figure 3: TNA5S Competencies Review Findings.

During the review process, three primary forms of waste were identified. Firstly, overproduction manifested as departments repeatedly generating amendments to competency descriptors, leading to the creation of multiple versions. Secondly, overprocessing was evident in the unnecessary inclusion of elements in competency descriptors documents. Lastly, waiting times were notable, primarily stemming from extended periods required for peer review and consultation with stakeholders.

Conclusion

In conclusion, the effective implementation of the TNA5S review conceptual model and framework demonstrates its success in streamlining competency review process. This achievement proves the adaptability of Lean principles in higher education, showcasing their potential to eliminate waste and enhance efficiency. The key takeaway lies in the commitment to sustain Lean practices, emphasising ongoing dedication as a critical factor for success. This accomplishment marks a significant step toward reshaping educational processes and promoting continuous improvement in higher education.

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