

Consolidate the Loss Structure of Different Manufacturing Sectors under Lean Context

A Case Study

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In the light of lean methodology, World Class Manufacturing (WCM) requires continuous improvement in analyzing the losses to eliminate the wasteful resources and to boost the overall productivity. However, the previous research was found to be very limited in its discussion and results concerning how to construct a standard loss structure which being both general enough to cover the entire manufacturing procedure and specific enough to point out the real issues happening for further improvement. Therefore, a discussion of a more balanced approach that considers both aspects is valuable.

Background

Lean production has become one of the dominant trends in the manufacturing industry over the last two decades. Most manufacturing companies have joined the global movement to “think lean” and have learnt that the isolated application of lean techniques cannot contribute to continuous improvement for the development of product and process. Within this regard, WCM, based on continuous improvement approach, becomes a mindset for making processes more reliable and less wasteful. Under the procedure of implementing WCM, the company would expect to progress through a turning point as a transition from the end of loss analysis to loss eradication, in order to standardize loss categories and loss analysis in a systematic method. For the manufacturing-based companies with different final products and working procedures in each sector, a comprehensive consolidation is also necessary for minimizing inefficiencies caused by, for example, communication, human errors, missing data and insufficient analysis from non-informative data reports.

The Case Study

The thesis attempts to investigate how a typical manufacturing company can build up a loss structure and information system for recording inefficiencies according to the specific need of its daily operations under the lean context. In this way, the progress focusing on the reduction of disorganized and repetitive loss categories, the consolidation directing the cooperation between different sectors and the loss eradication aiming at continuous improvement can all be covered under discussion.

Due to the time framework, a method based on longitudinal case study was used. The research adopted a balanced approach where the formal theory and field data were combined to frame an in-depth causal understanding for the phenomenon. Both qualitative and quantitative data were collected from trusted sources, including internal documents, meetings, observation and database. The case company focused in this study was Tetra Pak, an international food packaging and processing company with business represented worldwide.

Get to Know the Company

Tetra Pak is a typical manufacturing company with separated manufacturing sectors: Processing and Packaging. Therefore, unifying the performance analysis and manufacturing management systems is one of the important tasks. Operating under the Lean context, two different loss deployment systems were used in Tetra Pak to record all the operations losses in the two manufacturing sectors. The database structures used in the two systems also reflect the two different approaches as well as the nature of the working procedure in those two manufacturing sectors.

From the approach of Processing - the manufacturing sector which this thesis is focusing on, the loss structure was built based on the "major losses" by Ajuha and Khamba (2008). Each of the major losses was breakdown into more specific loss categories for detailed detection. The loss structure in Packaging was built based on the main department who should be responsible for the losses and based on the machine where losses happened.

Not only having differences in approaches to the Loss Deployment structure, the two sectors of Processing and Packaging also have significant differences in the final products and main working procedure and functions. Since the thesis is focusing on the Processing sector, the empirical data of Loss database in Processing was put under analysis for current status understanding. In the year of 2019, top 10 losses among 94 categories in Processing accounted for 59% in annual frequency and 77% in duration. However, the lowest 35 losses only accounted for 0.9% frequency and 0.2% duration. Therefore, the proposal of consolidation the loss structures need also care about simplifying and restructuring the current systems.

The Main Approach for Solving the Problems

A thorough literature review has been conducted in the process of constructing a comprehensive loss structure. Grounded in the main idea of lean manufacturing, especially Overall Equipment Efficiency with the purpose of measuring the effectiveness of planned equipment performance and its improved loss distribution map with additional concern about how well the organization's assets are used in every single minute of the total calendar time, some common analysis tools including cause-effect diagram and ABC analysis are found to be very useful for not only providing a systematic way of representing the causes and effects as well as their relationship but also distinguishing the majority of the quality losses. Different approaches in categorizing the losses are also dug further from a theoretical supporting perspective.

Given the limited range of results and findings from previous studies, the cause-effect analysis illustrated in a fishbone diagram brings great direction to break down the problems. After identifying the root causes of current quality problems, a multi-criteria ABC analysis regarding the frequency and duration of usage is performed for each one of the loss categories used in the two systems. This result helps to distinguish the top losses from the uncommon ones, where the prioritized changes should be focused on for further structure proposal.

Since differences in the nature of function working activities and final products will lead to differences in system structures and therefore end up with differences in the content and the scope of their respective coverage, a gap analysis on these differences between EPM and Loss Bank is conducted and is expected to contribute in building up a more comprehensive consolidation for the two systems.

All previous analysis is combined with the underlying theories to explore and discuss the possibility of constructing loss structures in different ways. The main theoretical support comes from OEE and major loss deployment models including (7+1) Wastes of non-value-added activities, Sixteen Major Losses in Production and PQCDMS (including 6 key productive elements: Productive, Quality, Cost, Delivery, Safety and Morale) System. The discussion is likely to make the newly constructed loss dictionary more suitable for the actual needs in the production process and to indicate the path for the final proposal.

The Main Results

During the analysis, the most important findings is the analyzing method of consolidating two different systems following the same concept of Lean Manufacturing, under the same theme of WCM. Firstly, different analyses were used to understand the current situation. Root cause analysis could also be done based on the nature of the operations activities. Besides the systematic database, insights information from experts, viewpoints from different users, as well as user behavior should be put under consideration for comprehensive analysis.

With the aforementioned analyses, the final proposal was the consolidated Loss Structure, which can be used in both two sectors of Processing and Packaging. The coverage of the proposed consolidated loss structure was the combination of the coverage of loss structure in both sectors. The proposal also unified the database structures in the two sectors and could be implemented in the same single information systems for the same reporting tools.

In case the time duration is lengthened, similar analysis should also be done from the side of Packaging for better understanding and a more comprehensive proposal. Since the procedure of consolidation is not "one-size-fit-all", it must be tailored and customized due to the manufacturing concept as well as the nature of the product or service when similar projects can be used in another case.

Interpreting the Case Study

In conclusion, the nature of this case study was doing the consolidation for the Loss structures which were used in the two manufacturing sectors in the same company. The key point is that both manufacturing sectors were using the same manufacturing concept of Lean Manufacturing, under the theme of WCM.

Due to the time limitation, the project has been done with the approach from Processing to Packaging sector. The reversed direction should also be done in order to achieve a comprehensive proposal. The full standardized guidelines for the users, one of the mandatory parts, should be built in detail and used as the basis for loss categorization and for avoiding the human mistakes.

This thesis work gave a suggestion in the overall research method for a similar project, especially the data collection and data analyses to the proposal. The companies can definitely take this work as a reference for their similar projects in researching methodologies. However, the research frameworks need to be tailored from case to case, due to the nature of the working procedure, the final products and services.