Classification and Application of Manufacturing Tools

Larissa Johnson
Advisor: Dr. Gershenson
Life-cycle Engineering Laboratory
REU in Sustainability
Michigan Technological University

Green Manufacturing Tools Taxonomy

Introduction

There are many tools available for use in solving manufacturing problems, but often it may be difficult to determine which tools to use with a given problem. Previous research has been done in creating and validating a classification system for lean manufacturing tools; once a waste has been identified, the system can be used to find tools which address that waste.

The purpose of this project is to create a classification system that can be applied to environmental impact-related manufacturing issues and can help choose tools to identify, measure, or reduce impact.

Background and Definitions

Background
A lean manufacturing tools taxonomy was to aid professionals in choosing which lean manufacturing tool to apply to a known problem. It is designed to "tell a story" about a waste. This story is guided by a series of levels containing possible sources of action or problems from which the user chooses words to fit a situation, for example: this tool *measures waste* due to the *efficiency* of *people* during the *management* of the *inspection* of *WIP* at the *plant* level. This taxonomy served as the starting point for the green taxonomy.

Navigating the Lean Manufacturing Taxonomy
The taxonomy has three sections:
•On the left are words that help guide the story
•In the center are options to chose from. These options are chosen based on the problem being classified
•On the right are the labels of each of the seven levels, which are:
- System: Describes where or how broad the problem is.
- •Object: This is the item/items affected by the manufacturing operation.
- •Operation: What is being done to the object.
- •Activity: Either the management or the performance (carrying out) of a given operation.
- •Resource: What resource used in manufacturing is causing the problem.
- •Characteristic: What best describes the problem cause.
- •Application: What is to be achieved by the tool.

Definitions
Lean Manufacturing: A philosophy and set of tools for eliminating waste
Green Manufacturing: Also Environmentally Conscious Manufacturing refers to manufacturing relating to the protection of the environment
WIP: Work in progress
Post-Consumer Recyclate: Processed post-consumer items which can be used as raw material

Methods

The process of developing the current version of the green taxonomy used a review of literature to find examples of environmental impact by manufacturing processes or actions.

At the beginning, an environment level was added to the original 7-level lean taxonomy. The purpose of this was to distinguish between the effects of a given problem on different aspects of the environment. As examples of impact were found, they were classified using the lean system. Where classification could not be done, a new item was added to a level. After classification of numerous impact situations, some items were removed from the levels.

Results

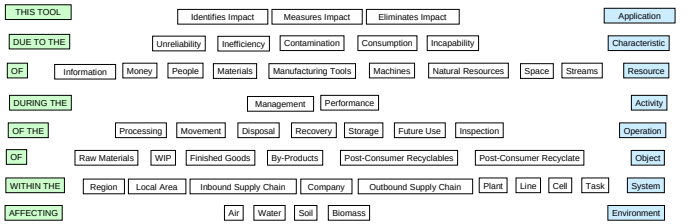


Figure 1: Final Version of Taxonomy

Using the Classification System

- Identify the problem
- Describe the problem using the following sentence. Use the guide to fill in the blanks.
  This tool ____ due to the ____ of ___ during the ____ of the ____ of ____ within the ___ affecting _____.

Guide
- Beginning at the top of the diagram, select what the desired tool should do
- Moving down, select the characteristic which is leading to the problem
- Select the resource which exhibits the problem
- Choose whether the problem is in managing or in carrying out of actions
- Choose the operation being managed or performed during which the impact occurs
- Select the object which is involved in the preceding process
- Select the where/at what level of the organization the problem is

Example of Use

Plated parts being produced must be washed in order to remove oils that occur as a result of processing. Washing produces several gallons of wastewater every minute. The root of the problem is oils getting on the parts creating the need for washing.

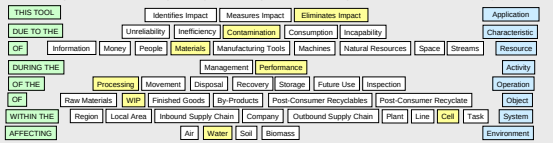


Figure 2: Example of Use

This would be read as "This tool eliminates impact due to the contamination of materials during the performance of processing of WIP within the cell, affecting water.

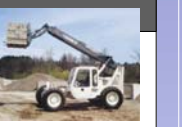
Future Work

The results of this project will be the basis for future work in developing, testing, and verifying a tool for classifying green manufacturing problems and tools.

Terex Handlers

About Terex Handlers

Terex Handlers is a company in Baraga, Mi, which assembles lifts for use in materials handling. They are in the process of implementing lean manufacturing principles throughout their operations. In the previous year, their production has increased from five to eight machines assembled each day.



TH636, a Lift Built By Terex. Photo From Terex Website

Improvement Project: Organizing Fork Tines

Description

Fork tines at Terex were stored outdoors on pallets as shown:

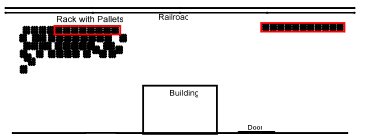


Figure 3:Top view of fork tine layout

The two storage racks (outlined in red) were far apart; pallets were not in any order. Fork lift operators had to search to find the correct pallet to transport to the assembly line.

Objective

Create a system of organizing fork tine pallets.
- •Make them easier to bring to the assembly line
- •Allow for a quick visual check of inventory numbers.

Evaluate the possibility of bringing parts to assembly only as they are needed.

Methods

- •Inventory fork tines
- •Identify unknown pieces
- •Determine space; use sales and inventory data to allocate space
- •Move racks to one location and move pallets into place
- •Interview fork lift operators regarding pull system

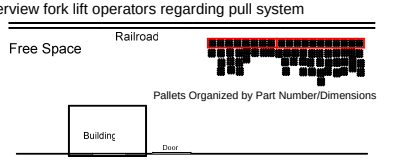


Figure 4: Top view of fork tine pallets after organization

Discussion

The pallets of fork tines were placed into their set places; some adjustments were made to spaces and overflow pallets were set in neat rows in front of their respective places on the racks. The desired results were achieved: pallets were easier for lift operators to find, and with a quick look an observer could see which parts were stocked and which were low in quantity or missing.

Based on interviews with a lift operator and others, it was determined that moving to a pull system could work now that the pallets are organized.