

Case Study: Implementation of 5S Methodology in JCB Assembly Business Unit Material Storage

By Vipul Dass, Abhishek Jain

Department of Mechanical and Automation Engineering, Amity University

Email : vipulhdass@gmail.com

Abstract: Purpose: The aim of this paper is to present a case of application of 5S methodology to JCB ABU Store to improve its previously flawed in-plant material handling processes. Approach: State of material storage and flow was determined and better methods applied. Findings: On the basis of material storage and flow improvements, it can be determined that adequate care in material storage and handling can make a big difference in daily work processes. Increase of safety, less time for material handling and effective material storage are the benefits obtained. Limitations: Due to the entire system still being in initial setup stages and only two of five assembly lines set up, there is a lot of change expected in the near future and as a result, disruption in material handling processes.

Index Terms: 5S methodology, Supply Chain, SC Management, Logistics, Visual Workplace, and Improvement.

INTRODUCTION:

An Organization's lifeblood is sale of manufactured products and to this end, organizations create business plans to position themselves in the marketplace in a manner that benefits them. There has been a shift in organization managerial methods wherein organizations are now moving away from the heavy bureaucratic system that bogged down effective decision making towards organizational structures dependent and focused on better innovation and implementation. This forms the fundamental difference between the thinking of old and the thinking of now.

Material flows used to be dependent on the capabilities of individual organizations. Organizations would buy a supply of inventory in advance for a certain period of time and ensuring a steady stream of product for a projected amount of time. In this, supply driven system. A feature of such organizational environments was that the organization would manage its business unit as individual components in charge of a specific function.. This is especially highlighted by the fact that products now have shorter product lifespans in addition to increasingly demanding customers. If an organization wishes to be able to compete in such a hostile environment, the need of demand driven, pull system. The concept of Supply Chain Management, although requiring some conceptual concreteness, offers an integrated philosophy that helps organizations manage various functions related to inventory such as material transfer, purchase and distribution. The purpose of Supply Chain Management is

to help achieve and maintain a competitive advantage by reducing operating costs, increasing profits or both.

JCB inaugurated two manufacturing facilities at Mahindra World City, Jaipur. These two unites are JCB's fourth and fifth manufacturing unit in the country, aimed at enabling JCB to keep pace with future economic growths and also to help strengthen its position in India's Construction Equipment Company.

REVIEW:

Organizations deliver products to customers. These products can be of the tangible, such as food and medicine, or of the intangible, such as number crunching, variety. These products are not singular entities but rather are a combination of various other individual building blocks that are brought together by companies from multiple locations to a single one and put together to make a product. Not only this, but most products today are a combination of both the tangible and intangible type. For example, JCB manufactures excavators and earth movers but also offers services related to vehicular maintenance and troubleshooting. Companies like food service outlets, offer food products combined with services provided by humans. When considering the entirety of products available on the market, on one side are products that constitute only goods, on the other side, products that are only services and in the middle products that are a combination of both. [1]

Operations are those actions facilitate materials and services travel from the source to the customer. Operations take a wide variety of inputs, process them and convert them into an output, namely goods and services.

The framework whose purpose isto create a single plan for material and information flow in a system is referred to as a logistic plan. Supply chain management on the other hand uses this framework as a base to link seemingly disconnected entities in the system – the suppliers and customers. A simple example might involve giving time estimates as to how long it will take to fulfil a customer demand right from the supplier stage itselfin a situation where the supplier accurately states time for material delivery.Supply chain management can thus be defined as the management of two-way relationships between suppliers and customers with the goal of providing superior customer value while minimizing cost to the supply chain as a whole. The point of supply chain management is the realization that proper

management of supply chain will result in a whole that is greater than the sum of its parts. One of the central themes of effective logistics and supply chain management is that an effectively managed supply chain plan provides a competitive edge over other competitors in form of customer loyalty and preference.

In the big scheme of things, logistics aims to provide a system wide view of the organization. The end goal of logistics is to create a reactive system that translates the demands of the market into a manufacturing plan which in turn influences the procurement plan. It is now counter-intuitive for departments to work independently within an organization. No longer is it necessary for each organ of the firm to formulate its own plan and pass it on to its successor. The entire organization forms one single plan and everyone sticks to it. [2]

Activities occurring in a supply chain that occur outside of the organization itself may be divided into two categories: **upstream activities**, activities that cause inward of material into the organization and **downstream activities**, activities that cause outward of products. Upstream activities consist of supplier tiers, with tier one suppliers being suppliers that directly supply their products to the organization in question while tier two suppliers would be suppliers that supply their products after some value added operations have been performed on items sourced from another supplier and so on. Similarly, a first tier customer would be one that gets products directly from the organization while a second tier customer would get it from a supplier(itself a first tier customer) and so on.

Thus, Logistics can be considered to be a superset of Supply Chain Management. Appropriate management of logistics allows an organization to meet the needs of the customer by coordinating the flow of materials and information in the organizational pipeline; the flow can thus extend right from the marketplace through the organization to the supplier in a coordinated manner

Lean management or simply lean is a set of methodologies adopted to minimize waste without sacrificing productivity. This waste is not limited to wasteful processes but also refers to simplifying existing processes in order to bring down costs. All this waste is called 'muda' in Japanese. This implies that lean aims to bring down operational costs and make them more efficient. Lean thinking is useful not only for in-plant operations but also for maintaining great customer service. [4][5]. While waste minimization techniques were being employed by companies and organizations for a long time before, the official formalized method of dealing with waste was first introduced and adopted by Toyota. Toyota initially simply intended to adopt lean production by waste reduction but soon switched to an entire lean operations enterprise. The core tenet of lean manufacturing is recognizing what adds value and reducing everything else. This method was recognized as lean in the early 1990s.

There are two primary ways of applying the lean method. The first methodology entails lean being considered as a set of tools

that are used to identify and lessen or eliminate waste. As waste is eliminated, quality of production increases and production time goes down, muda.

The second methodology involves improving the workflow process. This unevenness in work flow is referred to as Mura. Waste reduction takes a back seat in such cases. This is also called the Toyota way. This method requires persistent application and dedication to a work methodology, and is somewhat unconventional. Positive results are only obtained in the long term and thus this method finds few takers compared to the 'tool view' of lean management.

The primary difference between the aforementioned methodologies is not the goal, but the method itself. The first method applies tools directly to the areas of perceived wastefulness. On the other hand the second method improves the entire process from top to bottom, problems are exposed during this analysis and solved and as a result waste reduction naturally happens.

Both methodologies of lean manufacturing result in waste reduction and have a few common principles but have their differences as well. Such principles include, process flow control, visual control, automation, continuous improvement, strategizing with suppliers and waste minimization. The Toyota Way differs primarily in that it developed and morphed in response to real time situations and thus was not based on a theoretical framework. The principles of the Toyota Way arose out of need. The Toyota way categorizes lean as the reduction of different types of wastes: muda (valueless operations), Mura (unevenness), muri (overburden). The Toyota way does not see the tools as static but simply adapts them to the situation at hand. The tools are simply a means to an end.

5S is one of the most widely adopted and easily implemented tools in lean management. 5S methodology is one of the foundational concepts for lean management, upon which all other improvements rely in one way or another. [5]

The primary objective of 5S methodology is to create a workplace environment where everything is visible, has an assigned place and is easily accessed. 5S is the easiest method to expose glaring examples of waste in any organization.

The 5S stand for five Japanese words: Seiri, Seiton, Seiketsu and Shitsuke. In English these words are: Sort, Set in Order, Shine, Standardize and Sustain. [6][7]

- **1S - SORT:**

The first component of 5S is Sort. The main idea here is to take every current component in an area of the workplace and sort it all into what is necessary for the workplace and what is not. The unnecessary components are then sorted as being waste or needing reassignment to another workstation. The unnecessary items are not discarded outright. They are ideally placed in a particular red tagged area for a specific amount of time. Here anyone can sift through the unclaimed items to see if anything is necessary to their work. The company can designate this

material as scrap after a while in the form of periodic house cleaning.

- **2S- SHINE:**

The three primary components of the Shine are - workplace cleanup, maintaining clean status and preventing further desecration of the work area.

On the shop floor, common sources of workplace depreciation include spiller liquids, dust dirt and debris. A supply of adequate cleaning tools should be easily accessible to the team working that particular area. Cleaning supplies must not be the same throughout but vary depending on the circumstances. The kind of chemicals used to clean tables is different from the one used to clean floors.

Working in a clean environment is not only simpler and prevents distractions but also results in increased morale. The workers themselves must perform the cleaning as this will make them less likely to leave the workplace dirty. The Shine process is the responsibility of every employee. Assigning a special janitorial crew should not be the norm. The cleaning process must be done as if an official inspection was imminent.

The next step in the Shine process is maintaining this clean status. Continuous cleaning of the workplace, i.e., removing dirt and filth as soon as spotted is good but it is even better to make sure the workplace doesn't get dirty in the first place. Use of preventative measures is a must to keep the work place clean and in shape..

- **3S: SET IN ORDER:**

The 3rd step in 5S, this step entail the team members taking whatever insight they have gained from the implementation of 1S and 2S and analyzing the work area to look for additional improvement opportunities while keeping in mind the 5S tenet of making the workplace visually appealing and accessible.

As the name suggests, the 3S steps establishes that whatever item is placed in a particular location is there because it has a purpose. The availability of an item in a particular location will definitely help an operator do hi/her job properly and promote an optimum work flow.

Designating a fixed location for items makes it simpler for the operators to remember what tool they need for a job. It will also enable them to instantly recognize when things are out of place and also if something is missing from its designated location.

- **4S - STANDARDIZE:**

After the general look of the workplace has been improved, the next step usually involves instilling these practices as a standard. A requirement of standardization is that roles and responsibilities be very clearly defined and applied. Visual Control, of course, helps make it easier to do so. Cooperation between management and supervisors is necessary to progress in this phase. The management can hand out responsibilities while the team members must embrace the principles and

practices of 5S to effectively implement the aforementioned changes.

Key points to implementing Shine:

- a. Ideas for implementing Shine need to be conceived together with those who will be applying the standardized processes
- b. All changes done must be reflected with updated documents, flow charts, diagrams etc.

- **5S- SUSTAIN:**

Sustain is the last step in the 5S plan. As the name suggests, the point of 5S is to either increase or maintain the level of progress and/or work performance that has been achieved from project initiation. Management should instill benchmarks and hold periodic audits to check level of performance in any project. The focus of the audits should be the routines and rituals established as a result of the 4S practice.

Take note of the 5S work done in a particular area and promote its success throughout the organization. Choose new areas where the 5S concept can be applied and have previously experienced-in-implementing 5S members give their insight and lend their experience for this purpose. Additionally, broadcast the fact that 5S is never ending and that some improvement can always be made to a location that has already been improved previously.

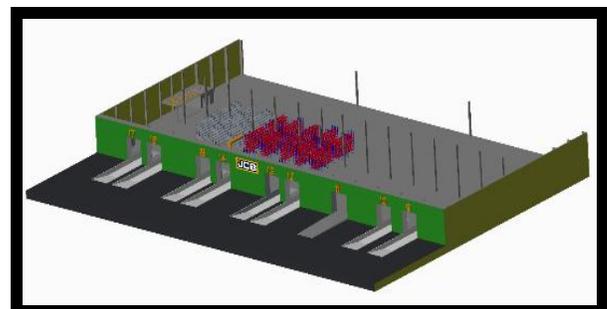
1. **RESULTS:**

Results of this work have been documented mostly in form of photographs. The photographs serve the purpose of contrasting the earlier state of the store with its current, improved one. This helps provide a readily available and visual understanding of the changes. The photographs also highlight advantages of following a visual workplace.

3D Part Model of ABU Store:

The ABU already has a floor plan which denotes areas of future expansion and details various dimensions and features. Unfortunately, there were some inconsistencies in the plan and as a result, the first task undertaken was to create a 3D floor plan which would detail the current state of the store and its future expansion.

The Image Below presents the initial expansion. The 2nd one presents projected expansion.





The reason for modeling the store in 3D were 3 fold:

- It intends to showcase future expansion and how the store will look with all storage facilities installed.
- Highlight the problems that the pillars pose to rack expansion, i.e., incorrect placement of racks results in wasted rack space.
- Serve as an easy-to-view poster to be placed in an easily visually accessible location.
- Additional detailing would mark out forklift movement lanes in the store in particular and assembly unit in general.

Updated Sub-Assembly Standard Operating Procedures:

Each sub-assembly relies on a printed operations manual which pictorially depicts the operations to be carried out in a step-by-step manner. Unfortunately, the SOP was at least 2 to 3 years old and various parts on the SOP were either not in use or had their part numbers changed. The objective of this exercise was to provide a list of updated part identifications used at each sub-assembly and forward this list to the process management department of JCB for consideration.

Part Cataloging:

There are approximately 650 individual parts involved in the construction of the Skid Steer Loader. Every part has some use in one sub-assembly or the other. Unfortunately, due to a lot of the smaller parts being similar in shape and size, especially the hardware and adaptors, and only being able to be differentiated by experienced personnel, it was of prime importance to record the physical appearance of how the parts look. This would assist the personnel assigned to the individual portions of the line to identify and collect the correct parts as per requirement. The parts were collected and photographed along with their part numbers. The plan is to have specific trolleys assigned to each workstation on the line. The trolley will carry this pictorial representation of the parts along with part number and location.

Rearrangement of Parts to Follow One Part One Location Philosophy (Shine and Sort):

Due to a lack of proper policing and some lack of attention to detail, a significant number of parts occupied multiple locations. Not only this but, for parts of the same kind but very minor differences, the locations would often be interchanged leading to significant downtimes on the assembly lines. The parts were first

checked to make sure where on the line they were attached to the machine and then arranged so.

The image below represents the state of parts. As a result of overstocking and lack of rack space, a huge volume of parts lie on the floor. Over time, the parts were placed rather haphazardly and as a result, the general area of the floor is in a complete disarray. Parts do not have a single location and are strewn about as can be seen in the image below. Additionally Racks were absolutely inaccessible by stackers. Parts that were unnecessary were removed from the floor and placed as required.

The excessive number of track chains were picked up and rearranged into 3 columns, removing one of the biggest reasons for space occupation.

As a result of this rearrangement, and removal of a significant number of other boxes, a lot of space opened up on the floor for future storage purpose. The images below display initial and final state.



Placement of Hardware Separately From Other Parts (Sort and Set in Order):

One of the primary reasons, a significant number of storage space was being used up in the racks was due to hardware occupation. It was recommended that on the lowest rungs of the racks, roller pins should be added so as to add a significant amount of space for hardware storage. The recommendation was accepted and roller racks added.



Appropriate Nomenclature for Storage Identification (Standardize and Sustain)

Due to haphazard manner of rack assembly, racks were named inappropriately and as a result, for a significant amount of time, a confusing system of location nomenclature was used.



A new nomenclature scheme was assigned and implemented. This scheme is final and will be continued to be used for the foreseeable and unforeseeable future. The naming method is of the scheme X-XX-XX. The first X represent the rack name and starts from A up to Z. The 2nd and 3rd X represent the row number starting from the ground up. The 4th and 5th represent the column number and each increment depicts one pallet sized space.



This new nomenclature was also updated into the IT system. A program called SAP (Systems, Applications and Product data planning)

2. Conclusion and Recommendations:

Implementing 5S in JCB will result in a workplace that is well oiled, efficient and easy to work in. The workers here are used to working on an “experience” basis, i.e., they are simply know from memory what lies where. That system needed to be

overhauled because a lot of the new workers were facing significant problems finding parts quickly and efficiently. Add to that the haphazard manner in which parts were being placed and this resulted in regular delays in part delivery and loss of precious work time on the assembly floor.

Implementing improvements was only possible because of the assistance from the workforce. This shows that the workers are willing to work towards a better workplace but simply require direction for doing so. This is extremely important since they are the ones who have to work with the changes. The workers insight and requests in material rearrangement and improvements were listened to and implemented as much as possible.

The new changes have resulted in a significant decline in worker requests for part locations. Now they simply have to go to the designated area for each workstation on the line. This added to the fact that parts have been given one location and sorted properly has resulted in decline in hours lost due to downtime.

Due to their own duties and busy schedules, there were many delays, but the workers pulled through whenever they could.

There is still a lot of room for improvement however and a list of suggestions has been compiled below:

- First and foremost, lack of facilities has resulted in severe setbacks in material storage. There is a severe dearth of plastic pallets. As a result, the cheap wooden pallets used to transport material is frequently used. These pallets are of non-uniform size and break easily, leading to frequent replacements not to mention injuries from the splinters. Plastic pallets need to be ordered in significant quantities.
- There is also a dearth of storage space on the racks. This is simply due to a lack of racks installed in the store area. Add to that the fact that there is a lot of excess material. This has resulted in a huge volume of material being placed on the floor. It is recommended that at least 5 more racks be installed for optimal material storage.
- A huge number of problems can be solved if the workers are simply trained better in material handling. There is a lack of general material handling training in the workforce. As a result they often do not understand the material storage nomenclature.
- Provisions need to be made for waste storage. Right now, all waste is simply picked up by assigned sweepers and housekeepers. This results in trash being strewn about frequently.
- Members of the inward team (the workers assigned to checking incoming material and delivering it to the appropriate locations) should be taught to hold material whose location is unconfirmed or those that lack a location in the first place. It is also recommended that the inward team should be policed to ensure that they check part numbers correctly to prevent identification mistakes when checking parts.
- There is also a need for additional trollies and stackers as well as additional workers for handling the workstations.

Currently only one person is assigned to the sub-assemblies (5 in number) and one person to the main line workstations (7 in number). This represents a herculean task for the single worker to keep the entire line stocked up and ready to go as required.

- The relocation of parts has reduced the cases of mistaken identities regarding parts. However, the case of lack of available parts needs addressing. As the situation stands, right now, the workers do not diligently address the problem of shorted parts properly. It is recommended that on days when the workload is low, a general part count be started so that the IT department of the store can appropriately represent correct quantities of available parts. This will help prevent overstocking certain parts while other parts are available in insignificant quantities.

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