



Packaging Standardization in Lean Manufacturing

An application of Part Standardization

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ABSTRACT

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The role of packaging in production, supply chain, and logistics is indisputable, especially when the consuming economy develops with rising demands of commercial goods. Because of such an important role, having an efficient packaging system is vital in the operation of a manufacturer and even essential when the Lean Manufacturing method is employed. The Packaging Standardization project approaches the packaging system to envisage part standardization opportunity with considerations of efficiency and cost reduction possibility of the Lean Manufacturer Schneider Electric Manufacturing Vietnam Plant.

The Packaging Standardization Project in Schneider Electric Manufacturing plant was implemented using Part Standardization in search of the packaging system's simplifying possibility. The study aims to highlight standardization as a useful tool in improving the Lean manufacturer in terms of the efficiency of the production's supply chain and cost reduction. The study of the Packaging Standardization project allows one to identify standard packaging among a group of packaging with a high potential of standardization. The paper also considered the sustainable development and other additional incognito benefits in terms of Inventory, Procurement, Logistics, and Manufacturing Management gained through the application of packaging standardization of the manufacturer.

In conclusion, given many benefits in the efficiency of the manufacturing supply chain, together with specific cost reductions, the Packaging Standardization Project has shown positive meanings and potential impacts of Part Standardization current and future operation of the Lean Manufacturer SEMV plant.

Key words: lean manufacturing, part standardization, packaging standardization

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ABBREVIATIONS AND TERMS

TAMK	Tampere University of Applied Sciences
SE	Schneider Electric
SEMV	Schneider Electric Manufacturing Vietnam
LM	Lean Manufacturing
PS	Part Standardization
SCM	Supply Chain Management
SC	Supply Chain
FG	Finished Good
BOM	Bill Of Material
PN	Part Number
SKU	Stock Keeping Unit
SPS	Schneider Performance System

1 INTRODUCTION

1.1 Thesis background

Nowadays, packaging plays an integral role in supply chain and logistics. The efficiency and effectiveness of moving goods in the supply chain depend on packaging among other things (Szymonik, 2016). This is emphasized in an industrial plant with application of Lean Manufacturing where according to Saghir (2002) packaging is a coordinated system of preparing goods for safe, secure, cost-effective and efficient movement throughout the whole supply chain, and a standardized packaging system supposed to be the plant's major focus not only as a management technology but also for the sake of manufacturing cost-reduction (Lean Manufacturing Business Bottom-line based – John X Wang). Recognizing the disadvantages of a non-standardized packaging system while understanding the potential possibility of packaging standardization, the author started the Packaging Standardization project while she was working at Schneider Electric Manufacturing Vietnam plant (SEMV).

The research topic deals with the existing product packaging box at Schneider Electric Manufacturing Vietnam plant (SEMV) with an aim to investigate the packaging system at the place and explore the potential improvements of the plant's current packaging performance, and at the result, propose packaging standardization options. Also, the thesis paper discusses on how Part Standardization (PS) supports the efficiency of Lean Manufacturing (LM).

1.2 Thesis structure

This thesis is based on the Packaging Standardization Project conducted in SEMV at the beginning of 2019. The project is considered as a case study and was reviewed and developed together with theoretical analysis in order to demonstrate the results and attest to the benefits brought by Packaging Standardization. Relevant pieces of literature regarding Part Standardization in Lean Manufacturing and its benefit on supply chain management have been accessed

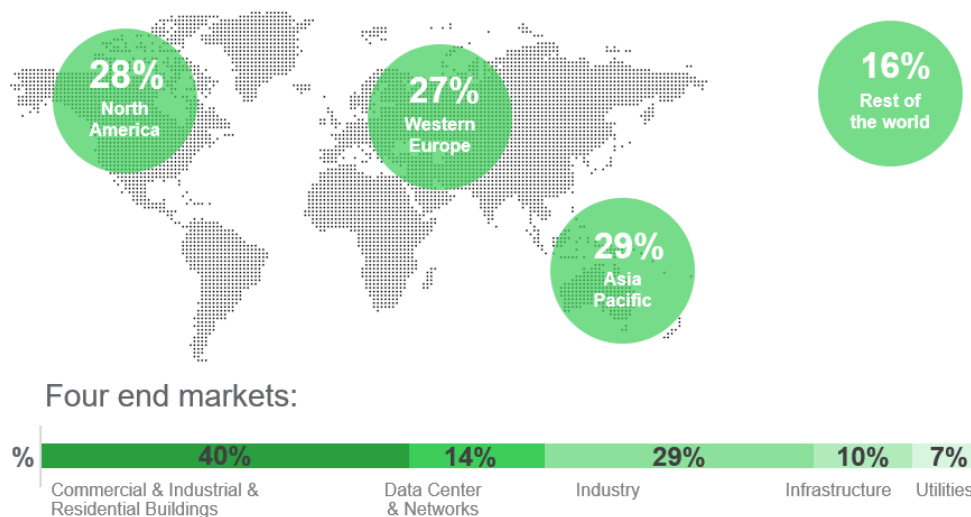
and utilized. The thesis should be followed in four major parts, which are the thesis and project's introductions, theoretical framework review, methodology principles which were applied for the research, a discussion on the project's outcomes, and, last but not least, the conclusion.

1.3 Commissioner background

1.3.1 Schneider Electric

Schneider Electric (SE) group was incorporated in 1871 but started even before that as a private family business by Schneider Brothers in 1836. Headquarter of the group locates in Rueil Malmaison France. Throughout 180 years with immense changes in the global economy, the Schneider Electric group has now become a leader in Energy Management and Industrial Automation. In 2019, SE currently operates business units in four end-markets, which are Homes, Buildings, Data Centers, Infrastructure, and Industries.

A well-balanced global presence (2018 revenues breakdown)



Life Is On | **Schneider**
Electric

PICTURE 1. Business market of Schneider electric (Schneider Electric Integrated Annual Report 2018)

According to the Integrated Report of Schneider Electric (2018), the group achieved a revenue of 25,7 billion euros with a global network presenting in over 100 countries and an exemplary high-ranking Supply, according to Gartner. It is Global Supply Chain Operations comprising 230 ISO certified industrial and logistics sites and 98 distribution centers around the world with 137000 strong workforces manage over 260,000 references and process over 150,000 order lines daily.



PICTURE 2. Schneider Electric's global facility (Schneider Electric Integrated Annual Report 2018)

Sustainability is part of everything we do is the statement of Schneider electric Ceo Jean-Pascal Tricoire, to emphasize the importance of sustainability to its operation. Indeed, the company values sustainability to its core of business proven by its continuous high ranks in Fortune, respectively, in 2018 and 2019.

1.3.2 Schneider Electric Manufacturing Vietnam (SEMV)

Schneider Electric has arrived in Vietnam since 1991 in the collaboration to develop the 500KV North-South Transmission Line high voltage electricity network. After 24 years, with the fast-growing and developing economy of Vietnam, Schneider Electric has expanded its operations as 3 front offices, 2 distribution centers, and 1 industrial manufacturing facility which is Schneider Electric Manufacturing Vietnam (SEMV) nowadays locating from North to South location of Vietnam in Ha Noi and Da Nang and Ho Chi Minh city.

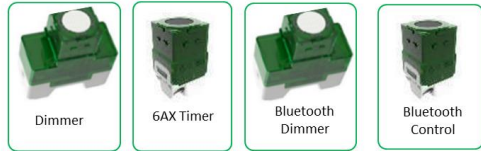
The forerunner of the Schneider Electric Manufacturing Vietnam (SEMV) plant is Clipsal Vietnam, a leading Australian company in electrical engineering. As a result of the acquiring Clipsal by Schneider Electric in 2006, the state-of-the-art facility SEMV factory is established by consolidating the old Clipsal Vietnam 1 (CVN1) and Clipsal Vietnam 2 (CVN2) manufacturing facilities based in Industrial Zone and Amata Industrial Park in Bien Hoa city. In 2019, SEMV completed the CMK Transfer Project to transfer the production of the Clipsal Manufacturing Malaysia (CMK) plant, which main products were residential and industrial socket & switches and fans, to SEMV plant in Vietnam. The combination event increased the production capacity of SEMV to approximately three times than before.



PICTURE 3. Schneider Electric Manufacturing Plant in SG High-tech Park Vietnam

SEMV plant locates in Ho Chi Minh high-tech park, where it focuses on manufacturing, developing, and supplying various electrical and wiring products including switch, socket for domestic and foreign trading business in East Asian - Japan and Pacific market. From 2018, in addition to the traditional wiring products, smart home electronic products are added to the product category of the new factory.

Smart Devices



Wiring Devices

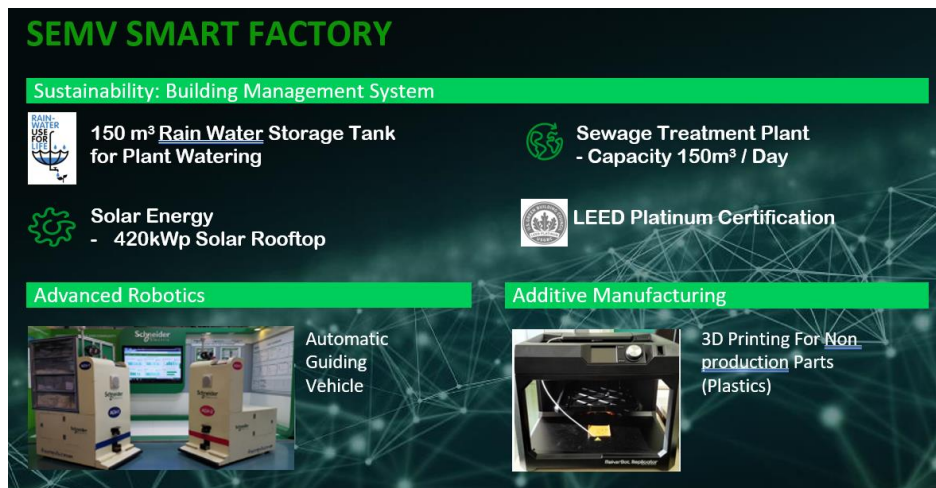


PICTURE 4. Products of SEMV

With an investment capital of US\$45 million, the SEMV plant was built on an area of 26200 square meters and defined to develop as a Smart factory with Lean application in an aim of becoming one of the major production centers in East Asia, Japan, and the Pacific (EAJP) region of the SE group.



PICTURE 4. Shopfloor of SEMV in 2019



PICTURE 5. SEMV as a Smart Factory

The supply chain network of SEMV including supply sources, logistics facilities, customer destinations bases in Asian and Pacific region majorly and Furthermore, its nearby Schneider manufacturing plants, distribution centers and business hub such as Batam plant in Indonesia, Cavité 2 plant in Philippine, Business-hub and Distribution Center in Singapore, Gepp Cross plant Australia and so on.

2 OVERVIEW OF THE PACKAGING STANDARDIZATION PROJECT

2.1 Problem description

The project conducted research and analysis of the standardization possibility of a packaging system in the SEMV factory. By mentioning the “SEMV packaging system” in this paper, the author aimed at addressing primary and secondary packaging types, which are the so-called Inner Box and Outer Box in SEMV definition. Therefore, as being the target research objects, in this case, Inner Box and Outer box are reviewed and analyzed accordingly in each own different categories of size, brand, product family, active status, destinations of markets, and so on.

The inefficiency comes from costs and waste caused by dissonant and less productive of the non-standardized packaging system of slow volume packaging boxes existing in the plant system. A large number of slow or even rare moving packaging results in a large number of tailing SKUs the system that needs to manage and maintain. Administration, procurement, inventory cost, and many unproductive has been caused. Furthermore, the packaging database of the boxes has been insufficient, outdated, and fragmented, which led to difficulties in tracking and managing the packaging system. The potential of automation of packaging has then been limited by the wide variant of non-standardized packaging. It also affected the logistics in terms of weak palletizing, unproductive container filling, warehouse organizing. Consequently, the container filling rate is affected. Together, an unproductive, non-standardized packaging box system and an out-of-date database create difficulties in optimizing the efficiency of packaging performance and incur wastes and costs.

2.2 Problem purpose

Be aware of how the disadvantages of a non-standardized integrated packaging system, the project was established with Part Standardization as the critical method considering the target packaging system of Inner and Outer Boxes to

generate standardization options and study on the potential benefit of lean supply chain at the SEMV plant. The purpose of this project is to assist the company in reviewing the existing packaging system of Inner and Outer Boxes, and study on the possibility of achieving packaging standardization options, which could help to reduce cost and wastes of production in particular and efficiency of the supply chain and logistics of packaging management in the SEMV plant in general.

At the same time, the CMK Production Transfer, a plant combination project to transfer production from another SE plant that was going to close in Malaysia to combine with SEMV's production, was at its peak of implementation speed. To prepare for the merge, SEMV business owners considered carefully an efficient system that would be ready for the production integration with such immense change in volume coming estimated in the middle of 2019. The event creates an urge to review the system starting from component level to generate a lean fundamental base in which efficiency of SEMV operating capacity is improved, and waste is optimistically reduced, making room for the production scope enhancement.

2.3 Problem objective

The project is targeted to improve the productivity of the packaging system of the SEMV factory with standardization possibility for packaging. By reviewing and studying on packaging system of SEMV, the project aims to simplify the packaging system, reduce the less productive variants of non-standardized packaging box regarding those are in less likely to move due to its low production volume. By analyzing the packaging data, the project aims to locate groups of packages with a high potential of standardization in terms of dimension, design, and product family. Through reviewing and accessing, the most befitting packaging box would be drawn out and developed as a standard packaging part replacing the rest of the group. The feasible standardization packaging options and their development directions, along with the cost savings from them, was intended to explore and report to the business owner. It helps simplify and standardize sets of the packaging of the Inner Outer box. Lessen types of packaging box means

that different products could share standardized packaging box even though they are from different products family. Classify and typify standard packaging options to simplify and generate a potent effect on plant SKU' variety administration and logistics flow packaging management.

Another objective of the research is to provide insights into the current packaging system. The understanding of the current status of the packaging database could allow the management team to evaluate the action needed to improve the database. Also, by reviewing the packaging information, the business owner would expect understandings for packaging weight control situations in order to have an overview of how ergonomic compliance according to Ergonomic principles of the factory Schneider Performance System.

2.4 Problem scope

The project focuses on part standardization research regarding primary and secondary packaging in SEMV, which are Inner and Outer packaging boxes. Since Clipsal and PDL are major product brands under the production of SEMV, together with Schneider Electric brands, standardization input selections targeted on packaging data of Clipsal, and PDL per requested by the business owner. The population of the packaging data was obtained from the packaging component database managed by Product Engineering Department in SEMV. The rest research information has been collected with support from other departments, including Supply Chain, Warehouse, and Logistics departments, in order to research the supply chain and surrounding environment of the packaging in SEMV. Master data and Bill of Material (BOM) has been accessed to analyze regarding product structure and production statement of each researched packaging types. In addition to information on designs and drawings is accessed, collected, and provided from the plant's drawing management system A and process management system B. The project includes practical fitting test and comparison research on actual packaging samples conducted by the author with correspondent samples. Strategy saving achieved from the generated standardized set of packaging would be calculated and benefit the general saving target of the plant.

2.5 Problem implementation

The project started as a Kaizen Continuous Improvement project based on the requirements of the business owner for the continuous improvement process applied in the SEMV factory. Part standardization is applied as the primary tool for project development and implementation. The project provides the audience with an overview of how Part Standardization supports Lean continuous improvement principles mentioned specific benefits on cost reduction and supply chain efficiency.

The project starts with aggregating packaging data for Primary and Secondary packaging boxes, respectively, which are the so-called Inner and Outer box, to update and build up the database. Thus, general review and classification acts were based on this built database to generate grouping selection for standardization. Besides the dimension and Production moving pace, other evaluation criteria including brand, number of packing had been considered as significant indicators serving the standardization selecting process in the project.

The database review is determined to filter out out-dated and pointless packaging boxes for both Inner and Outer boxes, thus reducing the number of SKU numbers for in-use packaging items. Inner and Outer carton boxes will be sorted out basing active status, brand, and, most importantly, size. They are then selected into correlation groups in order to compare and evaluate the standardization possibility. The outer boxes went under a similar reviewing and filtering process to sort out groups of high potential boxes. Furthermore, the outer cartons whose usage links with inner boxes as defined in BOM were as well considered in order to assure the quality and correctness of standardization selection. Once the potential groups of boxes and boxes were found, the researcher made empirical comparisons and tests on these box models to select the standard box among the group and standardize the rest according to this selected one. The feasibility was assessed basing on Artwork, Material Requirement Planning (MRP) type, Price, Consumption Forecast. By comparing actual dimensions, artwork designs, Material Requirement Planning product information that comes with the packaging, the groups with high potential and feasibility for standardiza-

tion were brought forth. The assessment was made by conducting size and technical inspection. It helps to continue developing the standardization plan for each group. Next, calculations based on the standardization plan of each group are made to give specific figures on the potential financial savings from Direct Material Cost achieving off the standardization choices.

These studies and calculations are presented to the business owner. In addition to the actual project, the researcher continues to study and give analyses on related theory to provide evidence of the benefits besides the financial saving for the SEMV plant's lean manufacturing and supply chain from these standardizations.

3 THEORITICAL FRAMEWORK

3.1 Packaging Overview

3.1.1 What is packaging?

Packaging plays an essential role in human life since the first days. Anna Emblem & Henry Emblem (2012) mentioned that packaging had been used in many forms since the first humans began making use of tools. They explained drastic shifts in how packaging develops had been shaped due to the appearance of trading, war, the Industrial Revolution, technology discovery, and, most importantly, the consumption. Nowadays, the concept of packaging developed and extended beyond its original purpose in many forms and materials. Saghir (2004) found that the definition of packaging is a coordinated system of preparing goods for safe, handling, transport, distribution, storage, retailing, consumption purposes in consideration of the efficiency and value-added. Another recent definition of packaging by Gopinathar et al. (2016) described it as a mean of all products which made from various material, used for various purposes of containment, protection, transferring, issuance, from raw materials to finished goods, along its way from the producer to the consumer. This brought to understand that packaging is not only operated its function but added value along its journey with the product.

Research has stated that packaging exists in various designs and materials yet may be defined as three significant levels, such as primary, secondary, and tertiary packaging. The first two packaging types, which are primary and secondary packaging, are the focuses of this study. According to Anna Emblem & Henry Emblem (2012), Primary packaging is the first packaging layer in which the product is contained and would be received by the customer. Primary packaging directly contacts the product and is a mean of communication of brand to market and customer. Secondary packaging designates the packaging used to group various pre-packaged products. Secondary packaging's primary purpose is for

grouping and logistical purposes whose fundamental role is to enable shelf loading, protecting, and collating individual units during storage and transport.

Due to different functions and technical characteristics, the primary or consumer packaging tends to contain product and brand information because it designates for product representative and commercial communicator. The material of primary packaging could be in various types with creative decoration thanks to its function. On the other hand, the logistics packaging or the secondary packaging is designed to protect and make handling more manageable, so that material with durability such as carton with layers usually chose. As a result, primary packaging can be made of many different materials, but the consumer packaging tends towards bright plastic while the industrial packaging tends towards dull cardboard (Waters, 2003).

3.1.2 Packaging in supply chain

The supply chain is a series of activities and organizations that materials move through from initial suppliers to final customers (Waters, 2003). Another definition of supply chain management (SCM) is a global network of organizations that cooperate to improve the flow of materials and information between suppliers and customers at the lowest cost and the highest speed (Govil & Proth, 2002). The Council of Supply Chain Management Professionals (CSCMP) defined logistics as a part of SCM where activities of planning, implementation, and control are performed in order to operate the movement of product among phase of supply chain while ensuring the efficient and effective flow of goods, services, and related information with ultimate purpose is customers' requirements. While Soraka (2002) stated that packaging covers the phases from manufacturing, distribution, storage, and sale to use, integrating the roles of containing, protecting, preserving, transporting, informing, and selling. From the above, it is clear to understand that packaging is a tool that enables the movement of the product from its point of origin to its point of consumption so that it influences SCM, logistics flow, and other industries directly or indirectly.

The packaging is strategically essential and lays significant impacts on supply chain and logistics performance (Henrik Pålsson, 2018). Product packaging facilitates supply chain and logistics efficiency. Packaging supports the interaction and relationship between logistics and packaging systems, which facilitates supply chain and logistics efficiency, improves value-added. More efficient distribution and storage of products with cost and lead time cut enabled by packaging. According to Paine (1981), packaging nowadays is a techno-economic function aimed at minimizing costs of delivery while maximizing sales. It is now more than a box or a carton, but rather to a coordinated tool that boosts the whole supply chain and leads to maximizing consumer value, product sales, and hence, business profits. As a result, it is correct to argue packaging as an essential competitive factor for companies to obtain an efficient supply chain due to their multiple roles in all activities along the supply chain.

3.1.3 Packaging at SEMV

When discussing the packaging system of Schneider Electric Manufacturing Vietnam, SEMV, Inner Box, and Outer Box are the primary packaging subjects. Primary and secondary packaging, respectively, referred to Inner and Outer packaging boxes in SEMV plant.

The first packaging object considered in this project is Inner Box, which is a primary packaging at SEMV. Inner boxes are not only in direct contact with the finished product but also in direct communication with the customer as a product package. The box is made of carton material. The thickness and number of layers depend on the product line, design, packaging, and durability compatible with the respective weight of the product, the corresponding technical requirements. The inner box of SEMV is usually using a 1-layer thin carton paper. However, in some cases, the thickness could be two layers of cardboard.

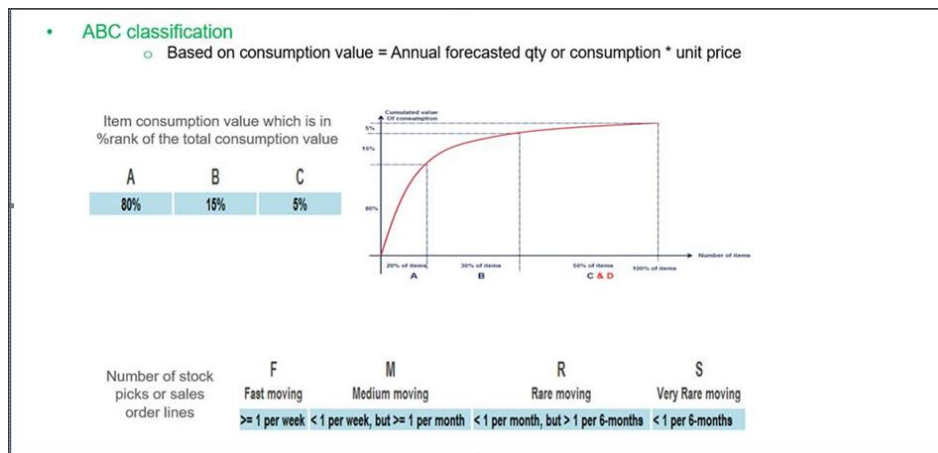
The outer box is considered as Secondary packaging in SEMV. The finished product inner boxes are then stored in the Outer box, which is secondary packaging. The outer box is made of cardboard with one to three layers to ensure it is sustainable and serves its purpose of protection and transportation. Finally,

Carton cartons are loaded onto pallets according to the factory designated stacking loading plan, with supporting tertiary material such as tri wall to ship out of the factory.

A packaging database in SEMV includes every information about packaging boxes in SEMV and how they linked together according to levels of packaging, which some of the essential criteria are Brand, Active status, FMR status, quantity number, dimension including LWH of the packaging. All defined and managed according to Component number or Part number or SKU. The part number is an identification code assigned to the component item for management purposes used by the factory. In SEMV, the part numbers used for the component items and are formed in a way to provide identification for a particular item and are managed under the master data of the plant. Stock keeping unit or (SKU) is a traditional approach to define a given type of product that is stored together, referring to the particular stock keeping unit and when address the items for inventory management, vendor, or customer use. Stock Keeping Unit (SKU) is a category of a unit with unique combinations of form, fit, and function. Packaging Components in the factory are managed in the factory's master data system under the Bill of Material, which is a listing of the materials needed for every product. A bill of materials is an ordered list of all the parts needed to make a particular product. It shows the materials, parts, and components (Waters, 2003). At SEMV, product BOM stipulates all the components that constitute a finished good (FG), including packaging boxes and accessories. Inner box and Outer box are none exception. They are collectively known and discussed as a packaging component. All constituents of a FG package are specified in the corresponding BOM of each particular product. They are all considered as product components and are under component management. Packaging boxes are regulated under different kinds of databases. Besides database with systematical details, technical drawings, and artworks, which provide design technical information and design of the packaging, are also consider packaging databases, which stored and governed under different database systems.

FMR status is a familiar term in SEMV, which means the number of a stock pick of an item which is assessed base on the speed of its sale order line or how usually it has been picked due to order coming from the customer. In SEMV, F,

M, and R stands for respectively Fast, Medium, Rare status. In SEMV, Items understood as F in the FMR category are those having fast-moving speed with large volume proven by sale order line are bigger from 1 time per week. It means that an item with F category of FMR status will have a fast-moving production speed when orders for that item are frequent, and it is usually picked to move from the stock into production. Kanban items with high production volume request could be an example of F items. Similarly, Rare and medium are categories for items with lower stock pick frequency or medium to rare production volume.



PICTURE 6. FMR status definition in SEMV

The project takes one of the Schneider Performance System, which is ergonomics regulations into consideration when accessing the database at the same time to eliminate and improve Ergonomic compliance. Ergonomic review for overweighted lift. The overweight load and lift are aimed to be identified and evaluated for management control purposes and ensure it complies with the Schneider Performance System of the plant.

□ **Conveyed weight limit:**

$25\text{kg} \times 0.4 = 10\text{kg}$ ($55\text{ lbs} \times 0.4 = 22\text{ lbs}$) (man or woman, 18 - 65 years old)
 Weight of one product is 5kg (11 lbs), which is therefore acceptable.

□ **Conveyed tonnage limit:**

$50\text{kg} / \text{minute} \times 0.4$ (operator) $\times 1$ (distance) $\times 0.5$ (conditions) = $10\text{kg} / \text{minute}$ ($22\text{ lbs} / \text{minute}$)

□ **Allocated minimum time:**

$$\frac{5 \text{ (object weight) } 11 \text{ lbs}}{10 \text{ (tonnage limit) } 22 \text{ lbs}} = 0.5 \text{ minutes}$$

PICTURE 6. Ergonomic regulation for product packaging weight limit in SEMV

11. **Lifts and Loads:** All loads over 10 kg (22 lbs.) have been identified and risk assessment should be in place and action items identified. Occasional lifts may have a weight up to 12 kgs. (26 lbs.), but should still be assessed. 80% of identified risks have a proposed solution and 50% have been implemented.

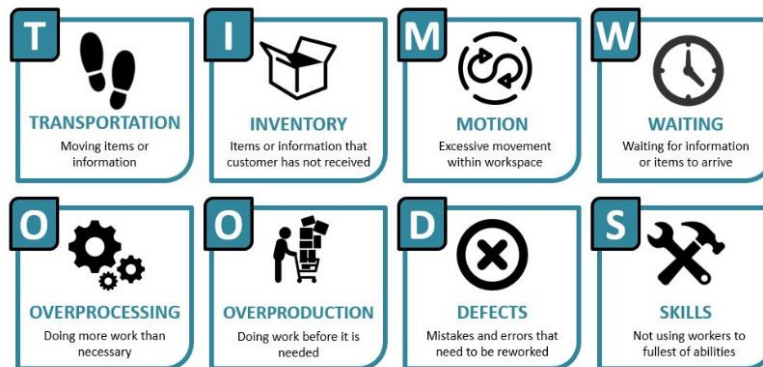
PICTURE 7. Ergonomic regulation for product packaging weight limit in SEMV

3.2 Lean Manufacturing

3.2.1 Introduction of Lean

NIST (2003) has suggested that Lean is a systematic approach to identify and eliminate waste through continuous improvement. The lean organizational model is invented initially in the Toyota Production System and developed by the Toyota Motor Company. Lean Production is recognized for its persistent goal of banishing waste from the industrial shop floors and service provider through continuous improvement. Lean focuses on the optimization of all the resources and processes in the supply chain by focusing on the elimination of non-value-added activities considered as wastes to achieve optimum profitability (Singh, 2016). By removing waste, an organization becomes more productive, ensuring that it is serving the customer's needs and bringing a financial gain to the organization. The benefit to the supply chain of Lean could be known as reducing lead times, improving delivery performance, increasing profit due to lowering costs, manufacturing related management such as inventory, logistics, processes (Ross, 2010). Hence general Lean poses a positive effect on customer satisfaction, supplier relations, management, and business performance in general.

Lean attacks eight types of wastes, including Transportation, Inventory, Motion, Waiting, Overproduction, Over-processing, Defects, and Skills.



PICTURE. 8 Wastes of Lean – TIMWOODS By Shmula Contributor

To solve the problem of waste, Lean Manufacturing has several tools. These include continuous process improvement (*kaizen*), 5S, Lean Six Sigma, the '5 Whys' and mistake-proofing (*poka-yoke*), Process Flow Improvement, Value Stream Mapping, Analytical Batch Sizing (ABS), Kanban, and so on.

3.2.2 Production efficiency desired in Lean Manufacturing

Manufacturing efficiency is an essential parameter for all manufacturers. Nickell et al. (1997) described efficiency as a level of productivity that has been performed within the business. The Comparative Integral Manufacturing Efficiency is defined as the product of Quality rate, Effectiveness, Availability, divided by the product of (used Energy, used Material, Emission ratio) (Kuznetsov et al., 2017). Thus, production efficiency refers to balancing input and output of the manufacturing process in order to effectively utilize resources and capacity while optimizing the quality of the goods being produced. One of the measurements of manufacturing efficiency is cost. At present, such ways of efficiency increasing as cost reduction, the organizational structure reform, optimization of the employed personnel, investment activity stimulation are observed in the practice of enterprise management. It is assessed as a long term is a long-term, systematic development to lower waste and increase the efficiency of production, which requires the utilization of appropriate methods leading to lower inefficient costs (Klabusayová, 2014). According to Klabusayová (2014), a level of production

efficiency, especially cost reduction can be achieved by Lean and its tools. Implementation of Lean Manufacturing is the approach for the search of manufacturing efficiency. It is right to argue Lean has the tools or even is the tool to support this process of development and management to the efficiency of manufacturing.

3.2.3 Lean supports green manufacturing

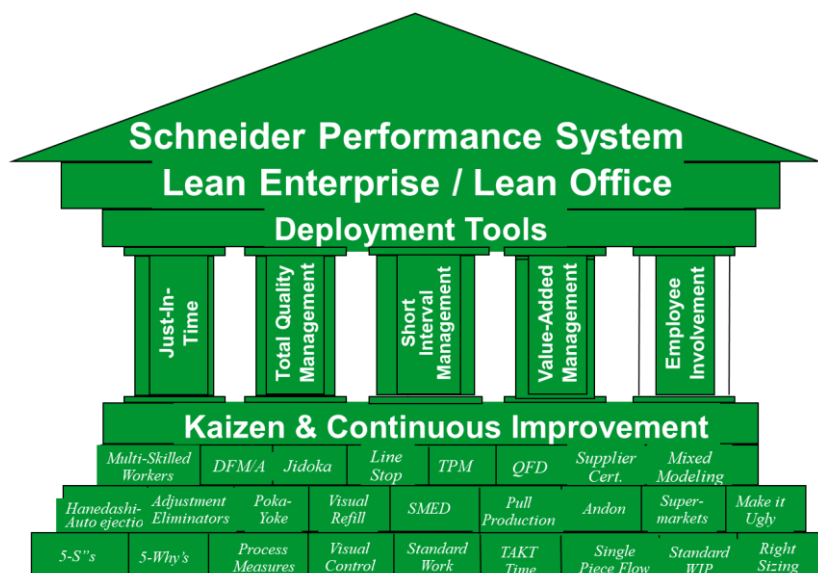
Lean focuses on eliminating waste in its implementation of production. By reducing wastes such as material wastes, unnecessary delays, and processes, it enables not only cost reduction and profits enhancement but also minimizing the environmental impacts in terms of green wastes, which could be energy consumption and carbon emission. According to Wills (as cited in Grantham et al., 2012, p. 82), green waste categories are energy, water, materials, garbage, transportation, emissions, and biodiversity. These wastes reside in product shipping of a plant, component scraps, or manufacturing packaging disposal as examples Gotham et al. (2012) discussed how Lean waste linked vs. green wastes in their research. Each Lean waste was analyzed for green outcomes that result in greenhouse gas (GHG) emissions. Reducing Lean waste means decreasing green outcomes, which could be storage, lead time. The companies that embrace Lean Manufacturing will be able to simultaneously embark on lean initiatives that increase their value while measuring and reducing waste and lessen environmental impacts. SEMV has also been recognized as one of the world's most sustainable-oriented business with its effort in green operation and developing has been highlighted and proven in its annual report with multiple sustainability-related awards.

3.2.4 SEMV as a Lean manufacturer

SEMV has been developed to be a lean and smart factory with an initial investment of 45mil euros. The factory equipped with advanced Lean Manufacturing technologies. SEMV is developing as smart and sustainability features, according to Schneider Electric's EcoStruxure. The plant combines the working office, production shop-floor, which are the primary area of the factory where to produce

and assemble the finished goods, testing lab, warehouse and docking locations for either material or products to be delivered in and out.

In Schneider Electric, many tools & methods to drive continuous improvement have been applied such as 5 Why, 5S, 6 Sigma, 7/8 Wastes, 8D, Cause & Effect Diagram, FMEA, VSM, Poka Yoke, DFSS, Lean, Kaizen in order to boost customer satisfaction and improve factory efficiency. In the Schneider Performance System, there are five crucial pillars which are JIT, Total quality management, Short Interval Management, Value-added Management, Employee management. Continuous Improvement Kaizen is one of the critical foundations for applying SEMV to those pillars as being described in the picture.



PICTURE 9. A LEAN SEMV

This project of packaging standardization has been considered as a Kaizen project supporting the Continuous Improvement in the factory. Kaizen is a Japanese word for “continuous improvement and incremental change.” kaizen emphasizes developing a process-oriented culture that is driven to improve the way a company operates (Chris A. Ortiz, 2009). The SEMV plant implements the Kaizen project to support its continuous improvement. This project is considered a kaizen project which focuses on using Part Standardization, which is a method in Lean. With the core operation orientation as a smart factory applying Lean Manufacturing, SEMV has been continuously developed its business efficiency enhancement by utilizing the Lean concept in many aspects within its production.

3.3 Part standardization: A value generator and enabler of cost efficiency

3.3.1 Part standardization is a tool of Lean

Standardization is primary for the implementation of Lean Manufacturing. The standardization process acts as a necessary tool supporting the continuous improvement of Lean. In the research about the role of Standardization in continuous improvement of Lean, Míkva et al. (2016) described Standardization as "a sum of inter-conditional actions and measures that lead to a rational unification of recurring solutions." As an effort to achieve strategy savings and enhance the level of productiveness in the manufacturing system, Standardization allows a manufacturer to simplify supply chain management which leads to reductions in cost, ensure quality, and improve flexibility and responsiveness. With proper implementation of Standardization, the business management team could prevent defects in production and evaluate and select the proper procedures to prevent the occurrence of other errors, which are possible to lay impacts on production. Research by Anderson (2004) suggests that there are many kinds of Standardization that some of the majorly known and popular applied in manufacturing are the tool, feature, process, and especially part standardization.

Part standardization (PS) is a tool in cost reduction of Lean. Part Standardization is defined as a strategy designed to eliminate variation in components. According to Fisher, Jain, and MacDuffie (as cited in Anderson, 2004, p.131), part variety or so-called part proliferation appears to pose the most significant negative impacts on assembly plant productivity. Anderson (2004, p.145) also indicates that "every part number incurs overhead burden." Therefore, reducing the variety of parts or in other words, could be SKU items, can help reducing cost an institution is carrying visible or hidden in the inefficient inventory of non-standardized components. PS helps standardize and simplify unnecessary SKU items from inventory control systems through the use of standard parts and components. Reducing the number of SKUs creates a leaner inventory. With the core operation ori-

entation as a smart factory applying Lean Manufacturing, SEMV has been continuously developed its business efficiency enhancement by utilizing Part standardization in its operation.

3.3.2 Potentials of part standardization

Standardization is one of the tools that can be applied in the continuous improvement of the organization (Míkva et al., 2016). By reducing items variation and product waste, Part Standardization could lay positive effects on Manufacturing in terms of cost reduction and efficiency of the production supply chain.

In terms of cost reduction, Anderson (2004) stated that cost-related purchasing, inventory, floor space, and overhead expenses are the most recognized through part standardization. Reducing the number of parts and promote a standard which will result in less purchasing and procurement cost since fewer parts are being purchased. The cost of expediting unusual or hard-to-get parts can also be eliminated. Part Standardization can, directly and indirectly, reduce all three categories of inventory, including Raw Material, Work In Process, Finished Goods. Since reducing inventory is reducing inventory carrying cost and management overhead costs, which lie in administration, documentation, qualification, and distribution of parts. PS helps to reduce Direct Material cost (DMC), which is the cost of the raw materials and components used to create a product. When a standardization task force standardizes on expensive parts, it can select the most cost-effective parts made in large enough quantities to take advantage of suppliers' economies of scale.

The efficiency of the manufacturing supply chain achieved via part standardization reflex on the flexibility and responsiveness of the manufacturing system. According to Anderson (2004), a simplified and standardized component system shows flexibility and responsiveness through many indicators such as the steady purchasing activities, flow of order and internal material logistics, inventory reduction, and set up elimination. Indeed, standardization in components reduces the number of suppliers because fewer parts result in fewer sources. The supply management, purchasing orders, and material logistics flow would be simplified

and strengthen in quality and process. Fewer purchasing actions result in better purchasing leverage that entitles the company to take advantage of supplier Economies of Scale and get quantity discounts and better delivery. Ordering fewer types of standard parts in ample quantities is the key to arranging JIT deliveries, which essential for flexible operations. Having fewer part types in the plant means that there will be less likelihood of mixed up components that support product quality while also reduce the waste in time for the qualification process. Reducing inventory and eliminating kitting can significantly reduce floor space or inventory space requirements. The flow of components within the plant will improve with fewer parts to order, receive, log-in, stock, issue, loads, assemble, test, and reorder. Eliminate Setup by Part Standardization allows all the products to utilize the same process without having either changes or modifications for the setup of the assembly process for a different part. This opens opportunities for automation. There is also the possibility to achieve a steady flow of material since delivery is balanced and better planned as it creates a matching tonnage into the tonnage out of materials. Eliminate Setup by Part Standardization allows all the products to utilize the same process without having either changes or modifications for the setup of the assembly process for a different part. This opens an opportunity for automation. Furthermore, According to Anderson (2004), Part Standardization makes it easier for parts to be pulled into the assembly by reducing the number of part types to the point where the remaining few standard parts can receive the focus to arrange demand-pull and Just-In-Time deliveries.

3.3.3 Packaging standardization

Packaging has been demonstrated as a significant impact on the efficiency, costs, and environmental impact in the whole journey of it through the supply chain from packaging material procurement and packaging design and development to logistics and scrap handling (Ballou, 2004). Packaging standardization in this project is considered as part standardization in which the number of packaging component types would be standardized and simplify in numbers. Packaging standardization can generate value and enable cost efficiency. Cost-cutting opportunity resides in packaging standardization in terms of inventory and

material cost reductions. The role of standardized packaging enables the production shifts towards more efficient automation, physical logistics flow, leaner inventory, better quality and process control, and overhead cost of purchasing and procurement together with administration activities.

4 METHODOLOGY

4.1 Research Strategy

This study paper bases on a Kaizen project carrying out in the SEMV plant at the beginning of 2019 by the author targeting packaging boxes as a research subject. The project-based study allows the researcher to approach the specific existing phenomenon, which is the packaging system in SEMV, with particular sets of data and theoretical concept that goes along. This packaging standardization project, a case study, explored the dynamics and structures of the packaging system and, therefore, allows the author to learn its issues, make an in-depth analysis and as well gain an in-depth understanding and discover solutions or generalizations for the study objectives.

The aim of this packaging standardization project is to review, categorize, classify diverse characteristics of the SEMV packaging box system and investigate its possibility of standardization and afterward benefits of it on the Lean manufacturer's supply chain. As a result, analyzation, observation, and experimental tests, together with calculation, had been done accordingly to generate standardization options bases on the inner packaging box and outer box data.

The study integrates a mixed research strategy, including theoretical, qualitative, quantitative research methods. The multi-method enables the researcher to approach both of the features, qualities, and theory of the case and, therefore, open opportunities for the researcher to approach and to access the problem from both characteristics and numerical perspectives. Also, more complete and synergistic utilization of data could be achieved by using an integrated research method. While qualitative research enables the researcher to access and develop the overall understanding of the quality, characteristics, and meanings of SEMV various kinds of packaging, quantitative research aims at describing and interpreting the packaging system statistically in terms of numbers. The author used qualitative research when review and accessing the packaging database in order to classify typify boxes based on its product characteristics such as design, colors, brand, destinations. On the other hand, the quantitative method had

been utilized to support the process of collecting and gauging packaging dimensions as well as calculating and generating its financial savings. Academic research was also applied in the research in order to discuss a research outcome regarding existing academic theoretical structures and philosophical concepts from both academic sources and SE in-house regulations and definitions. The packaging standardization in SEMV has been conducted in a manner of Six Sigma concept regarding Kaizen methodology in which theoretical research helps to discuss and consider the outcomes regarding its influence on the supply chain efficiency of a Lean Manufacturer.

4.2 Data collection

The paper is based on a theoretical framework within the packaging, Lean Manufacturing, and Supply Chain. The empirical data was collected as a packaging standardization project, which was in the form of a Kaizen continuous improvement application at SEMV. As being a Lean manufacturer which Lean has been applied rigorously over the plan manufacturing process and supply chain. This makes it possible to study the impact of packaging standardization on the efficiency of its supply chain. The results have been contributed to developing a first step for the author and audience of generalizing a look into the possible potential of project feasibility, supply chain efficiency with visible financial impacts.

The author worked as a Global Supply Chain Trainee in Product Engineering Department in the SEMV plant. The position allows the writer to approach the study objective with product packaging data. It makes direct observations from document, employees, dimensional experiments on product packaging samples, and another internal review on packaging database and its manufacturing and supply chain process become accessible. The primary source of data of this study was collected from existing materials, databases, sample, together with internal knowledge and regulations from the manufacturing plant.

The data sources could be considered as memory organizations that are described as archives, libraries, a wide variety of documents and materials, in the form of visual and textual data genres. By these mentioned data collection meth-

ods, the author gathers knowledge of the researched phenomenon through making observations, experiments, analyzation basing on a collection of data and literature framework from both internal of the plant and external academic sources related to the phenomena along the study process.

4.3 Data analysis

During the study, data and findings have been analyzed by quantitative and qualitative analysis methods. It means both types of data are utilized at the same time to assessing the information. The collaboration of the two data analysis methods aims to not only increase the overall understanding of the characteristics and meanings of the researched object or topic but also describing and interpreting the research object statistically in terms of numbers and calculations.

The data analysis process of this project could be described as followingly:

1. Collecting and analyzing a mixed type of quantitative and qualitative data, which are master data of packaging, Product BOM data, Drawing and artwork of the packaging box, Data of price, consumption forecast, Procurement, and so on.
2. Reviewing, double-checking, and updating either outdated or missing data of packaging boxes regarding their status, brand, family, product customer, supplier, FMR status, and so on, of the product packaging box.
3. The inner and outer boxes were sorted and classified into each of their categories in order to filter out active items sharing the same brand, target product families, and FMR status. Results statistics of this step provides an overview of the actual status and quantity of the two targeted primary and secondary packaging in the current operation of the factory.
3. An appropriate data processing method has been used to treat the database in two main categories. In this step, Inner and Outer box are reviewed, compared, and analyzed in terms of size, package quantity, brand, and the link of usage

between inner box to generate groups of box sharing similarities and obtaining high potential off standardization in each of their class. Level of usage sharing or in another word usage link between the inner box and outer box are reviewed and identified after this step giving the researcher first insights into how the next step of standardization could be formed.

4. With standardization candidate groups generated, the sample of Inner box and Outer box were ordered internally from SEMV's sample storage and warehouse system to review and conduct actual observation and experiments on size, design, artwork, product package, price to examine the feasibility level of the chosen group in later product evolving change.

5. Financial savings of each standardization option are calculated based on how many SKUs simplified incurs how much consumption will be optimized and cost will be cutting when standardizing x number of SKU into 1 SKU for each group for both Inner Box and Outer Box. Also, how standardization of the inner box group would link to the possibility of standardization for the outer box was considered as well.

6. With actual savings obtains could be calculated from a set of standardization, the writer also studies more on how invisible cost and waste relating to supply chain efficiency of the manufacturer could be obtained as well via the post-study and explanation in this post.

5 PROJECT OUTCOMES

The study has generated outcomes in statistics and insights about the SEMV factory packaging data system through this thesis paper regarding the current situation of the packaging and its database, the ability of standardization, and also the potential of further improvements and research for the packaging system in later on. The results are presented in different categories in order to interpret the results comparing to the study's objectives which had been set out previously.

5.1 Overview of packaging database

Through the project, SEMV's packaging information system was reviewed and checked for the completeness and level of how data is updated. The database was fragmented and outdated as there were missing and expired information of the packaging had been found by the researcher. The project implementation has compared, added, connecting and updating the packaging database based on the current information that could be collected from master data and other sources from other departments in the factory. Therefore, the project provided statistical updates as well as recognition on flaws of the packaging database.

From the aggregated data achieved regarding packaging in SEMV plant, the statics that indicates the general situation of Inner and Outer packaging boxes had been review as below. Readers also know details about the number of active packaging currently existing in the system. The number of SKUs for Inner box is larger than the Outer Box's.

Non-Schneider Brand Pakaging in SEMV	
Inner box	127 pcs
Outer Box	106 pcs

TABLE 1. Non-Schneider Brand Packaging in SEMV including Clipsal and PDL

Total SEMV FGs	6941
Active FGs in PE database	2013
Standard Package	1351
Overweighted Package (>10kg)	661

TABLE 2. General data of current Inner and Outer box packaging

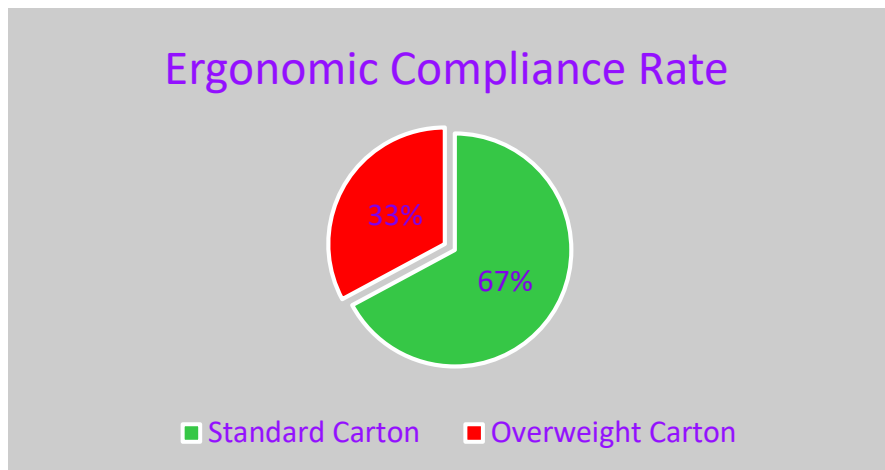


FIGURE 1. Generated Ergonomic Compliance Rate in SEMV

At the same time, the data indicated the number of overweight packaging, which violated the SPS Ergonomic Regulation of SEMV. However, due to the outdated database, the missing and outdated database could have led to inaccuracy statistics over the Ergonomic control of the factory. Overall the researcher's conclusion by the study for SEMV plant's ergonomic control is outdated and does not cover the situation of overweight packaging in the SEMV plant.

5.2 Packaging standardization possibilities

The main target of the project was to study packaging standardization possibility in order to reduce the variation of packaging components in the factory so that the plant could cut waste in packaging part proliferation, achieve higher productivity in packaging administration, inventory management, and cost reduction.

The standardization considered the Forecast of consumption, Price, and FMR status of each item to evaluate and select the standard part, which will represent

the rest of the other component in the group. Each item comes with a price, volume forecast of next year's production usage, and current status of order picks. An ideal standard part should be the one that at the same time, allows the business to achieve the best component price while generating a reasonable combination in forecast volume and optimization in eliminating the current slow-moving product.

As a result, there are ten groups of Inner boxes and six groups, respectively, for Outer boxes, which have been generated out with the high potential of standardization. The selected item for standardized is list in the left column while the nominated standard item is shown in the right column. The standard part after standardization with possible modifications such as design or packaging information content in order to harmonize and standardize a shared design for the others will replace and represent the group. The rest of the group, which is not the standard item, could be eliminated from the factory system.

INNER BOX	Before	Potentials of after	Difference
Standardization group	10 groups		
Number of SKU	29 SKU items	10 SKU items	Reduce 19 SKU items

TABLE 3. Potential SKU reduction for Inner Box

OUTER BOX	Before	Potentials of after	Difference
Standardization group	6 groups		
Number of SKU	15 KSU items	6 SKU items	Reduce 9 SKU items

TABLE 4. Potential SKU reduction for Outer Box

The standardization options have been analyzed and interpreted in terms of design, specifications via actual samples inspection, and calculations. Standardization proposals had been released for the business manager review. The standardization includes not only the selection for the standard part but also provide comment as standardization development guideline which explained what modifications or adjustment could be generated.

As a result, the possibilities of standardization for ten groups of inner boxes and six groups of Outer box has shown that 19 Inner Box and 11 Outer Box items could have been eliminated from the system through this project. It means 29 items of Inner box could be standardized into ten items, in which 19 items or in other word, as SKUs, could be reduced. On the other hand, 15 items of the Outer box could be standardized into six items.

The standardization criteria aim for inexpensive parts prioritize those with high order volume. Thus, the standard part will help reduce direct material cost, together with excessive part with low volume so that together, it allows simplification in inventory, quality, product engineer, and procurement management. Cost reduction for direct material, inventory, administrative, and overhead, as a result, will follow the component simplification to go down. Bigger minimum order quantity (MOQ) allows better price and simplification in subcontract order management. The leaner variation of packaging box hence benefits warehouse, shop floor, as well as packaging database considering space, administration, and maintaining activities.

5.3 Potential of financial savings

Direct material cost (DMC) savings is a visible and immediate cost reduction that was displayed as a result of this packaging standardization project. The DMC Savings was taken into account as success indicators of the project and how it benefits the company in general.

With ten groups of inner boxes, the possibility to standardize 29 items into ten items, reducing 19 items, could generate a potential rough saving of 371,791,227 VND, which is approximately 14258 EUR. For the Outer box, six groups of outer boxes in which 15 items have a potential of standardization into six items leaving

nine items at SKU reduction, the potential rough saving is 33,182,336 VND, which is approximately 1272 EUR. The rough saving was calculated on balancing between the cost of proper use of the original group of packaging items with the spending for DMC.

INNER BOX	Before	Potentials of after	Difference
Spending in VND	VND 3,741,927,234	VND 3,370,136,007	VND 371,791,227
Spending in EUR	€ 143,501	€ 129,243	€ 14,258

TABLE 5. Potential Direct Material Cost Reduction for Inner Box

OUTER BOX	Before	Potentials of after	Difference
Spending in VND	VND 257,682,053	VND 224,499,717	VND 33,182,336
Spending in EUR	€ 9,881.96	€ 8,609.44	€ 1,272.52

TABLE 6. Potential Direct Material Cost Reduction for Outer Box

However, cost reduction resides in other efficiency improvements by the project, which, unfortunately, either described in number or calculation via this project. That is the overhead cost which hides in the improvement of documentation, procurement, purchasing, spaces, activities, and process saved by the simplification of the packaging SKU.

5.4 A simplification of packaging tails

The packaging standardization project showed efforts in harmonizing and optimizing the use of packaging boxes in different production moving speed to help the plant to achieve higher productivity in packaging inventory management and reduce production costs. As a result, the project proposed standardization options helping eliminating packaging items with less likely to bring values to the supply chain system than a standard part of it could provide. It means that a packaging part with an existing low level of order pick, higher price and small number of production forecast but still have the needs for production even though

it is small, should be considered to be standardized into a better worthy maintain of item which will bring advantage in administration, procurement, and cost advantage. In that way, standardization will help the factory to cut all the tails of low moving products. A more significant combination in volume will enable the plant to plan for bigger purchase orders and achieve a better price offer from the suppliers.

There are items of which FMR status cannot be determined due to the lack of a management information system despite the project implementer's effort to trace back. The author considers the FMR status of the standard part of these items.

INNER BOX	Before	Potentials of after	Difference
FMR status	13 F	5 F	Reduce 8 F items
	4 M	1 M	Reduce 3M items
	6 R	0 R items	Reduce 6 R items
	6 Unknown	3 Unknown	Reduce 3 Unknown

TABLE 7. Potential Improvement of FMR status of Inner Box

OUTER BOX	Before	Potentials of after	Difference
FMR status	2 F items	2 F items	
	2 M items	2 M items	
	3 R items	2 R items	Reduce 1 R item
	8 Unknown items	0 Unknown items	Reduce 8 Unknown items

TABLE 8. Potential Improvement of FMR status of Outer Box

The table result has shown that the effort in reducing slow-moving packaging items was effective by reducing a positive number of Rare, Medium, or unknown category items in this research. For the Inner box, there is significant in reducing those tails while in Outer box, it is more about reducing the outdated and unknown status item by standardizing their usage. These unknowns are only in the scope of the research in this article and maybe in the wrong status due to the scatter of data that the writer was not able to reach. Therefore, it may not yet reflect the actual situation of these items.

6 CONCLUSION

6.1 Conclusion of the Packaging Standardization Project at SEMV

After all, the packaging standardization project at the SEMV factory achieved visible results in terms of generating insights and standardization options. Through standardization of the project, the study aims at investigating the possibility of making the packaging system of the plant leaner by simplifying variants of packaging SKU and improving the productivity and efficiency of the manufacturer's supply chain. The project helps to picture the current situation of Inner and Outer packaging in the factory while contributing to updating and investigating the packaging data system. Through this study, the packaging database was suggested to be updated and synchronized for better management purposes. The project discussed packaging standardization options and analyzed the orientation for implementing these proposals. Besides, the calculation study indicated specific numbers on the cost-saving side of each packaging standardization case. Thanks to the standardization, the cost reductions were shown to be obtained by the reduction in direct material cost saving by Inner and outer packaging box. The other invisible and longterm efficiency lies in the improvement of procurement and purchasing, better price and supplier management, shopfloor warehouse and database space-saving, and last but not least, management and maintaining related activities optimizing.

The paper provides the audience with an overview of how the kaizen project is implemented and the support the Continuous Improvement of a Lean, smart factory. Also, the role of Lean manufacturing has been highlighted by the study that it is a strategy that helps increase production productivity by identifying and eliminating non-value-added activities. Utilizing Lean methods and processes allows the manufacturer to lower non-efficient processes and waste. Utilizing lean manufacturing principles is one of the necessary procedures of how to achieve these goals. Furthermore, by cutting waste from packaging, the project poses a positive impact on reducing green waste, which indirectly contributes to energy savings in production and management, indirectly protects the environment and lower waste along with carbon foot sprint.

In general conclusion, the study, taking packaging as the subject, discussed the benefit of part standardization under cost reduction and efficiency of manufacturing supply chain by reducing waste in the variation of components. The study has shown that implementing part standardization can benefit a manufacturer with a Lean manufacturing application. Indeed, Part Standardization has been a critical action in reducing waste. Standardization supports the fundamental precept of Lean production and business in the way of reducing costs, improving the inbound and outbound logistics and manufacturing process, create a leaner facility and management system and, most importantly, improving boosting the overall efficiency of the business operation by visible and invisible long term values.

6.2 Limitation of the project

There were constraints that caused difficulties that directly affect the project implementation process and project results. The first to mention is that the information system is outdated, asynchronous, and incompleted. It affects directly the packaging item sorting, analysis process, and selecting standardization options. The results are also affected by the lack of information in order to achieve a better analyze the results such as weight, activity level, FMR status of items. Especially the issue of reviewing and managing the packaging box system in terms of SPS Ergonomics.

Secondly, there were challenges in approaching and accessing to the packaging sample due to the overload of sample management departments. Also, the availability of the sample was a constraint as well because some of the samples are missing or outdated. Because of that, the researcher was unable to conduct the best sample assessments.

The third difficulty was the limitation in the time of the author while working at the company. The project has been started in January, and the author left the company at the end of March. In between, there were also disruptions due to other tasks of the job besides this project.

6.3 Potential development in the future

Packaging Standardization generates insights and open opportunities for packaging standardization regarding logistics standard, which takes the dimension of the inner box and outer box into consideration to achieve better pallet stacking plan for the mixed pallet, Less than Container Load shipment and multilayer stacking. By considering the inner box size, the quantity of packing of the outer box for adjustment and evaluate optimized options in dimension, packing load, ergonomic packing weight, pallet stacking pattern. Review the variety of carton boxes used for each destination to analyze the loading plan, support to improve the efficiency of the mixed pallet of product transported.

The reduction and simplification of the packaging system and the number of SKUs enable the use of standard packaging for the product group, which helps opens the potential for the automatic packing process.

The standardization proposals in this packaging standardization project could be applied to, later on, develop Product Evolution Project (PEP) and Quality Value Engineer projects (QVE) to driving changes of the packaging component and implement these standardization proposals.

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APPENDICES

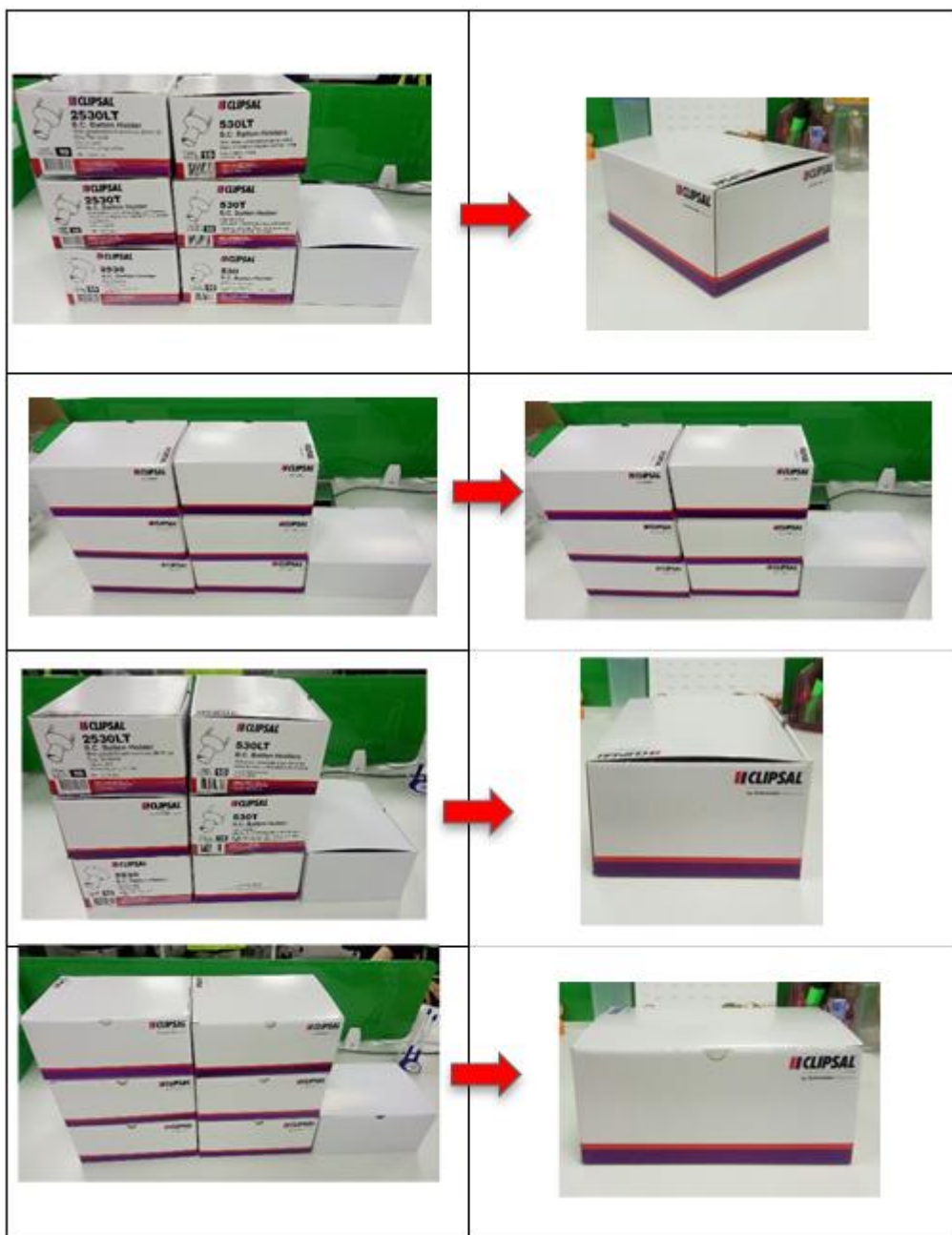
Appendix 1. Standardization group of Inner packaging box

Group1	EC2530LT	EC2530LT
	EC530AWP	
	EC530LT	
	EC530T	
	EC2530	
	EC530	
	EC2530T	
Group7	8836461	EC2010
	EC2010	
	IBC2025	
	EC2010_1	
	EC2025XA	
Group 12	EC51_1-N	EC51/1
	EC51/1	
Group 17	30BIB	438IB-TR
	438IB-TR	
Group 18	EC2060_1	EC2025_1
	8836381	
	EC2025_1	
Group 13	IB360150140	IB360150140
	IB360150140S3K	
Group 11	EC4030	EC4030
	EAV98572	
Group 9	EC4070	EC4070
	EAV98566	
Group 5	413IB-B_N	413IB_N
	413IB_N	
Group 4	S1A76376	56E8-56C310-GY
	56E8-56C310-GY	

Appendix 2. Standardization group of Inner packaging box

Group 8	397490	397490
	AP30	
Group 9	EOD82	EOD93B5_A
	EOD93B5_A	
Group 10	EOD409B_A	EOD409B_A
	CODE-S02-OC	
	EOD409B	
Group 11	EOD404	EOD404_A
	EOD404_A	
Group 13	OBC2025	OBC2015D4
	OBC2015D4	
Group 14	AP20	AP415
	OC-AP20	
	CODE-AP20	




Appendix 3. Example number 1 of samples inspection for Inner Box standardization



Appendix 4. Example number 2 of samples inspection for Inner Box standardization

Side 1		
Side 2		
Side 3		

Appendix 5. Example number 3 of Inner Box standardization analysis

Inner box		
No	Current	Proposal
Comp Number	EC2060_1 8836381 EC2025_1	EC2025_1
Design		<ol style="list-style-type: none"> 1. Standardize to the box EC2025_1 (color, aw) 2. Eliminate the on-the-box printing, using separate lable instead
Side 1		
Side 2		
Side 3		
Side 4	