Lean implementation in traditional distributor warehouse – a case study in an FMCG company in Indonesia

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Abstract: Warehouse is a crucial part of firms’ logistic system and plays an important role in delivering products from manufacturers to end consumers. Lean principles originated from manufacturing practice can be adapted to warehouse environment to enhance its productivity. The study was based on a multinational fast-moving consumer goods in Indonesia which relied on small and medium enterprises (SME) as their intermediaries to distribute its products throughout Indonesia. Lean warehousing techniques were used as a practical tool to introduce a good and efficient warehouse practice for its distributors. As a standardised framework for its distributors, the company introduced three stages for lean warehouse implementation, i.e., ‘create stability’, ‘create flow’, and ‘make flow’ in the warehouse. Implementation was done for the first two stages in one pilot distributor, resulting to 26% increase in picking productivity and a more balanced warehouse operation. Result will be used as a baseline and show-case for further implementations to the rest of its distributors.

Keywords: lean warehouse; distributors; 5S; waste; value stream mapping; muda-mura-muri; Indonesia; visual management; create stability; create flow; make flow.


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Maulana Nofrimurti is an undergraduate student at International Business and Management, Bina Nusantara University. He is in his final year and currently doing his thesis for bachelor degree.
1 Introduction

Managing products’ movement efficiently is a common objective in supply chain management. While firms in developed countries are already in mature stage for their supply chain implementation, those in developing countries are still struggling to make effective and efficient supply chain, due to lack of proper supply chain infrastructure (Mandal, 2014).

Warehouse is an important aspect of supply chain management. In its basic role, warehouse serves as facility for consolidating products to optimise transport cost (Bartholdi and May, 2014). It can also serve other value adding roles such as assembly services, product bundling and unbundling, recycling, repair and returns management (Coyle et al., 2013).

There are multiple ways of grouping warehouse types. Ghiani et al. (2004) classified warehouses into production warehouses and distribution centres. Warehouses can also be grouped by their roles in the supply chain such as raw material warehouse, work-in-process warehouses, finished goods warehouses, distribution warehouses, fulfilment warehouses, local warehouses direct to customer demand, and value-added service warehouses. They also gave different classification based on ownership, i.e.: company-owned, public and leased warehouse. Bartholdi and May (2014) categorised warehouses by customer service types: as a retail distribution centre, a service parts distribution centre, a catalogue fulfilment or e-commerce distribution centre and a third party logistic (3PL) warehouse.

A good warehouse management is essential to firms’ supply chain. Efficient and effective warehouse operation gives optimum cost to serve and enhances customer service level. To have an effective road-to-market strategy, firms must pay attention to operation management of all the warehouses along its distribution network: in other words, not only their own warehouses but also those belong to their intermediaries.

The research is based on case study of a fast moving consumer goods company (FCMG) in Indonesia, serving its customers through two main channels, i.e.:• Direct selling to modern trade, either directly to customers’ stores or to their central warehouses.
• Direct selling to traditional trades through distributors. Distributors then sell and distribute the goods to small retailers in their respective region.

Product distribution in Indonesia’s big cities mostly involved modern trades, which have sufficient warehouse management system and practice in place. On the other hand, to cover product distribution in remote part of Indonesia, firms must rely on traditional and smaller scale distributors.

The company under study had 195 small and medium enterprises as their distributors across Indonesia with different business sizes and warehouse conditions, as outlined in Figure 1. Distributors were small and medium enterprises, with varying skills and expertise in warehouse operation due to the following factors:
• Size of business with the company under study, which will influence the investment they are willing to put in their warehouse and distribution.
• Number of served clients. Some distributors serve multiple clients, while others are dedicated distributors to the company under study.
• Type of served customers. While majority serve traditional retailers (require canvassing and smaller vehicle in delivery), some also serve small key account in the area (require bigger trucks).

• Number of involved product categories. Some distributors are specialised only for certain products category, e.g., confectionery, due to different requirement in market penetration.

Figure 1 Type of distributors and warehouse types (see online version for colours)

<table>
<thead>
<tr>
<th># of Distributors</th>
<th>Warehouse Type</th>
<th>Type</th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales Offices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Java Region</td>
<td>Rack</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Central Java Region Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East Java Region</td>
<td>Rack</td>
<td></td>
<td>1</td>
<td>14</td>
<td>12</td>
<td>27</td>
</tr>
<tr>
<td>East Java Region Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Java Region Total</td>
<td>Without Rack/Flooring</td>
<td>1</td>
<td>15</td>
<td>12</td>
<td></td>
<td>29</td>
</tr>
<tr>
<td>Solowest Region</td>
<td>Rack</td>
<td></td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Solowest Region Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sumatera Region</td>
<td>Without Rack/Flooring</td>
<td></td>
<td>1</td>
<td>15</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>Sumatera Region Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Java Region</td>
<td>With Rack/Flooring</td>
<td></td>
<td>4</td>
<td>18</td>
<td>17</td>
<td>39</td>
</tr>
<tr>
<td>West Java Region Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td>29</td>
<td>94</td>
<td>72</td>
<td>195</td>
</tr>
</tbody>
</table>

Figure 2 gives overview of road to market for the company under study.

Figure 2 Distribution channel of the company
In summary, managing distributors’ warehouse poses the following challenges to the company under study:

- Its 3rd party with multiple stakeholders. When the distributors serve other clients, the warehouse must also fulfill other clients’ requirement and need.
- (Small size) distributors have limited resources in term of manpower, material handling, or space.
- Distributors are different entities with their own business objectives. Aligning distributors’ interests and operation to their client objectives may require trade-offs (e.g. distributor profitability vs. service level to end consumers).

The company under study has implemented lean warehouse concept and tools in their own warehouses and have experienced some benefit. As distributors play an important role in its distribution network, they were also interested to explore opportunity in improving warehouse management of its distributors.

The objective of the research was to help the company under studied creating an implementation framework of warehouse management system for its traditional distributors using Lean principle. Implementation and evaluation to one pilot distributor was also performed. The result should be used as baseline and show-case for further implementations to the rest of the distributors.

2 Literature review

2.1 Lean principles

Lean principles were originated from manufacturing environment. Its basic principle is to eliminate 3M: muda, mura, and muri, which are Japanese terminology for waste, variability, and high burden condition. Majority of lean implementation typically concentrate on reducing waste which are consider as non-value-added to the organisation.

Several Lean tools have been established in the past, aiming to eliminate 3M and get continuous process improvement by increasing productivity, reducing cost, or both. In general, lean tool can be classified into the following category (Aljunaidi and Ankrah, 2014):

- visualisation tools, such as 5S and Pokayoke
- just in time tools, such as Kanban and Andon
- process improvement tools, such as Value stream mapping and Kaizen
- automation tools, such as Jidoka
- production levelling tools, such as Heijunka, quick change over, and takt time.

Although originated in automotive production environment, Lean has been implemented in other areas, e.g.:

- It can be applied in service sectors, such as done by (Srichai et al., 2013) who applied it in school environment, and used value stream mapping to identify muda, mura and muri to enhance school safety.
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- Venkateswaran et al. (2013) implemented hybrid 5S by combining traditional 5S with inventory management in healthcare industry involving multiple number of stock keeping unit (skus).

- Daultani et al. (2015) gave overview of current and future state of lean implementation in healthcare business, and concluded that different healthcare services had unique challenges to lean implementation as the result of their inherent characteristics of service delivery.

- McAdam et al. (2014) explored the implementation of six sigma and Lean into small and medium enterprise (SME) using case study from 18 SMEs. They concluded that Six Sigma is considered very data driven, while Lean is much more practical (i.e., although it still involves measurement it is less focused on microscopic data gathering). The feedback from the SME was also to avoid the over mechanistic approach of the Six Sigma statistical calculation and better adopt a more flexible approach, but with appropriate training.

- Bouami (2015) elaborated example of lean implementation in maintenance area and how wastes can be minimised through the use of value stream mapping and cost modelling based on multinational automotive supplier in Morocco. The proposed model aimed to help decision makers the possibility to map maintenance process and identify cost of activities and potential wastes in implanting lean maintenance.

- Motwani (2015) presented a case study of lean implementation in a publishing services of automotive industry. It incorporated the use of lean principle and socio-technical systems (STS) into the organisation in order to enhance customer service, reduce cost and increase profitability.

2.2 Warehouse management and lean warehousing

A good warehouse management depends on a good design to support efficient operations. Most of previous studies on warehouse management concentrate on how to design warehouse effectively (Gu et al., 2007; Baker and Canessa, 2009) and how to improve warehouse operations by introducing techniques such as ABC product classification and analysis (Chan and Chan, 2011) or stocking policies optimisation (Battini et al., 2010).

In lean warehousing area, a lot of studies have been done, with different combination of lean tools, e.g.:

- Pan et al. (2010) used value stream mapping in shortening delivery time.

- Chen et al. (2013) applied lean together with RFID technology to enhance warehouse management, again by utilising value stream mapping to identify potential improvement and using RFID technology as solution together with lean concept.

- Dotoli et al. (2013) used value stream mapping to identify non value added activities and used Gemba Shikumi technique to assess the best response actions.

- Bozer (2012) developed ‘house of lean for warehousing’ and identified fundamental operational or asset-based changes required to implement lean principles in a warehouse.
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- Lean Enterprise Institute (LEI) gave a comprehensive principle of lean warehousing starting from basic tools such as 5S & visual management to sophisticated ones like levelling Muri & Mura or creating one-piece flow environment.

Lean warehousing can bring possible improvement in both internal and external aspect of warehouse operation, as indicated by McKinsey study in 2010 (Alicke and Lösch, 2010). Table 1 summarises possible improvement area and potential savings in warehouse management based on their study.

<table>
<thead>
<tr>
<th>Area of improvement</th>
<th>How</th>
<th>Potential savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehouse internal</td>
<td>People</td>
<td>1–5%</td>
</tr>
<tr>
<td></td>
<td>Processes</td>
<td>4–9%</td>
</tr>
<tr>
<td></td>
<td>Performance management</td>
<td>2–5%</td>
</tr>
<tr>
<td></td>
<td>Layout</td>
<td>3–4%</td>
</tr>
<tr>
<td>Warehouse external</td>
<td>Interaction with third party</td>
<td>0–4%</td>
</tr>
<tr>
<td></td>
<td>Ownership</td>
<td>0–5%</td>
</tr>
</tbody>
</table>

Source: Adapted from Alicke and Lösch (2010)

What lean tools can be implemented depends on case and context. As warehouse becomes more modern, more tools can be used. Nevertheless, what is crucial is the role of management support in lean implementation. Management involvement in lean implementation opens communication lines with employees on the factory floors, creates a more positive feeling towards management and plays key roles in lean implementation success (Worley and Doolen, 2006).

3 Methodology

The methodology of the study consists of two main groups (see Figure 3):

3.1 Framework creation

Framework creation consists of Step 1–3. Step 1 was done by direct observation in few distributors; assessing currently used tools in firm’s own warehouse; and interview and brain storm with key stakeholders internally and in few distributors. Step 2 was done by data collection of all distributors’ warehouse profiles and capability which was then stored in a database. In Step 3 implementation plan/road map was drafted to be tested in one pilot distributor.
3.2 Implementation

Implementation was planned through Steps 4–12. But due to readiness of the pilot distributor, only Steps 4–10 were performed. The distributor belongs to an A-class type so commitment from their management was easier due to the size of business with the company under study. The pilot distributor also served other principals, so complexity was expected to be sufficient.

The steps were planned sequentially in order to get continuous knowledge building and value creation of lean concept.

- Steps 4–10 were also broken down into two sub-groups, i.e.: ‘create stability’ and ‘create flow’. Step 11–12, although only concept, meant for last stage of lean implementation ‘make flow’, and should address issue of inventory reduction and rhythm wheel to customer demand.

- Clustering which steps belong to which sub-groups was part of framework creation (i.e., result of Step 3).

4 Analysis and discussion

The proposed implementation framework was summarised in Figure 4. Details of each stages are elaborated together with the implementation result in pilot distributor, as following:
4.1 Stage 1: create stability

The foundation and must-have requirement is to ‘create stability’ stage for lean application. ‘Create stability’ is basic requirement for all type of distributor, which covers quality and safety of product and workers. ‘Create stability’ covers the following lean tools in the warehouse operations:

- 5S, which basically put everything in good order and only those you need
- visual management to support KPI monitoring and product ‘first-expired-first-out’ (FEFO) dispatching rule
- standardisation of warehouse processes, documented as ‘one-point-lesson’.

The objective of this stage is to perform good house-keeping, create good visibility in warehouse operation, make awareness of non-value added activities and preliminary elimination of seven type of waste (Muda).

Figure 5 shows what has been done at the pilot distributor in this stage, e.g.:

- increase staff awareness by giving trainings on lean concepts
- 5S in the warehouse aisles to increase process productivity and work safety.
- visual management by colour-coding products based on expiry period to increase picking productivity based on first-expired-first-out (FEFO) rule
- visual management in KPIs monitoring.

4.2 Stage 2: create flow

After stability is created, the next stage is to think how to create flow: to align between the sub-processes in order to increase productivity. Three areas of operation improvement are addressed, i.e.:
5S: Put everything in a good order and only those needed

- Improve worker safety and process productivity

Colour marking for visual management of first expired first out (FEFO):

- For distributors with limited investment on technology, product FEFO can still be done using colour marking: Green for products with remaining shelf life < one year; yellow for between six month and 12 month; red for below six months
- Picking and dispatching is based on the colour coding. Reduce potential bad goods and enhance product freshness

Visual management KPI:

As warehouse activities mostly done on the floor, KPI monitoring with visual management forces team to review the performance regularly on the spot, review what only matters, and involve relevant people up to the floor shop

Note: Due to brand confidentiality, picture is intentionally made blurred.
Figure 5  Summary of ‘create stability’ activities (continued) (see online version for colours)

<table>
<thead>
<tr>
<th>Standardisation with one point lesson</th>
<th>Training warehouse staffs with interactive training kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encourage staffs to articulate possible improvement and share with colleagues</td>
<td>• Simplify knowledge transfer on possible warehouse improvement to ordinary floor shop staffs</td>
</tr>
<tr>
<td></td>
<td>• Encourage participations and ownership for later process improvement</td>
</tr>
</tbody>
</table>

Note: Due to brand confidentiality, picture is intentionally made blurred.

4.2.1 Warehouse layout analysis and execution

The first step in ‘create flow’ stage is to make sure distributors have good warehouse layout. A good layout allocates products’ storage based on zoning and sectoring to ensure efficient movements during operation, ease of product traceability, and minimise product damage and expiry at warehouse.

Figure 6  Warehouse layout – before and after (see online version for colours)
To assess and seek improvement on its current warehouse layout, analysis of past sales requirements at pilot distributor was done. The analysis calculated storage space requirement by product category based on weight, popularity, and quantity. Based on the analysis, new layout was then proposed as shown in Figure 6. The new layout helped eliminating waste time during transporting from and to designated storage bin.

4.2.2 VSM on internal warehouse movements

To eliminate further type of waste in its internal warehouse movement, value stream mapping was done by:

a. indicating steps required in performing internal warehouse activities

b. segregating value adding activities from non-value added activities

c. simplifying the steps by eliminating the non-value adding activities and designing future state of value stream mapping.

The current and future state of value stream mapping at the pilot distributor was shown in Figure 7. From the value stream mapping, it was indicated that the bottle neck activity was in picking process. Majority of the pilot distributor’s customers ordered in small quantity, resulting picking directly from the rack was not efficient. As improvement it was decided to introduce ‘pick-face’ area at the bottom part of the racking for small-quantity picking. Which products should be in ‘pick-face’ and how big the ‘pick-face’ area per product was calculated and implemented. The result of productivity improvement in the pilot distributor was as shown in Table 2, where picking capacity increased by 26%.
Table 2  Productivity improvement – before and after

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Before Observations</th>
<th>Before Standard time</th>
<th>Before Min/pallet</th>
<th>After Observation time</th>
<th>After Standard time</th>
<th>After Min/pallet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picking</td>
<td>Sec/pallet</td>
<td>1.00 119 185</td>
<td>985 148 229</td>
<td>97</td>
<td>1.240 148 229</td>
<td>148 229 120</td>
<td>120</td>
</tr>
<tr>
<td>Checking</td>
<td>Min/pallet</td>
<td>21 2 4</td>
<td>16 2 4</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loading</td>
<td>People</td>
<td>5 3 2</td>
<td>5 3 2</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replenishment</td>
<td>Network available</td>
<td>1.500 900 600</td>
<td>1.500 900 600</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity/operating hour</td>
<td>People</td>
<td>73 365 157</td>
<td>91 365 157</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2.3 Workload balance analysis

The next step of ‘create flow’ stage is to perform work balancing between activities. Balanced workflow will eliminate waste in the form of waiting time or inventory between the work stations. The current practice at pilot distributor was to assign 5 pickers vs. 3 checkers vs. 2 loading operators vs. 1 replenishment operator, creating overload work for pickers but idle time for checkers. With warehouse balancing analysis, it was proposed to have 8 pickers vs. 1 checker vs. 2 loading operator vs. 1 replenishment operator. As number of operator must be integer, it was suggested to combine some of the sub-activities in loading into checking to smooth the line balancing.

Result of warehouse activity balancing in the pilot distributor was shown in Table 3.

Table 3  Result of line balancing (see online version for colours)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Before Picking</th>
<th>Before Checking</th>
<th>Before Loading</th>
<th>Before Replenishment</th>
<th>After Picking</th>
<th>After Checking</th>
<th>After Loading</th>
<th>After Replenishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picking</td>
<td>Sec/pallet</td>
<td>795 119 185</td>
<td>985 148 229</td>
<td>97</td>
<td>1.240 148 229</td>
<td>148 229 120</td>
<td>120</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Checking</td>
<td>Min/pallet</td>
<td>16 2 4</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Loading</td>
<td>People</td>
<td>8 1 2</td>
<td>5 3 2</td>
<td>5 3 2</td>
<td>5 3 2</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Replenishment</td>
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<td>1.500 900 600</td>
<td>300</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Capacity/operating hour</td>
<td>Pallet</td>
<td>146 122 157</td>
<td>97</td>
<td>120</td>
<td>150</td>
<td>4.041</td>
<td>4.041</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity</td>
<td>CS/wk</td>
<td>3.945 3.287 4.246</td>
<td>2.466 9.860 4.246</td>
<td>4.041</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.3 Stage 3: make flow

The next stage of lean implementation is ‘make flow’. It’s the final stage of implementation, where, not only 3M (muda, mura, muri) are minimised or eliminated, but also when process flow as per how consumer want it.
‘Make flow’ stage concentrated on two areas of improvement, namely: reducing inventory and creating rhythm wheel to align with customer demand. It can be done by implementing more sophisticated lean tools such as rhythm wheel, supermarket replenishment, automation tools like Jidoka, etc.

This last stage of implementation framework was not implemented yet in the pilot distributor since resources from both the company and distributor were not ready at the time of study. It was decided to sustain the first two stages first before the pilot distributor can move forward to the last stage.

4.4 Staging and modular implementation plan

Clustering the implementation framework into three groups creates modularity in its execution, and possibility to tailor them to distributors’ profile and needs. Staging implementation also gives enough time for knowledge absorption before moving to the next step and window opportunity for process alignment between principal and distributor.

To gain significant benefit of the framework, the company under study need to implement it to its several or key distributors. To accelerate progress, next implementation should be done in cluster, i.e.: simultaneous implementation in distributors with similar profiles or close proximity to optimise staff allocation during implementation.

5 Conclusions and limitation

Lean tools, although originated from production environment, are suitable for warehouse environment. For traditional warehouses, with limited knowledge and resources, lean concept is even more powerful due to its simplicity, systematic yet affordable: It can bring direct improvement by introducing practical analysis and tools such as 5S, visual management, waste identification through value stream mapping, and warehouse activity balancing.

To introduce lean concept to a number of small and medium enterprises, having little prior knowledge about lean, it was suggested to break implementation into three stages: ‘creating stability’, ‘creating flow’, and ‘make flow’. Stages implementation ensures a more systematic knowledge transfer and sustainability of process improvement. Nevertheless, implementing first two stages in a pilot distributor has shown productivity improvement in their picking process and a more balanced warehouse operation.

The study has the following limitations, which offers opportunity for the following future study:

- Implementation in the pilot distributor excluded the last stage. The study can be expanded by implementing last stage ‘make flow’ to at least the key distributors.  
- Implementation was only tested in one pilot distributor. Further implementation roll-out to all or key distributors and how it can together contribute to overall firm’s performance should be done.
Acknowledgements

The authors are grateful to the anonymous referees of the journal for their extremely useful suggestions to improve the quality of the paper. Usual disclaimers apply.

References


