Lean Manufacturing (LM) Implementation Literature Review Based on the K-Chart

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Abstract

Finding novelty is the first step in starting research. However, it is difficult to do so, especially for new researchers. Various models are offered as a way of getting a novelty. These models include SLR (Systematic Literature Review), K-Chart, Card System, Decision Tree, Mind Mapping. Among the available models, K-Chart provides an advantage in visualization to display the results of a complex literature review in the form of a decision tree. However, the use of K-Charts as a solution is still limited. This study proposes the use of K-Charts to find novelty in Lean Manufacturing Implementation in SMEs. A case study is presented in this paper to validate the application of the K-Chart model. This case study aims to find out the novelty in implementing Lean Manufacturing in SMEs based on the emerald journal database.

Keywords
Lean Implementation, Manufacturing, SMEs, K-Chart

1. Introduction
Finding novelty is the first step in starting research. However, it is difficult to do so, especially for new researchers. Various models are offered as a way of getting a novelty. These models include SLR (Systematic Literature Review), K-Chart, Card System, Decision Tree, Mind Mapping (Cahyo, 2020). Several studies related to the SLR model are presented by (Alexander et al., 2019; Hu et al., 2015a; Prasanna & Vinodh, 2013). K-Chart models presented by (Abdullah et al., 2006). Several challenges have been encountered when applying these models. A literature review with a note-taking or card system challenges reading an article and writing down critical ideas on a card. This review often results in researchers reading the entire article and transferring the card contents into a table.

Among the available models, K-Chart provides an advantage in visualization to display the results of a complex literature review in the form of a decision tree. However, the use of K-Charts as a solution is still limited. K-Chart is a model for finding novelty on research topics developed in the form of a decision tree (Abdullah et al., 2006). This model helps researchers in the first phase of research activities, namely planning. The planning phase identifies issues and topics, sets goals, identifies deliverables and milestones, and places a timeline. This model consists of several layers. Layers start from the general problem layer and continue with the more specific layers. These layers include (1) issues layer, (2) methodologies layer, (3) results layer, and (4) timeline layer.

A K-chart manages issues from broad to specific. General issues (general issues) have been placed on higher branches in the tree diagram, while specific issues have been placed beneath them (sub-issues). The bold line indicates the research focus. Next, the methodologies layer was created. Methodologies are methods used to obtain data and analyze

it (Abdullah et al., 2006). This layer generally consists of theory, simulation, experiment, and survey. We can add other methodologies based on the literature study. The results layer displays the research parameters. The research parameters are divided into performance parameters (PP) and design parameters (DP). PP is the dependent variable, namely the effect or output of the system under study, while DP is the independent variable, namely the input or cause. The timeline layer is a research project planning to set a target completion time and monitor each design performance. Research planning and monitoring are used to evaluate the causes of late delivery of results, inefficient use of resources, and increased costs. In this study, the timeline layer is not discussed because the research focus is on determining recency. K-charts are very useful for researchers to help the literature review process and find the novelty of a research study topic.

This study proposes the use of K-Charts to find novelty in Lean Manufacturing Implementation in SMEs. K-charts have clear organizational advantages and designation of the problem studied, the methodology adopted, detailed expected results and schedule for each outcome, and monitoring features. A tree diagram is used to present all of this simply.

With a rich visual display combined with supporting references, it is hoped that the use of K-Charts can help researchers to find new research on Lean Manufacturing Implementation in SMEs. K-chart has capabilities that include clear organization and designation of issues under study, the methodologies adopted, the detailed results expected, the timelines for each of the results, and the monitoring features (Abdullah et al., 2006). The K-Chart model will be tested in a case study to find the novelty of Lean Manufacturing Implementation in SMEs based on articles available in the emerald database.

The first time lean was introduced to the manufacturing sector was in 1990, when James P. Womack published The Machine That Changed the World (Zaheer et al., 2020). Lean can define as doing more with less. While this may appear to be an oversimplification, it summarizes the Lean concept as more efficient use of the resources available when needed (Alkhoraif et al., 2019). The transition from traditional production to lean became necessary because it provided a more efficient and cost-effective solution to the manufacturing industry (Sabbagh et al., 2016; Womack et al., 1990). By demonstrating the existence of both direct and indirect effects of lean manufacturing, (Nawanir et al., 2013) provide clear evidence that lean manufacturing implementation is critical for improving company performance. As a result, lean manufacturing enables industries to walk down the path of business excellence (Mejabi, 2003; Che Ma mat et al., 2015). Bhasin and Burcher (2006) identified several such barriers that arise in small and medium-sized businesses and large businesses and identified issues that manufacturing companies face when implementing Lean. Small and medium-sized enterprises (SMEs) are attempting to apply new methodologies/approaches/principles such as lean-to achieve ongoing performance (Alkhoraif et al., 2019). Unfortunately, many Small and Medium Enterprises (SMEs) have not applied the concept of lean manufacturing due to concerns about time, cost, and subsequent benefits. The author explores the article on lean implementation in SMEs using the K-Chart methodology.

2. Research methodology

This research procedure follows the steps of the K-Chart. The flow chart of the research procedure is shown in FIGURE 1. The first step in the K-chart procedure is to determine the general scope of the study. Furthermore, general issues are defined and broken down into sub-issues, sub-sub-issues, and so on, specifically in the area under study. Each item in focus is distinguished by a thicker (or colored) line on each item and a line connecting them. These items will be the main study, while the other items intended for literature review only.

After the issues layer, the methodology layer is determined. The methodological layer can consist of more than one item, which is the focus of research. The performance parameter (PP) is determined as the dependent parameter and the design parameter (DP) as the independent parameter. Performance parameters intended for general issues. For example, acceleration, speed, and fuel consumption are PP for vehicles (general issue). A design parameter can affect more than one PP. For example, pressure is DP that affects two PPs, namely speed and fuel consumption. Items with a dotted line indicate a higher priority design parameter.

3. Case Studies and Discussion

The case study discussed in this study is to discover the novelty of the research theme of lean implementation in manufacturing SMEs. The problem is how to minimize costs by eliminating waste. The literature review source was

obtained from the emerald database with the search criteria shown in FIGURE 2. The search was conducted in August 2021. The search results are shown in FIGURE 3.

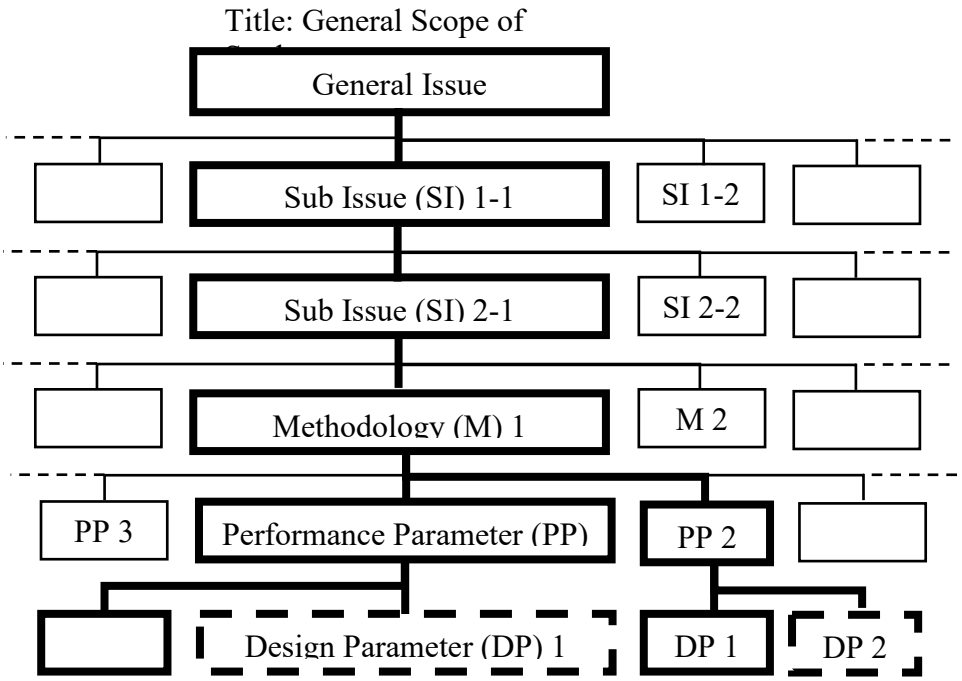

FIGURE 1. K-chart structure

FIGURE 2. Search criteria

FIGURE 2. Shows the keywords used to search for articles to review. The search in this study was restricted to the emerald database, with the keywords manufacturing implementation in all fields, lean in abstract, and SME in abstract used. The manufacturing implementation keyword is applied to the search area on all fields to ensure that all manufacturing and implementation terms are retrieved from all available fields. The word manufacturing often does

not appear in the title and abstract or uses other terms equivalent to the word manufacturing. The keywords lean and SME were limited to the abstract search. Searches with these keywords are not carried out by title because not all relevant articles display lean or SME in the title. The abstract holds more words than the title but less than the other fields.

FIGURE 3 depicts the search results for the keywords manufacturing implementation, lean, and SME. The search process resulted in 18 relevant articles. Furthermore, the results were reviewed manually to evaluate the suitability of the research objectives. Articles that are not relevant to further research are separated from the articles to be analyzed. Inappropriate search keywords will result in a growing list of articles, but the number of irrelevant articles also increases. Thus, the number of search results is not always relevant to the research objectives. The search process can be improved by changing the keywords and/or search fields. The search will be an iterative cycle until the percentage of relevant articles is much greater than the irrelevant ones and ensures that the search criteria do not eliminate the relevant articles.

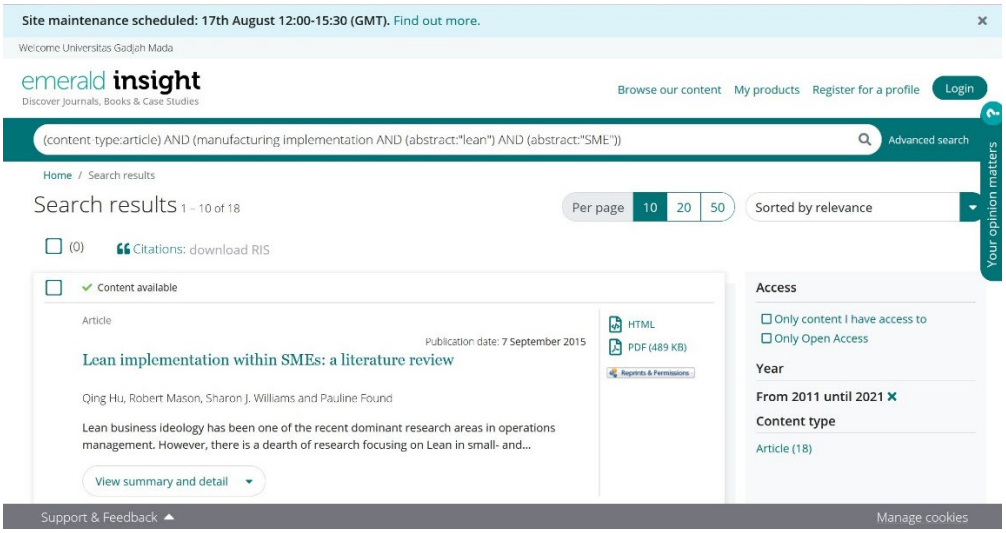

FIGURE 3. Literature search results

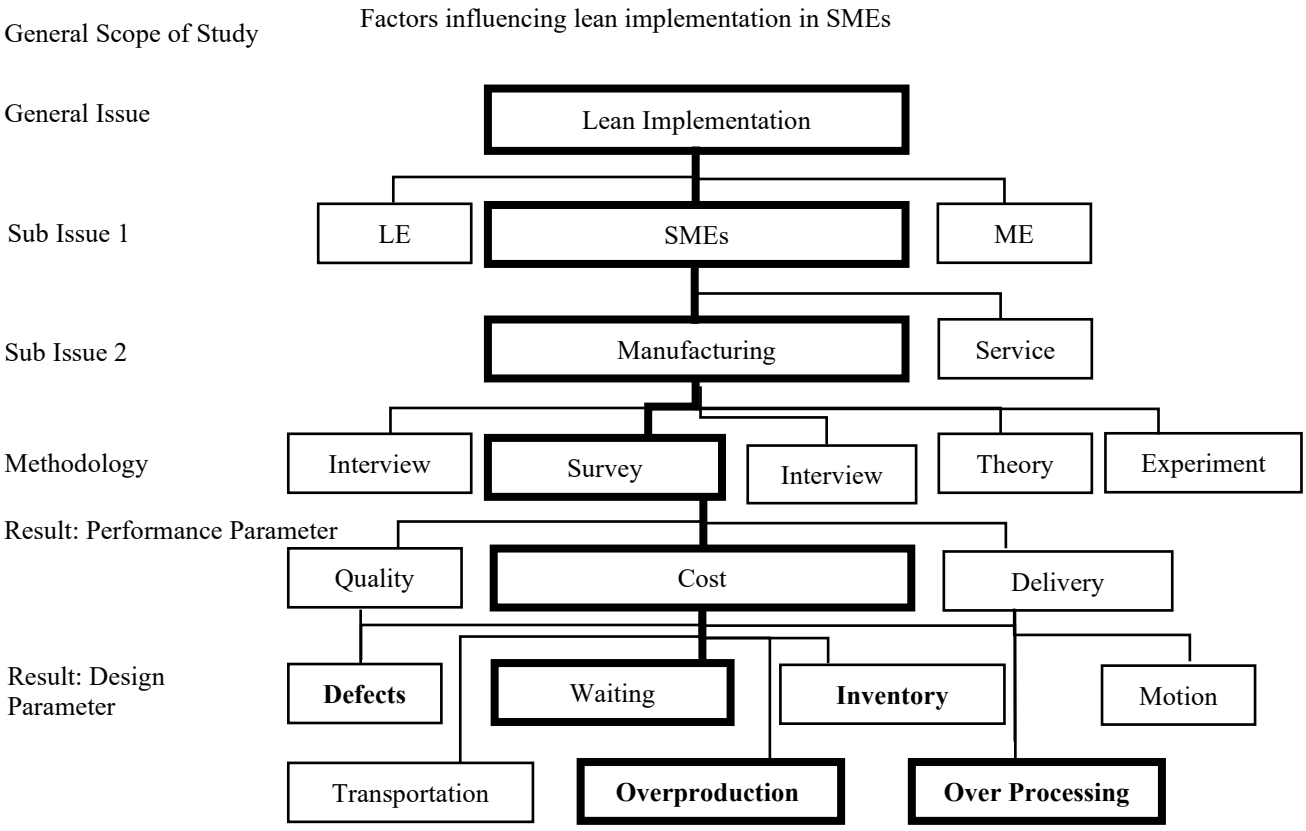

FIGURE 4. K-chart application in case studies

FIGURE 4. shows the conceptual K-Chart model of lean manufacturing implementation in SMEs. The model started by setting the general scope of the study as the first layer. This study was conducted to determine the factors that influence the implementation of lean in SMEs. The general scope of study related to the research objectives used to search the database articles and determine relevant keywords. The last layer also shows factors that affect lean implementation in SMEs, namely the layer design parameters.

The second layer is the general issue. Lean implementation is the main issue in this research. Lean implementation will take place on the research object as a whole. The third layer is the sub-issue. In this conceptual model, issues are divided into two layers, namely sub-issue one and sub-issue two. In other cases, sub-issues can have more than two issues. Sub-issue 1 categorizes objects into four categories: large enterprises (LE), medium enterprises (ME), small enterprises (SE), and small-medium enterprises (SMEs). Some studies separate ME and SE, but most use SMEs as a differentiator with LE. This study focuses on SMEs; therefore, the box line containing SMEs is bolded to indicate the focus of this research. The fourth layer, namely sub-issue 2, divides SMEs into two, namely manufacturing and service industries. This research focuses on SMEs in the manufacturing industry. From the general issue layer to the sub-issue, it becomes the keyword search for articles. Each layer consists of items generated from the initial conceptual and developed based on the articles reviewed.

The fifth layer is the methodology layer. In this layer, the various methodologies used in the articles reviewed are displayed. Interview, survey, theory, and experiment are some of the standard methodologies commonly used in research. Based on the literature review, other methodologies used can add. The methodology layer can divide by adding new layers to accommodate various relevant tools.

The sixth and seventh layers relate to the research results. The resulting layer is divided into performance parameters and design parameters. Performance parameters in this conceptual model are divided into three, namely quality, cost, and delivery. Cost is the focus of the conceptual model. All performance parameters are influenced by design parameters which include seven wastes. The waste includes defects, transportation, waiting, overproduction, inventory, over-processing, and motion. This conceptual model shows that this researcher focuses on the effects of transportation waste and waiting on performance parameters.

SMEs as the focus of sub-issue 1 assumes that the hierarchy below also applies to other industry scales. This industry can prove in subsequent studies. An example is the design parameter in seven waste and applied to medium and large industries. This study can also extend to cover other types of industries, such as the service industry.

4. Conclusions and Recommendations

The purpose of this study is to propose the use of K-charts in conducting a literature review to support researchers to find new research in the field of lean implementation in SMEs. The results showed that the K-chart was able to identify research opportunities that translated into research novelties. K-charts have the potential to be used in various disciplines or research fields. However, it is necessary to prove the truth in the research area.

K-chart is very useful, and several things need to be improved. Among others, K-chart is a stand-alone tool and requires a methodology to use it as a solution. This tool requires selected literature which will later be used in conducting a literature review. The way to determine the selected literature is not yet available or part of this tool. The K-chart uses an initial conceptual based on the researcher's knowledge so that the initial conceptual results will tend to differ between researchers. The relationship between the K-chart and the literature studied is not visible on the resulting chart. The limitations of the media to display charts in one sheet limit the researcher from considering many items at each layer. Another study as a continuation of this research has been carried out to develop a methodology for using K-charts.

This study has shown a conceptual model of lean manufacturing implementation in SMEs in a K-Chart based on previous research articles. This research contributes to researchers knowing the object of research as the issue discussed, methodology as a way of obtaining and processing data, performance parameters as indicators achieved in various studies, and design parameters that contribute to the achievement of performance parameters.

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