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Manufacturing Line Uptime Improvement: A Lean Approach

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Abstract: *The purpose of this manuscript is to propose a framework for implementing 5S+S in engineering-to-order (ETO) projects with a focus on knowledge work. The application of this framework helps to improve overall performance in companies providing knowledge work. The methodology allows transparency and control over projects in day-to-day management, through the implementation of digital tools such as visual management, 5S+S online audits, key performance indicators (KPI), dashboards, etc. This paper presents the implementation of lean management concepts in customer-specific tailor-made engineering projects, which has not been sufficiently addressed in the existing literature. The methodology used in this paper is based on the application by researchers of lean concepts in a combination of three different disciplines, namely, lean project planning and control (LPPC), lean quality management system (LQMS), and Lean Design. First, attempts at knowledge work improvement through lean are presented, based on the existing literature. Second, all three approaches: LPPC, LQMS, and Lean Design are explained. Third, the possibility of combining all three concepts into one framework is discussed. The use of 5S+S in knowledge work is demonstrated, and a framework is developed, based on a DMAIC (Define, Measure, Analyze, Improve, and Control) approach. The used framework is presented using an illustrative case in a small and medium-sized enterprise (SME) providing engineering services. The suggested methodology is applicable for engineering services-providing companies seeking overall project performance improvement. The findings are useful for project managers and engineering discipline leaders who aim to implement lean thinking in engineering projects*

Keywords: Machine Line Uptime ,MTTR,MTBF,5S+,SUR(Set up Reduction),I4.0(Industry 4.0)

I. INTRODUCTION

The Plant Engineering department is responsible for the maintenance of the shop floor which includes the forging, and machining area of the plant .thus maintenance of the machine is directly responsible for the performance of the plant. as the machine goes into a breakdown. e unexpected stoppages machine m maintenance department has to take action as soon as possible to maintain the desired flow of production & sustain the uptime (running time) of the machine.

As the PE department perform Repaired action it is expected to perform it inappropriate time thus it is required to all tool, fixtures & Parts must be sorted & placed in a labeled area which gives a minimum time loss during maintenance & help maintenance personnel to get required tool & part in time without any searching thus it gives time to focus on a machine more & thus machine uptime will be increased.

To reduce maintenance time it is important to apply 5S+, Industry 4.0, and other applicable lean tools like (VSM, SW, RIE, and TPM) in the maintenance department. So basically 5S+ tool, Implementation of I4.0 &SUR tool is helping to uptime improvement. In our experience, industrial businesses recognize the value of Industry 4.0 but are unsure what it looks like in practice or how to realize these efficiencies, especially when it comes to maintenance and operations. Many are stuck with run-to-failure maintenance strategies, aging equipment, and IT infrastructure. For this reason, we have chosen **three relevant Industry 4.0 technologies** that are giving the industrial sector **improved reliability and availability** of their equipment.

II. LITERATURE SURVEY

5S is a management tool, which can improve housekeeping, environmental conditions, and health and safety standards (Pasale and Bagi, 2013) that are relevant to every people (Nasir, 2011). The 5S implementation allows people to realize the importance of good housekeeping, especially in manufacturing plans (Nasir, 2011), and to increase the safety climate (Srinivasan, 2012). Hunglin

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(2011), in his research in Wang Chen Industry Manufacturing Factory, Taiwan, has done 5S implementation that focuses on organizing tools and improving the working environment. This research is using 5S methodology as the guide for improving the factory. Pasale and Bagi (2013) also agree that 5S can improve the recent condition. They have done research in Sunmill Industries Pvt. Ltd. Shiroli M.I.D.C. Kolhapur,259 17 India, and used fixture setting time as the performance measurement. The manufacturing industry profoundly impacts economic and societal progress. As being a commonly accepted term for research centers and universities, the Industry 4.0 initiative has received splendid attention from the business and research community. Although the idea is not new and was on the agenda of academic research for many years with different perceptions, the term "Industry 4.0" is just launched and is well-accepted to some extent not only in academic life but also in the industrial society as well. While academic research focuses on understanding and defining the concept and trying to develop related systems, business models, and respective methodologies, industry, on the other hand, focuses its attention on the change of industrial machine suits and intelligent products as well as potential customers on this progress. It is therefore important for the companies to primarily understand the features and content of Industry 4.0 for potential transformation from machine dominant manufacturing to digital manufacturing. To achieve a successful transformation, they should review their positions and respective potentials against basic requirements set forward for Industry 4.0 standard.

Working in any kind of manufacturing environment one of the unfortunate characteristics is waste. Waste can extend from unused raw material to damaged products, and it can carry quite a financial loss for the company if not treated efficiently. To reduce waste, there are several methods and strategies that companies can use depending on the desired results. One of the most popular methods is the Single Minute Exchange of Die or SMED. SMED was developed by Shigeo Shingo in 1950s Japan in response to the emerging needs of increasingly smaller production lot sizes required to meet the required flexibility for customer demand. The SMED technique is used as an element of Total Productivity Maintenance (TPM) and a "continuous improvement process"[4]. It is one of the methods of reducing wastage in a manufacturing process. The phrase "single minute" does not mean that all changeovers and startups should take only one minute, but that they should take less than 10 minutes (in other words, "single-digit minute")

III. PROBLEM STATEMENT, SCOPE, OBJECTIVE

3.1 Problem Statement

The purpose of projects is to provide students an opportunity to apply the knowledge they have learned, their intellectual abilities, and practical skills. By doing this process the required time for the maintenance department is reduced, therefore machine line uptime is improved. The main purpose of the project is to reduce the fatigue of operators and improve uptime MTBF and reduce MTTR as well as 5s+ score & machine set up time improvement.

3.2 Scope

Setup Reduction is a technique useful for level load balancing, a key strategy for lean deployment. Setup Time is defined as the time to change from the last item of the previous order to the first good item of the next order. Setup includes preparation, replacement, location, and adjustment activities. And the second one we focusing a 5S+ map is a diagram or floor plan that provides an overview of a work area, process, or station. It provides a visual reference to show where the tools, supplies, workers, and travel paths are, and how they relate to each other. A good map may also include a description of the work that happens in the area shown. A key role is indeed played by the Internet of Things or IoT, in the scope of Industry 4.0 Industrial IoT with its many IoT stack components, from IoT platforms to Industrial IoT gateways, devices, and much more.

3.3 Objective of the Study

The basic objectives of the present study are as follows:

- 5S improves speed and quality of work performance. After that, it cuts down employee frustration when "the system doesn't work". Finally, 5S creates a visually attractive environment.
- Objectives and benefits of Industry 4.0 The industry's 4.0 objective is to help industrial companies to become more competitive in their activities through digitalization To make solar power poultry shed heating & ventilation systems that will use non-conventional solar energy.
- Setup reduction effort, is to minimize the time in which process equipment remains "off-line" and unavailable for productive purposes.

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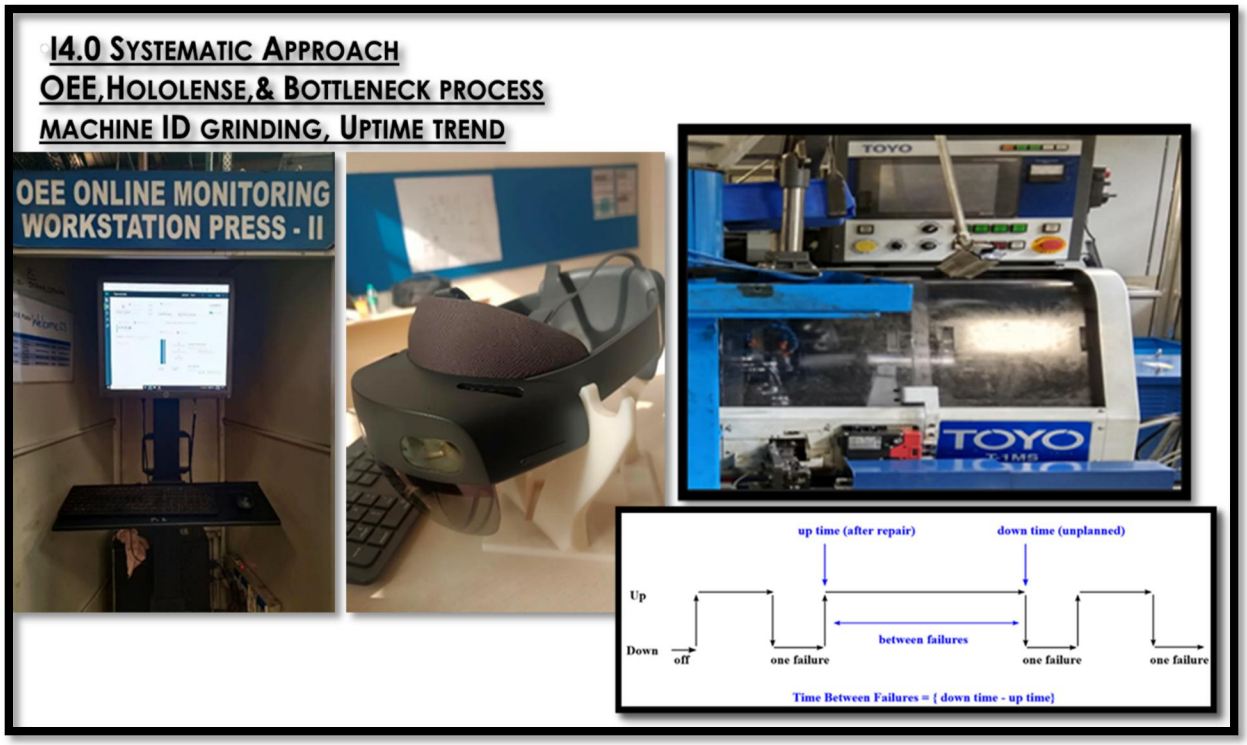
IV. METHODOLOGY

The following steps are implemented during project execution:

- Step 1: Basic Information & Literature survey about I4.0 maintenance area breakdown data.
- Step 2: Selection of Lean tool which is used for this coming concern.
- Step 3:Systemeatic approach of Idustry4.0 revolution.
- Step 4: Identify the internal and external elements, calculating the individual times.
- Step 5: Reduce the time for the external elements.
- Step 6: a systematic approach to workplace organization. This method includes the five steps of Sort, Set in Order, Shine, Standardize, and Sustain.

V. PROPOSED DESIGN



Picture showing the project overview which we working on the concern. We are using a systematic approach tool which helps to improve uptime, and set up time .so we **implement 5S+** standards in the maintenance area because off there are no standards for working, material handling, and consumable part finding there is the main area of improvement. After that we worked on the machine line so we studied the route cause analysis of the line end we found the bottleneck process of the line which is having more set-up time and (ID Grinding Machine) so we implement the systematic approach of the lean tool **set up reduction**. So the team started observation of internal and external activities. So after analysis, we eliminate more eternal activities with the help of company guidance. And we eliminate the setup time of the ID grinding machine. Also using the industry 4.0 approach in a project which the help of the Eaton industry we used HoloLens for project review because as per company rules team could not come every time in the company so we used Microsoft HoloLens for virtual review. Implementing OEE (Thingwrox) online to measure OEE(Overall Equipment Effectiveness) Where we can see machine availability, Performance & Quality.

V. CONCLUSION

At so end of the project, we achieved the main purpose of the project. We improve uptime throughout Lean tools & with a help of I 4.0. And finally, we got a 100% result.

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