

A Continuous Improvement in Lean Manufacturing to form a Learning Organization: A Conceptual Model

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ABSTRACT

Lean manufacturing is a learning process for improvement through the principles of continuous improvement and learn by doing. Lean manufacturing is unique to each company so that it is not easy to be imitated by competitors directly so that it can increase the company's competition. PT Tjiwi Kimia, Tbk practices lean manufacturing in daily operational activities. PT Tjiwi Kimia, Tbk also adopts MBOS (Management by Olympic system) to encourage continuous improvement. The interaction between continuous improvement and lean manufacturing practices can be achieved through the learning process from the KPIs set by management. the commitment of management as stated in the vision and mission of the Company also plays a role in turning the interaction. with this interaction, it will encourage the company to become a learning organization. The whole process can be described as a model that continues to rotate to improve internal competitiveness.

Keywords: *Lean manufacturing, continuous improvement, learning organization*

1. INTRODUCTION

The 21st century is characterized by customized products. This leads to complex production planning and control systems that make mass production a challenge. Many organizations are struggling in the new globally competitive customer-driven market. To overcome this situation and become more profitable, many manufacturers are turning to lean manufacturing. The goal of lean manufacturing is to become highly responsive to customer demand by reducing waste. LM aims to produce products and services at the lowest cost and as quickly as required by customers (Bhamu & Singh, 2014)

Knol, Lauche, Schouteten, & Slomp (2022) explains how LM is applied by examining the interaction between lean routines and continuous improvement routines. It was found that continuous improvement does not simply emerge from lean routines. Active involvement and building good relationships from actors at various levels are needed to change and settle new routines. Saabye, Powell & Coughlan (2023) theorized that continuous learning in lean manufacturing is similar to the principle of learning by doing. Lean and learning are systemic approaches that cannot be adopted by copying practices that have been developed over years and decades. System conditions differ between companies in how operations are built, jobs are designed, how people are paid and rewarded and how measures are used and policies, procedures and information systems (Seddon & Caulkin, 2007). Dorval, Jobin & Benomar (2019) added that achieving continuous improvement practices requires changes in organizational culture. Alves, Dinis-Carvalho & Sousa (2012) suggested that lean promotes thinkers but needs to provide some conditions, namely the need to become a learning organization.

PT Tjiwi Kimia, Tbk is a pulp and paper company under the APP (Asian Pulp & Paper) Purinusa Ekapersada business group or called APP Indonesia. PT Tjiwi Kimia, Tbk produces quality products to meet the growing global demand for paper, packaging and tissue marketed in more than 150 countries spread across 6 continents. PT Tjiwi Kimia, Tbk practices lean manufacturing principles in the daily production process in the use of various lean tools such as 6S (a combination of 5S and safety), TPM (Total Productivity maintenance), visual control, automation, gemba walk and others.

To be able to drive continuous improvement, PT Tjiwi Kimia, Tbk adopts the MBOS (Management by Olympic System) system. The MBOS concept was adopted from MBO (Management by Objectives) by Drucker (1954). Tools in MBOS include improvement projects, cross sharing-learning, index competition, incentives and rewards. MBOS

takes control by actualizing the Company's aspirations/objectives through KPIs (Key Performance Indicators). With KPIs, performance gaps from the actual year and next year's targets can be pursued through the formation of improvement projects. There are 3 types of improvement projects, the first is JDI (Just Do It) initiated by staff/officers (shop floor), SGA (Small Group Activities) initiated by middle management and finally SDA (Skill Development Activities) initiated by top management with world-class benchmarks or targets so that they can be shared or learned between business units. This research seeks to explain and conceptualize the interaction of lean manufacturing in daily operations and continuous improvement into a concept that is easy to understand so that it can help similar research on lean manufacturing and continuous improvement.

2. RESEARCH METHOD

Research at PT Tjiwi Kimia, Tbk with objects at Paper Factory 2 using Qualitative methods with the types of data collected in this study are primary data and secondary data. In this study, primary data was obtained through interviews and observations of parties directly related to this research. Secondary data obtained through literature studies, as well as documents originating from libraries and the internet obtained through the internet need to be selected and selected wisely so that the data obtained is reliable.

3. RESULT AND DISCUSSION

From the results of the research, it is obtained that the research subject, namely the leader, understands the concept of lean manufacturing and continuous improvement from various kinds of training provided by the company and independent training either from curiosity or cross learning which is then adjusted to the needs of daily operations. To be able to support these improvements, especially in the production section at PF2, 4 main indicators are used, namely OEE (Overall Equipment Effectiveness, EBITDA, COST and CCI (Customer Credit Insurance). Progress improvement can be seen to have the biggest role is OEE because it is derived from all levels from the highest position is Factory head, paper machine manager and supervisor. OEE is broken down into Total Efficiency, Net Gross Efficiency, Time Efficiency, and Capacity Efficiency on Table 1 to Table 4.

Table 1. Total efficiency (%)

PM	AVG 2023	AVG 2024	DEC	JAN	FEB	MAR	AVG 2025	BUDGET 2025
PM 5	88.43	84.06	78.67	86.57	86.40	83.47	85.48	84.82
PM 6	83.71	83.46	83.97	82.98	80.18	86.56	83.24	84.75
PM 8	87.29	83.41	89.51	90.01	90.03	86.07	88.70	86.45
PM 9	74.82	76.37	78.54	76.73	76.13	80.88	77.91	80.14
Total PF 2	80.80	79.60	81.02	81.41	80.74	82.73	81.63	

Table 2. Net gross efficiency (%)

PM	AVG 2023	AVG 2024	DEC	JAN	FEB	MAR	AVG 2025	BUDGET 2025
PM 5	88.84	85.64	80.96	84.54	85.23	85.12	84.96	86.12
PM 6	85.29	85.28	87.02	84.15	85.08	87.63	85.62	85.99
PM 8	87.09	82.89	85.00	86.14	86.17	85.24	85.85	86.89
PM 9	93.68	93.16	91.82	92.57	91.18	93.77	92.51	94.00
Total PF 2	90.59	89.26	88.56	95.29	88.69	87.50	90.49	

Table 3. Time efficiency (%)

PM	AVG 2023	AVG 2024	DEC	JAN	FEB	MAR	AVG 2025	BUDGET 2025
PM 5	93.80	93.36	90.51	94.23	95.01	92.46	93.90	90.36
PM 6	94.32	93.35	93.10	93.15	90.59	93.49	92.41	93.94
PM 8	92.78	92.93	95.66	95.37	96.19	93.67	95.08	93.40
PM 9	88.18	89.75	93.85	91.29	89.08	91.97	90.78	90.29
Total PF 2	92.33	92.35	93.28	93.51	92.72	92.90	93.04	

Table 4. Capacity efficiency/ waiting time (%)

PM	AVG 2023	AVG 2024	DEC	JAN	FEB	MAR	AVG 2025	BUDGET 2025
PM 5	106.11	105.14	107.4	108.67	106.7	106.05	107.14	109.01
PM 6	103.79	104.82	103.7	105.87	104.0	105.66	105.19	104.90
PM 8	107.80	108.23	110.1	109.57	108.6	107.80	108.66	106.50
PM 9	90.54	91.32	91.1	90.79	93.7	93.77	92.76	94.40
Total PF 2	102.06	102.38	103.1	103.73	103.3	103.32	103.44	

To facilitate the depiction of the continuous improvement process, a case example is taken from the improvisation target in PM 9 with KPI settings from management in 4 shift groups represented by group A, group B, group C and group D on Table 5. In addition to OEE there are also other KPI parameters with a focus on quality and waste elimination. For this improvisation process, from each group there will be a peer leader who initiates the learning. In this case the peer leader learned from the sister mill in Perawang and also between groups to be able to pursue targets. Each idea put forward is submitted to the improvement project either JDI or SGA with ideas varying from changes in work standards, automation improvisation and others. To motivate the process, the leader monitors and mentors the process of achieving the KPIs every month, and the company through MBOS carries out rewards and penalties which have an impact on bonuses in quarterly bonus.

Table 5. Case example of KPI setting at PM 9

KPI item	UOM	sign	UoM	weight	JAN 25			
					Group A	Group B	Group C	Group D
Sheet break	Min	-	Target	20%	624.25	624.25	624	651
			Actual		518	512.00	470	485
			Achievement rate		23.4	23.60	24.00	24.00
	Freq	-	Target	20%	53.67	53.67	54	56
			Actual		46.00	51.00	49	47
			Achievement rate		22.86	20.99	21.74	23.21
UDT by prod	Min	-	Target	30%	166	166	166	173
			Actual		37.00-	-	-	-
			Achievement rate		36.00	36.00	36.00	36.00
Pope reel	Ton	+	Target	20%	4.193	4.193	4.193	4.375
			Actual		3.875	3.897	4.055	4.270
			Achievement rate		18.48	18.59	19.34	19.52
Capacity efficiency	%	+	Target	10%	95.55	95.55	95.55	95.55
			Actual		91.26	91.07	91.17	91.09
			Achievement rate		9.55	9.53	9.54	9.53
OEE	%	+	Target		80.69	80.69	80.69	80.69
			Actual		78.55	78.55	78.55	78.55
			Achievement rate		97.3%	97.3%	97.3%	97.3%
Time efficiency	%	+	Target		90.42	90.42	90.42	90.42
			Actual		93.85	93.85	93.85	93.85
			Achievement rate		103.8%	103.8%	103.8%	103.8%
Total Score					110.3	108.71	110.62	112.27
raking					3	4	2	1

At the end of the year, each KPI will be accumulated and then competed between the four shifts through index competition, the winners will be rewarded and awarded, for the illustration can be seen on **Figure 1**. The winner from index competition then will be competed with the other sister-mills. The results of these achievements will become a benchmarks. The overall results of continuous improvement will then update the old work process into a new, more effective work process, one of which is by updating the work instructions



Figure 1. Illustration of scoring and awarding from case example at PM 9

The process of the case example can be made in a flow and the flow can be conceptualized according to what was initiated in Subali's research (2020) on the relationship and adaptation between operation strategic model which is developed by Slack & Lewis (2015:15,24) and learning organization which is developed by Andreu & Ciborra in Moingeon & Edmonson (1996:126). This model states that the development of capabilities at the operational level is the result of the use of resources that are functionally used to solve problems that arise from operational work routines, which are usually well-known problems and always occur in repeated routines.

By being adjusted to the theme of lean manufacturing, the organizational routine is changed into management target, and the capabilities is changed into lean performance. That's because the lean manufacturing is seeking the productivity by eliminating the waste by using the company resource efficiently. The proposed model consists of two cycles, the first is lean adoption, which explains how the lean tools is adopted into the company, and the second is lean learning, which explains how the improvement occurs. The complete proposed model can be seen on **Figure 2**.

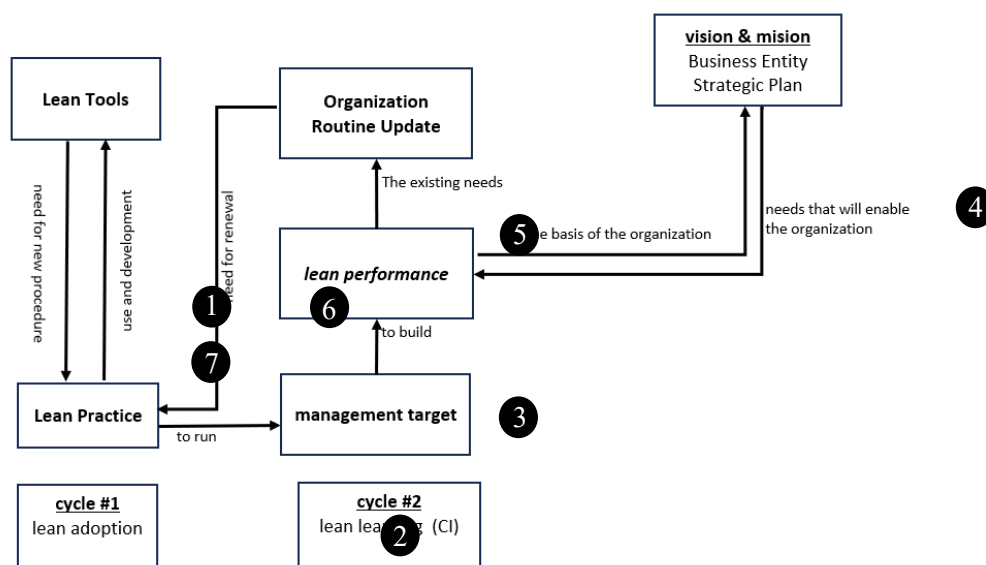


Figure 2. Proposed conceptual model of learning organization from continuous improvement in lean manufacturing

3.1. LEAN ADOPTION

This cycle explains the patterning process. This cycle will have many adjustments, forward-backward cycle between lean tools and lean practice to properly suit with the company conditions and needs the shopfloor to adapt with the new lean tools. This cycle always occurs when the company installing the new tool to support the lean manufacturing, for example, when the company install the latest automation tool likes SAP system, install the latest quality control equipment by using artificial intelligence and so on.

3.2. LEAN LEARNING

1. Management target produce a gap between current performance and the desired performance based on lean practice in production. Management targets are reflected in KPIs that are continuously monitored. This interaction is called as top-bottom relationship. This gap in lean manufacturing causes the shopfloor to learn in generating ideas and innovations in achieving the desired performance.
2. The interaction to achieve this lean performance can be called as bottom-top relationship and at this stage it shifts from patterning to enacting. During the improvisation process, the shopfloor can submit any ideas for improvement from small scale /Just do it to bigger scale/Small Group activities, to build lean performance. This process happens from learning by doing or learn by action.
3. The relationship between vision and mission to lean performance is the commitment of the company and management to support a learning climate in the company, for example, by applying incentive and reward systems, freedom to learn, in example, cross learning internally or externally with supplier/vendor, quality team, team discussion and many others. This relationship is a soft lean practice, which is motivational by meeting shopfloor needs for learning. In another relationship, lean performance is needed to achieve the company's vision and mission, to become a competitive company and can become a distinctive feature from competitors.
4. These achievements especially from the winner that announced at the end of year competition/index competition will be used as a benchmark or best practice. This is called as organization routine updates. These updates are often necessary to adapt to changes in the environment, improve efficiency, or incorporate new technologies.
5. The organization routine updates affect the lean practice so everyone will use the best practice and do it in lean manufacturing routines.
6. Sometimes in one case, the new lean practice can affect or update the existing lean tools, likes updating from mechanical to the latest automation process, to make the lean routines run properly.

The whole cycle then starts from beginning and repeats continuously, and somehow become the organizational culture.

4. CONCLUSION

PT Tjiwi Kimia practices lean manufacturing in daily operational activities. PT Tjiwi Kimia also adopts MBOS (Management by Olympic system) to encourage continuous improvement. The interaction between continuous improvement and lean manufacturing practices can be achieved through the learning process of KPIs that can be conceptualized in continuous improvement that continues to rotate to increase competition from the production department. the role of the leader, especially in formulating KPIs and supporting the learning environment, has an important role in the formation of continuous improvement so that it can achieve KPI targets. while the commitment of management can support continuous improvement through existing facilities, clear performance measurement/scoring, cross sharing learning, index competition, and also reward & penalty. The proposed concept model is a rotating cycle of a set of interactions to developing it's lean manufacturing capabilities. It is hoped that the conceptual model can help provide an overview that makes it easy to be universally applied in other business places with some adjustments and adaptation to be a learning organization. This proposed model also has a limitation by not including the dynamic capabilities.

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