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AN ANALYSIS ON APPLICATION OF LEAN FRAMEWORK IN HEALTH AND SAFETY MANAGEMENT FOR MANUFACTURING & SERVICE ORGANIZATIONS

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ABSTRACT

Lean is the popular philosophy in the present business management strategies. With immediate benefits from implementation of Lean in business processes, all major organizations had started deploying it. On the other hand, Health and safety management system (HSMS) has changed its facet from obligatory requirement to a Legal requirement. The Governments from across the world has increased focus on HSMS and are changing the legal regulations accordingly. In this highly regulated environment, it is required by all organizations to change its reactive approach to proactive approach. In this context, our paper reviews the Lean management, its relevance in HSMS and development of a structured framework for implementation.

Keywords: Lean, Health & Safety management system, Value stream mapping, ISO 45001.

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1. INTRODUCTION

Lean is a process improvement strategy which creates value for customers through minimizing or elimination of waste. A Lean process is ideally faster, efficient with best quality and much safer. Lean is applied on the following principles:

- Customer value: Determine what matters most to the customers
- Focus on process: Enable the workforce to identify and remove waste from the system
- Lean culture: Fostering a respectful and interactive culture of process ownership

The customer value is created by identifying and segregation of the process activity in to Value added activities (VA), Non value added activities (NVA) and Necessary non value added activities (NNVA).VA activity is the process step that an external customer sees as valuable like material used in the product, process used to transform an item to final product and doing the activities right the first time. NVA is a process step that does not add value from the customers perspective. NNVA is a process step same as NVA from customer perspective but the process step is essential as part of regulatory compliance.

Lean identifies the wastes in to eight types:

I. Defects
II. Overproduction
III. Waiting
IV. Non utilized talent
V. Transportation waste
VI. Inventory waste
VII. Motion waste
VIII. Extra processing

The general misconception during lean implementation is reducing the staff strength and increase the productivity. Which leads to lot of resistance from the staff for implementation and acceptance for changes. But the fact is People are not a waste, but often their talents are wasted on activities which does not create value. It is very essential to create awareness among the staff in removing the misconceptions from the employee's minds for a successful implementation and fruitful results. The common faults in organization structures are the departments are designed for vertical process reporting / structure, but actually the processes run horizontally so Lean courses the structure horizontally in managing processes.

Health and safety management system is a framework for managing OH&S (Occupational health & safety) risks and opportunities. The aim and intended outcomes of the OH&S management system are to prevent work related injury and ill health to workers and to provide safe and healthy workplaces; consequently, it is critically important for the organization to eliminate hazards and minimize OH&S risks by taking effective preventive and protective

measures. When these measures are applied by the organization through its OH&S management system, they improve its OH&S performance. An OH&S management system can be more effective and efficient when taking early action to address opportunities for improvement of OH&S performance. Implementing an OH&S management system conforming to this document enables an organization to manage its OH&S risks and improve its OH&S performance. An OH&S management system can assist an organization to fulfil its legal requirements and other requirements.

Traditionally, health and safety management system involve a lot of documentation and monitoring which are very tedious. So, the organization management are very reluctant to implement the system. With day to day evolution of Lean systems which is benefitting the organizations to reduce its cost and improving its efficiency. Now, its time to integrate the lean framework into the health and safety management for better results with focus on risk elimination and reduced documentation.

2. LITERATURE REVIEW

Lean is a popular manufacturing philosophy which organizations all over the world have adopted to increase profits, cut costs, and remain competitive. Lean helps organizations achieve this goal of increasing productivity by identifying and eliminating wastes related to material, time, and effort. Although lean was primarily developed for the manufacturing sector, its' principles are applicable in other industries as well [7].

Health and safety management system (HSMS) reflects an organization's commitment to safety and it is an important ingredient in employee perceptions about the importance of safety in their company. The purpose of HSMS is to help organizations tackle occupational safety and health challenges continuously and improve control on factors influencing health and safety [1].

The traditional safety metrics (recordable rates, frequency and severity rates, etc.) which report outcomes. This tells us how we have done in the past up to some point in time. To be able to manage effectively and to create an injury fee workplace, process information is needed. Information that tells management how they are doing at any given point in time which allows for process interventions that eliminate the conditions or actions that may lead to an incident. Process (systems) metrics allow for a holistic approach to managing safety interventions [2].

Lean is the method of reducing non-value adding activities in the manufacturing industries. Workplace safety and health hazards improvement helps the manufacturing industries to reduce wastes like time when an employee gets absent, compensation cost of unsafe employee and waste from damaged manufacturing equipment & tools. The importance of workplace safety and health hazards improvement is not a questionable issue in the eyes of professionals and researchers' area but, the concern is on how to control its severity from its risks. As studies showed that many researches have not been conducted on lean in Safety and Health considering how to reduce or eliminate non-value adding wastes [4].

Lean and safety should not be viewed as having conflicting goals but should be addressed simultaneously. The integration of lean and safety can help companies achieve a competitive edge that is critical while providing a safe workplace. Despite the synergistic nature of lean and safety, researchers have found conflict or at least neglect to consider safety in lean implementation [7].

Lean manufacturing's 5S program which is a basic systematic approach for organizing the workplace should be used to develop safety support tools and safety programs [5].

Lean provides a driving force for the formulation and implementation of safety management planning; and it also enables frontline employees to participate in the formulation of work planning, which enhances their sense of responsibility and motivation, and therefore enhances

the safety training and promotes their compliance with safety regulations and participation in safety activities [8].

Lean can become successful through Identification of all actions to bring a product to the customer, across all firms. There is no privacy. Each firm's costs become transparent [6].

3. OBJECTIVES

The objective of this research is to develop a Lean framework suitable for application in Health & Safety management system.

4. METHODOLOGY

4.1. Lean Framework

Lean was originated from Toyota to eliminate waste and inefficiency in its manufacturing processes. Toyota benefitted tremendously from this Lean approach and was so successful that it has become famous across the world. Basically, Lean has five key principles – Value, Value stream, Flow, Pull & Perfection. Any Lean framework had to be developed from these five key principles (refer exhibit 1).

- Value: Value is always defined by the customer's requirements for a specific product or service. For example, what is the lead time of delivery? What is the price? What is the expected quality requirement? What are the other important requirements or expectations that must be met? This information is very much crucial for defining value.
- Value stream: Once the value (end goal) has been established, the next step is mapping the "value stream," or all the steps and processes involved in taking a specific product from raw materials and delivering the final product to the customer. Value-stream mapping is a simple but eye-opening experience that identifies all the actions that take a product or service through any process. That process can be in design, production, procurement, HR, administration, delivery, or customer service. The idea is to draw, on one page, a "process map" of the flow of material / product / information / data through the process. The goal is to identify every step that does not create value which are termed as non-value added (NVA) activities, value added (VA) activities which creates value to the product / service and then find ways to eliminate those wasteful steps. Value-stream mapping is sometimes referred to as process re-engineering. Finally, this exercise also results in a better understanding of the entire business operation.
- Flow: After the waste (NVA) has been removed from the value stream, the next step is to make sure the remaining steps flow smoothly with no interruptions, delays, or bottlenecks. Make the value-creating steps occur in tight sequence so that the product or service will flow smoothly toward the customer. This may require breaking down silo thinking and making the effort to become cross-functional across all departments, which can be one of the greatest challenges for lean programs to overcome. However, studies show that this will also lead to huge gains in productivity and efficiency, sometimes as high as 50-percent improvement or more.
- Pull: With improved flow, time to market (or time to customer) can be drastically improved. This makes it much easier and smoother to deliver products as needed, as in "Just in time" manufacturing or delivery. This means the customer can "Pull" the product from you as needed (often in weeks / days, instead of months / quarters). As a result, products don't need to be built in advance which will provide benefit in terms of - No materials stockpiled, creating expensive inventory that needs to be managed, saving money for both the manufacturer / provider and the customer.

- Perfection: Achieving the above four Steps (Value, Value stream, Flow & Pull) is a great start, but the fifth step is perhaps the most important: making lean thinking and process improvement part of the corporate culture. As gains continue to pile up, it is important to remember lean is not a static system and requires constant effort and vigilance to perfect. Every employee should be involved in implementing lean. Lean experts often say that a process is not truly lean until it has been through value-stream mapping at least half a dozen times.

Exhibit 1 Lean Cycle

4.2. General Lean Tools & Techniques

During the implementation of Lean cycle, various tools and techniques are used in each of the cycle step based on the processes and operations. The general tools and techniques used in each of the step is presented in the below exhibit 2.

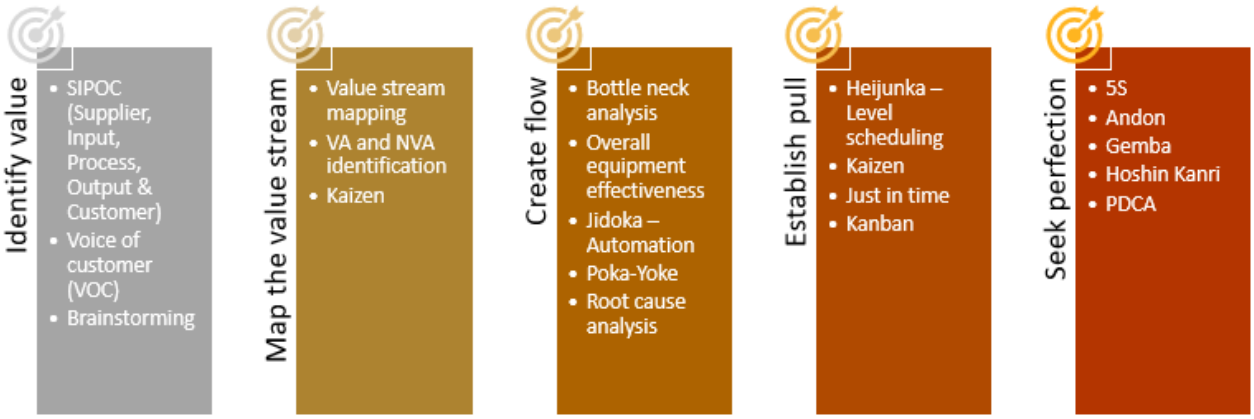

Exhibit 2 Lean tools and techniques

4.3. Health and Safety management system (HSMS)

Health and safety management system (refer exhibit 3) is a set of interrelated or interacting elements of an organization to establish policies, objectives and processes to achieve the established / intended objectives. HSMS is followed in organizations as ISO 45001:2018

system, which is an international standard from ISO (International organization for standardization). The intended objectives / outcomes of the HSMS are to prevent injury and ill health to employees and to provide safe and healthy workplaces.

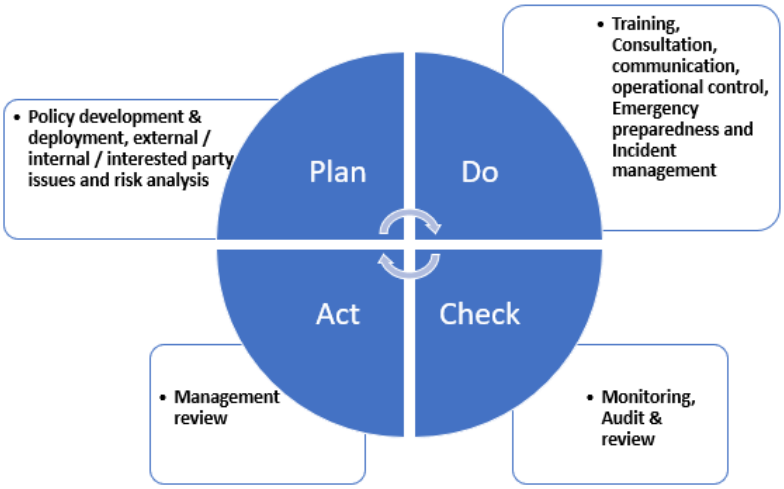

Exhibit 3 Health and safety management system

It is important in HSMS that the risks and opportunities related to health and safety are identified and mitigated. The risk is the combination of the likelihood of the occurrence of a work-related hazardous event or exposure and the severity of injury and ill health that can be caused by the event or exposure. The opportunity is a circumstance or set of circumstances that can lead to improvement of health and safety performance.

Even incident management also plays a prominent role in HSMS. Incident is called as an occurrence arising out of, or in the course of work that could or does result in injury and / or ill health. For each incident a corrective action is necessary to eliminate the cause / s of an incident and to prevent recurrence.

5. ANALYSIS

Lean application in Health and Safety management system will definitely reduce the H&S risks and improve the workplace safety. But there should be a rationale measurement metrics in order to measure the H&S objectives. Because Lean is a fact & data driven approach and measures the improvement efforts in terms of productivity, efficiency and takt / lead time which in turn measurable to monetary benefits. Similarly, the following metrics can be helpful in measuring the H&S performance improvement.

- Lost time hours: It refers to the number of lost time hours occurred in a calendar year. The objective can be like reduction of Lost time hours by certain percentage.
- Incident / accident rate (Lost time injury frequency rate – LTIFR): LTIFR refers to the number of lost time injuries occurring in a workplace per 1 million hours worked. For example, a LTIFR of 10 means that there are 10 lost time injuries occurred for 1 million hours worked. Lost time injuries (LTI) include all on-the-job injuries that require a person to stay away from work more than 24 hours, or which result in death or permanent disability.
- Average training man hours: Average number of training hours conducted per employee in a year.
- Near miss report rate: Total number of near misses reported in a year per employee.

- Average risk rate: The risk rating is the product of severity and occurrence. And the average risk rate is the average of the risk rating of all risks identified for all process activities.
- Average H&S non-compliance rate: Noncompliance is the non-fulfilment of H&S requirements. It is calculated as division of non-conformities found in present year to the conformities of present year.

5.1. Selection of Lean tools & techniques suitable to HSMS

The selection of Lean tools and techniques is based on the purpose of application and intended objectives. The following factors are considered in selection of Lean tools & techniques:

a. The HSMS is a support function in an organization (manufacturing or services) and the function provides services to its internal customers. So, the Lean framework to be developed under services category.
b. How the benefits are measured. In HSMS as discussed earlier, the results can be measured through the selected metrics, i.e., LTIFR, Average risk rate etc.
c. Purpose of application – As per our stated objective, Lean framework is to be developed for HSMS. It means that the framework is used in improving the HSMS and not directly in the core operations of the organization.
d. Maturity level of organization – The HSMS functional staff generally has reasonable educational qualifications and skills. Therefore, medium level of maturity is considered.

Voice of the customer (VOC): It is a term that describes the customer's feedback about their experiences with and expectations for products or services. It focuses on customer needs, expectations, understandings, and product improvement. The feedback can be from either internal customer of external customers. The feedback collected is stratified and analysed based on the objective.

Brainstorming: It is a session where a group of people meet to generate new ideas and solutions around a specific domain of interest / problem by removing inhibitions. People are able to think more freely, and they suggest many spontaneous new ideas as possible. All the ideas are noted down and those ideas are not criticized and after brainstorming session the ideas are evaluated and selected based on the most suitable and viable options.

Value stream mapping: It is a method for analysing the current state and designing a future state for the series of events that take a product or service from its beginning through to the customer with reduced wastes as compared to current map. A value stream focuses on areas of a firm that add value to a product or service, whereas a value chain refers to all of the activities within a company.

Jidoka: Jidoka highlights the causes of problems because work stops immediately when a problem first occurs. This leads to improvements in the processes that build in quality by eliminating the root causes of defects. Jidoka sometimes is called autonomation, meaning automation with human intelligence. This is because it gives equipment the ability to distinguish good parts from bad autonomously, without being monitored by an operator. In the case of service processes, it gives the process the ability to distinguish good decisions from bad autonomously.

Poka-Yoke: Methods that help operators avoid mistakes in their work caused by choosing the wrong selection in decisions / actions is called Poka-Yoke. For example, Product designs with physical shapes that make it impossible to install parts in any other orientation other than the correct orientation.

Root cause analysis: A root cause is defined as a factor that caused a nonconformance / problem and should be permanently eliminated through process improvement solutions. Root cause analysis is

defined as a collective term that describes a wide range of approaches, tools, and techniques (5 Why analysis, Fish bone diagram etc) used to identify causes of problems.

Just in time: The just-in-time (JIT) inventory system is a management strategy that aligns material orders from suppliers directly with requirement schedules. Companies use this inventory strategy to increase efficiency and decrease waste by receiving goods only as they need them for the required process, which reduces inventory costs.

Kaizen: Kaizen is a Japanese term meaning "change for the better" or "continuous improvement." Kaizen sees improvement in productivity as a gradual and systematic process. The concept of kaizen encompasses a wide range of ideas. It involves making the workplace more efficient and effective by creating a team spirit and improving everyday procedures, ensuring employee satisfaction, and making a job more fulfilling, less tiring, and safer.

5S: 5S represents Japanese words that describe the steps of a workplace organization process. English equivalent words are shown in parenthesis

1.Seiri (Sort), 2.Seiton (Set), 3.Seiso (Shine), 4.Seiketsu (Standardize) & 5. Shitsuke (Sustain). To keep it simple, the five S methodology helps a workplace remove items that are no longer needed (sort), organize the items to optimize efficiency and flow (straighten), clean the area in order to more easily identify problems (shine), implement colour coding and labels to stay consistent with other areas (standardize) and develop behaviours that keep the workplace organized over the long term (sustain).

Gemba: Gemba (Japanese term) means real place. The concept originated from the Japanese police / detective agencies of crime spot. As from crime spot, the police collect the real evidences and understands the actual situation. Similarly, in Lean the problems are understood from the real place of origin and develops solutions.

PDCA: PDCA is termed as “Plan Do Check Act” cycle. It is also called as Deming cycle used in continual improvement in a systematic way.

Plan – Analysing the problem, planning of possible solutions and selection of potential solution. Do – Test / pilot the potential solution and measure the results. Check – Study the results for effectiveness. Act – Implementation of effective solution and the cycle continues for monitoring & continual improvement.

5.2. Development of Lean Framework suitable to HSMS

To develop any robust framework, the risks and the factors leading to the risks are to be studied adequately along with the requirements of HSMS. The following risks and factors reviewed are presented in the below table 1.

Table 1 Review of Lean Risks & Factors

S. No	Risks	Factors
1	Very limited use of statistics	Limited study of historical data, hence opportunity to miss process key insights
		Due to limited use of data and statistics, sustainable process development is not possible
2	Limited pool of tools	Implementation in some specific areas / problems is not easy as the available tools may not be suitable to the cases
3	Acceptance of change by employees	Misperception in employees that Lean may result in job loss

S. No	Risks	Factors
		Due to obsession of traditional methods, employees are not willing to accept change
4	High cost of implementation	As Lean management suggests the complete change over of the processes, initially the implementation costs are more in terms of training and process infrastructure changes.
5	High management expectations in terms of quick short-term benefits and lack of long-term vision	As management invests lot of money with the costs associated with Lean implementation, it is general tendency to focus on quick benefits rather long-term benefits which lead to employee pressure leads to process failures
		Lean management may provide short term benefits but not in all the cases, it depends on the present process wastes and process maturity levels. But Lean always provides long term benefits for any kind of processes.

5.3. HSMS requirements

- Safe workplace design
- Empowered employees for proactive safety management
- Easy data and metric measurement
- PPE availability on time and at right place
- Standardization of work methods and work procedures
- Integration of operational and H&S documentation

After careful study of risks and factors of Lean management and requirements of HSMS. The below framework presented in exhibit 4 is developed for effective implementation.

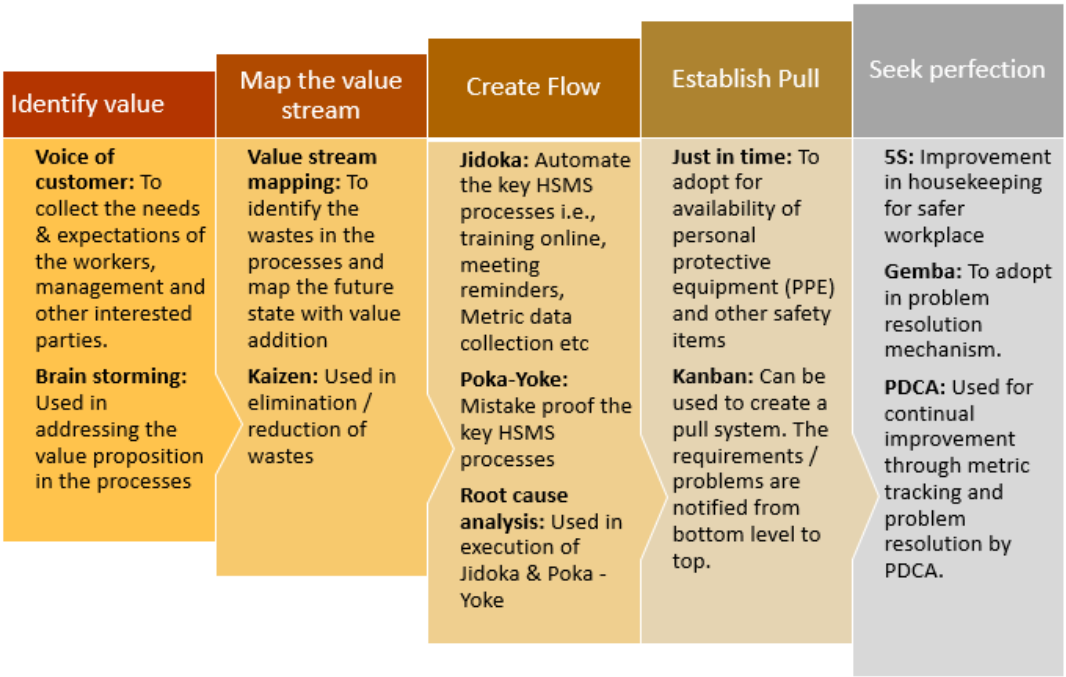

Exhibit 4 Lean framework for HSMS

6. CONCLUSIONS

The literature review indicates that the research in Lean management pertaining to Health and safety management is very limited and most organizations preference over manufacturing / service productivity undermines the implementation in HSMS.

The application of Lean management in Health and safety management system will definitely result in more workplace safety and cost effectiveness. Also, at the same time the organizations need to focus on long term goals rather than short term goals for positive & reliable results.

The key results and recommendations which are evaluated in this study are presented below:

I. Understanding of Lean relevance in HSMS
II. Selection of relevant Lean tools and techniques suitable to HSMS
III. Review of risks and requirements on application of Lean in HSMS
IV. Development of Lean framework for HSMS
V. Recommended methods for usage of tools & techniques in HSMS

CONFLICT OF INTEREST

The authors confirm that there is no conflict of interest to declare for this publication.

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