

**CMMI-BASED LEAN LEARNING MANAGEMENT & ORGANIZATIONAL
DEVELOPMENT (LMOD) SYSTEM: A CONCEPTUAL FRAMEWORK FOR
SUSTAINABLE LEAN IMPLEMENTATION AND OPERATIONS IN MINING INDUSTRY**

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Abstract:

The paper suggests a CMMI's Organizational Training (OT) Process Area (PA)-based Lean Learning Management & Organizational Development (LMOD) Framework for lean Implementation. It's recommended that any process improvement framework implementation requires regular training, learning & knowledge sharing. Generally, a new process improvement framework starts with organization-wide training. The training needs to be managed in a systematic & structured way and should be continued throughout the process implementation cycle. Lean is one of the most popular frameworks for process improvement that is utilised by businesses of all sizes and in a wide range of departments & divisions. Lean is being implemented by mining companies as well, although with very little impact and success. Process improvement specialists and lean practitioners have faced significant challenges in implementing lean successfully and profitably. To achieve organizational-wide learning and growth, a strong training, coaching, and knowledge-sharing strategy is needed. The researcher proposes an LMOD Framework for lean Implementation that is based on the Organizational Training (OT) and Process Area (PA) of the CMMI. Several levels of process areas and practises will be present. The many capability/maturity rating system levels specified in CMMI V1.3 will serve as the foundation for the framework. The framework's use is constrained in some ways, and it needs to be tailored to the needs of the organisation. Also, it can be further improved by including more training methods and exercises to make it more thorough and durable.

Keywords: Lean, Mining, Organizational Training (OT), Knowledge sharing, CMMI, Improvement Framework

Introduction

Any new system enhancement framework requires training and learning of new processes, methods & guidelines, and sharing of best practices & lessons. Guided mentoring & Coaching programs are always integral to process change and improvement programs. Generally, the new process improvement journey starts with training, mentoring & Coaching programs to ensure better adaptability and acknowledgment from the stakeholders at all levels. Such process improvement-related training needs to be planned & managed in a methodical / organised manner. As per José Dinis-Carvalho [2], ineffective and inadequate training as one of the reasons for the failure of improvement initiatives. The comparable argument may be presented for lean, one of the most popular frameworks for process improvement in business and other fields. Lean has been implemented by mining companies, albeit with very tiny gain and accomplishment. Companies have confronted with major challenges. A lack of systematic and efficient training during planning and execution may be one of the factors contributing to the low success rate of lean implementation. Lean planners and practitioners can adopt the best training strategies from other process improvement frameworks like CMMI, PCMM, etc. for increased success and acceptability. When a lean project or programme is implemented, a new framework for structured training can be designed, tested, and followed. Among many process frameworks, CMMI is one of the widely used process improvement frameworks globally and has benefited thousands of IT / Technology companies. It has process areas and proven practices & guidelines related to organizational training. It's being designed by combining some of the best practices followed by IT / Technology organizations. This paper proposes CMMI's Organizational Training (OT) Process Area (PA)-based Lean Learning Management & Organizational Development (LMOD) Framework for Lean Implementation in Mining. The proposed conceptual framework will

consist of multiple levels/stages of training-related process areas & practices as defined in CMMI V1.3.

Literature Review

Lean is a framework to improve systems by eliminating waste. It emphasises on elimination all types of wastage. Lean manufacturing, often known as lean production, is an approach to managing a manufacturing or service organisation, according to ASQ. It helps organizations in achieving objectives like:

- Waste reduction
- Better quality
- Optimized processes & systems

Any lean implementation requires a systematic and structured training. A traditional/basic training system may not be very effective and sufficient. To make it more effective, there is a necessity to propose a training structure to make sure that lean initiatives are executed effectively. Generally, a training framework includes the identification of training needs, planning, execution, evaluation & monitoring, knowledge sharing, and governance.

As per José Dinis-Carvalho [2], Womack and Jones presented lean thinking as an interpretation of Toyota's successful production system strategy. Over the years, practitioners and academics worldwide have contributed to the body of knowledge surrounding lean philosophy. A few researchers have offered an intriguing illustration of a theoretical structure of lean tools and assumptions. In many different kinds of organizations worldwide, applying lean ideas, concepts, and tools is quite common but not always successful. In the literature, lean training is regularly cited as being crucial to the attainment of lean initiatives. According to reports, inadequate training was a noted barrier to successful lean implementations in companies. According to a second study, training is the most frequently cited important success factors in the literature on improvement programs, followed by management commitment and involvement.

As per Denning [9], there are companies where lean programs have failed. But at Toyota plants, lean is being implemented through customized training, learning & mentoring programs. Organizations must prepare a sustainable lean training program to ensure a successful implementation. An effective Lean training program is essential as more businesses adopt the Lean methodology for continuous improvement and waste reduction. Nonetheless of their position in the value chain, everyone in the organization must have a thorough understanding of Lean and, more significantly, understand how it will benefit the business, its clients, and its staff if it is to be adopted fully. Key components of Learning, Training and Coaching. Mckensy's Jacqueline Brassey et al. [7] outline the following essential components of a successful leaning & training strategy:

- alignment with business strategy & improvement initiatives,
- co-ownership between departments & HR team,
- right execution and scaling up, measurable benefits,
- enablement of 70:20:10 learning framework
- application of technology and systems

As per lean.org [11], Training is engrained in Gemba with Plan-Do-Check-Act (PDCA) at its central. The Coaching is based on the learner's needs & skills type of problem to be solved, and the focus is always on individual & organizational capability building. The focus is on elevating the awareness and proficiency at all the levels in organization.

CMMI and Organizational Training (OT) Process Area

As per wibas.com [3], The CMM was created primarily to offer a systematic, structured framework to handle problems with software management and engineering process. Later, CMM evolved into the Capability Maturity Model Integration (CMMI), which offers a means of displaying and evaluating organizational practices and activities concerning predetermined standards. CMMI's maturity/capability level & rating system enables enterprises to easily assess their present capability & performance and help plan future improvements. CMMI's Organizational Training (OT) Process

Area can help mining organizations to design and develop a training system and capability, which can be used to support & drive organization-wise learning and Coaching.

Research gap and necessity of the new framework

Many companies are implementing lean projects/programs to improve systems. The attainment level of lean Enactment is not very high. One of the causes may be the lack of good training during the Implementation of the lean initiative.

So, there is a need to put a structured OT management framework to ensure the best training & learning during large projects/program execution.

Objectives of the study

The existing facts suggest the partial application of Lean training & learning structures and a non-existence of comprehensible system to coach practitioners and management during lean Implementation. Industry requires pioneering learning systems and frameworks. So, there is a requirement to promote innovative learning systems which would help achieve better results. There are improvement frameworks like CMMI, PCMM, etc., which can be used to build LCLM system for structured & systematic planning & monitoring of lean training in the organization. If lean training is combined with other improvement frameworks for coaching purposes, it will provide better learnings to practitioners and may give superior results & quantifiable improvements. This study aims to propose a new learning management model/framework for lean Implementation. The study suggests applying CMMI's organizational training practices with lean Implementation in mining for better learning & Coaching during lean improvement initiatives across the departments and organization.

Methodology

We relied upon the secondary data available from IT industry, because of the proven track record and training & learning practices. After studying the Org Training Practices, we derived the similar practices for new proposed model, which can be used a structured framework for Org Level Lean Training in mining organizations. Along with the model, tools & techniques and key metrics are also proposed. As an extension of the proposed model, a knowledge & learning framework is also included which will strengthen the learning practices in the organisation.

Discussion / Results: The proposed Lean LCLM Framework

Identifying the training needs for a lean improvement project is key to the success of the Implementation. New process improvement framework implementation requires a well-planned training strategy for all the levels in the organization. The training objectives should be mapped to the organizational vision, mission, goals & objectives to ensure that the training purpose aligns with management's expectations.

CMMI's OT process area has a well-defined structure for training implementation. It starts with training need identification, followed by a strategic training plan at the organizational level and the responsibilities of the stakeholders. Once training needs & responsibilities are identified, the next step is to deliver/impart training at the organizational level & project/program level and monitor the progress & effectiveness systematically. After training, the effectiveness of delivery is measured, monitored & tracked to ensure that learning objectives are met. A similar structure with some customization will be useful for lean implementation also. The following diagram shows the hierarchy of CMMI's OT Process Areas Practices (see figure 1).

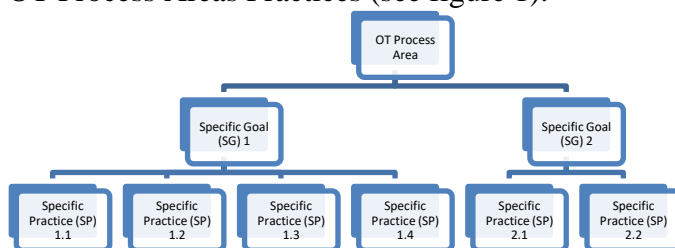


Fig. 1: CMMI's Organizational Training (OT) Organization

New Proposed Structures and Mapping of Framework's Practices:

CMMI OT PA's Practices and Processes [3]	Proposed Learning Management & Organizational Development (LMOD) Framework Practices & Processes
OT.SG 1	LMOD.SG1 Create Lean Training Ability for Lean Implementation. <i>A learning capability, is created and kept for lean training, learning & Implementation</i>
OT.SP 1.1	LMOD.SP1.1 Setup Strategic Training Needs for Lean Implementation: <i>Establish/Setup and maintain strategic training needs of the organization for Lean Implementation</i>
OT.SP1.2	LMOD.SP1.2 Select / Decide which Training Requirements are given to the Organization for Lean Implementation: <i>Select / Decide how training assignments are divided / distributed to the team and in organization</i>
OT.SP1.3	LMOD.SP1.3 Prepare an Org-Level Tactical Plan for Lean Implementation: <i>Prepare & keep Org-Level plan for Lean Implementation</i>
OT.SP1.4	LMOD.SP 1.4 Setup a Training Expertise & Capability and Knowledge base for Lean Implementation: <i>Setup and keep a Training Expertise & Competency and Knowledge base to fulfil organizational training requirements for Lean Implementation</i>
OT.SG2	LMOD.SG 2 Provide Training: <i>Train people for lean implementation</i>
OT.SP2.1	LMOD.SP2.1 Provide Training for Lean Implementation: <i>Provide Lean related training as per plan.</i>
OT.SP2.2	LMOD.SP2.2 Produce Records of Training: <i>Keep records of related to Lean Training.</i>
OT.SP2.3	LMOD.SP 2.3 Measure Effectiveness: <i>Measure effectiveness of lean training</i>

Table 1: New Lean LMOD System / Framework

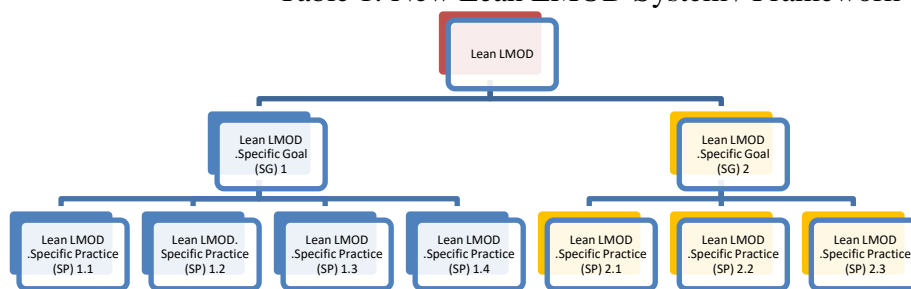


Fig. 2: CMMI-based Lean LMOD Framework



Fig. 3: LMOD Framework's Work / Execution flow

Set of tools/techniques in framework:

Tools / Techniques
SWOT Analysis for training planning
Skill Matrix
eLearning Tools / Systems
Instructor-led online training
Self-paced online / web-based training
Blended training with a component of evaluation
Role-playing
Coaching & Mentoring
On-the-Job Training
Training through Collaborative Tools
Peer-to-Peer Learning
Train the Trainer

Table 2: Training/Coaching Tools/Techniques



Figure 4: Enterprise Level-Lean Learning Management & Organizational Development (LMO)



Figure 5: Enterprise Level- Learning & Knowledge Management

The proposed framework will generate following reports/outputs [12, 13, 14]:

- Strategic Training Plan for Lean Implementation
- Tactical / Operational Training Plan for Lean Implementation
- Training Monitoring & Tracking reports, including-
 - Number of Training to be imparted per Year
 - Number of Man Days of Training Per Person
 - Average Rating of Trainings

- Effectiveness of Training (based on learner's development & growth)
- Before and After Training Rating of Learners
- Training Completion Rate
- Trainer's Database
- Training cost per Employee
- Learner's Dropoff Rate
- Learner's pass rate after the training
- Org level Best Practices & Lessons Learned
- Course Completion Rate
- Industry's Best Practices
- Number of Community of Practices (COPs)

Limitations and Future Research Scope

One limitation of CMMI is that it can be a complex and time-consuming process to implement. The framework involves multiple maturity levels, and each level requires significant effort and resources to achieve. Additionally, CMMI may not be suitable for organizations that do not have a well-defined software development process or lack the necessary resources to implement the framework effectively. Similarly, implementing lean management techniques can also present challenges. Lean management involves identifying and eliminating waste in processes, which can be difficult without a thorough understanding of the organization's processes and culture. Additionally, lean management requires significant time and resources to train employees and implement new processes. Another potential limitation of both CMMI and lean management is resistance to change. Employees may be resistant to new processes or sceptical about the benefits of these approaches, which can slow down or impede Implementation. Finally, both CMMI and lean management require ongoing commitment and maintenance to be effective. Organizations must continue to assess and improve their processes to maintain the benefits of these approaches over the long term. While CMMI and lean management can be effective approaches for improving organizational processes and performance, they may not be suitable for all organizations or may present challenges in Implementation.

Conclusion & Implications

The framework is designed to cater to lean Implementation in mining organizations by using best practices and models available in other industries. It combines processes, practices, tools, techniques, methodologies, and guidelines to meet the needs of lean-related learning & training at the organizational and department level. It also covers some elements of individual development plans and growth. In the future, more & more processes, practices, and tools can be added to make the proposed framework more practical, acceptable, and robust.

The CMMI is a framework to improve the quality and performance of an organization's software development processes. CMMI-based Lean LMOD systems combine the principles of CMMI with lean management techniques to optimize learning and development within an organization. The primary goal of a CMMI-based Lean LMOD system is to create a culture of continuous learning and improvement by promoting a systematic approach to learning and development. The system involves identifying the organization's learning and development needs, designing and delivering training programs, measuring training effectiveness, and continuously improving the process. Implementing a CMMI-based Lean LMOD system can help organizations improve their processes, increase productivity, and reduce waste. The system can also enhance the organization's ability to adapt to change and remain competitive. Eventually, a CMMI-based Lean LMOD system can be a valuable tool for organizations looking to create continuous learning and improvement culture. However, the system's effectiveness depends on how well it is implemented and the organization's commitment to the process.

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