ALL ARE WELCOME

M.S. Seminar Talk

Title: **From Fragmentation to Systemic Integration: An AI-Enabled Digital Infrastructure Layer for Manufacturing Quality Ecosystems**

Speaker: **Mr. Srijan Tiwari (ME23S401)**

M.S. Research Scholar (Centre for NDE), Dept of Mechanical Engineering, IIT Madras.

Date and Time: **26-02-2026 @ 3:00 PM**

Venue: https://meet.google.com/xry-yvax-zkq

Abstract

Manufacturing quality in heavy engineering sectors such as EPC, oil and gas, power, defence, and large-scale fabrication operates within highly regulated compliance environments governed by standards including ASME, API, ISO, and IBR. While technical standards and inspection protocols are well defined, the coordination of human capital, certification pathways, and deployment workflows remains structurally fragmented. In particular, the recruitment of QA/QC and NDT professionals continues to rely on generalized job portals, informal referral networks, and manual certificate verification processes, resulting in prolonged hiring cycles, inconsistent skill validation, and limited transparency in competency assessment.

The consequences of this fragmentation extend beyond administrative inefficiency. Rework, rejection, and schedule overruns in manufacturing projects are often linked to gaps in skill alignment, supervision quality, and certification authenticity. When workforce deployment lacks standardized verification and traceability, enterprises are compelled to operate in a reactive mode, absorbing avoidable quality risk. The recruitment function, therefore, emerges not merely as an HR activity but as a critical risk control interface within the manufacturing quality value chain.

This research proposes a platform-oriented coordination model that positions recruitment as the primary integration layer within the broader Manufacturing Quality ecosystem. The model is designed to address three systemic inefficiencies: inconsistent validation of credentials and experiential depth, disconnection between training outcomes and industry deployment requirements, and absence of an auditable digital layer linking certification data, workforce performance, and inspection workflows. By structurally embedding verification, assessment, and deployment logic into a unified digital framework, the proposed system transforms recruitment from a transactional process into a data-backed trust mechanism.

Within this architecture, training is not treated as a parallel activity but as an aligned competency pipeline directly mapped to certification standards and project-specific skill requirements. Procurement of inspection devices and consumables is integrated as an

enabling infrastructure layer, ensuring that workforce capability and technological tools are coordinated rather than independently optimized. Artificial intelligence functions as a trust-enhancing layer, assisting in credential validation, competency matching, structured skill representation, and performance data interpretation, while preserving human decision authority in hiring and certification outcomes.

The proposed model advances a shift from fragmented point solutions toward systemic integration across stakeholders, including asset owners, inspection service providers, training institutions, certification bodies, professionals, and device manufacturers. By establishing a persistent data layer across recruitment, training, and deployment, the framework seeks to reduce hiring cycle time, enhance compliance integrity, improve project velocity, and structurally mitigate the Cost of Poor Quality.

This study contributes a coordinated platform framework for Manufacturing Quality systems that integrates technical rigor, workforce validation, and business process design into a unified digital ecosystem. It demonstrates how workforce orchestration, when architected as a systemic integration problem rather than a staffing challenge, can become a strategic lever for operational reliability and long-term competitiveness in regulated industrial sectors.