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e-VSM MAKE EASY

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ARTICLE INFO	ABSTRACT
Handling Editor: Rahimah Mahat *Article History:* *Received 8 July 2023* *Received in revised form 2 September 2023* *Accepted 7 October 2023* *Available online 1 November 2023* *Keywords:* Value Stream Mapping, e-VSM, LEAN Healthcare, excell, lean course.	Background and problem statement: Value stream mapping (VSM) is backbone tools in lean used to examine and enhance the flow of materials or information. In the context of e-VSM, the "e" typically stands for "electronic" or "electronic-based." It describes the application of digital to the value stream mapping process. Using software, computer-based tools, or online platforms, e-VSM able to monitor and assess improvement suggestions and digitally record value streams. Current State Value Stream Mapping (VSM) : Comparable time was done between manual value stream mapping (VSM) and electronic-value stream mapping (e-VSM) a total of 7 processes with total process time (TPT) of 56 minutes and total waiting time (TWT) of 48 minutes, resulting in a process efficiency (PE) of 53.85 %. The post electronic-value stream mapping (e-VSM) revealed a total of 2 processes, with TPT of 15 minutes, TWT of 0 minutes and the PE of 100.00%. The PE increased by 46.15%. Non-value added (NVA) activities identified were inventory, motion, extraprocessing, transportation and non-utilized talent. Kaizen Burst & Root Cause Analysis : In manual system, participants must draw and calculate process and time for efficiency.To simplify the process e VSM were used to enter the whole process and autocalculate for total waiting time, total processing time, lead time, and process efficiency. Moreover analysis on non value added, value added and value enable also calculated. Countermeasures & Action Plan : Excell format was used to preplan the value stream mapping structure. eVSM was used under guidance in every lean health care course at Bukit Mertajam Hospital and lean health care state level course. This include awareness and refresher course. Duration of teaching can be shortened from two days to one day. Sustainability: eVSM was used widely in kaizen office meeting at hospital level Bukit Mertajam Hospital. eVSM is inclusive in lean teaching modul at Pulau Pinang towards lean digitilisation.

1.0 Introduction and background

A **value stream mapping, or VSM** is typically created as a one-page flow chart depicting the current process of delivering service in from provider to customer in the healthcare industry. An important goal of value stream mapping is to identify, analyse, and eliminate processes that do not provide value so they can be improved.

Value stream mapping is backbone tools in lean used to eliminating waste from healthcare systems. However for the beginner lean participant it take longer time to produce the map.

VSM template with autocalculation was done by Dr Mohd Fahmi and improvised by team members. In the context of e-VSM, the "e" typically stands for "electronic" or "electronic-based." It describes the application of digital to the value stream mapping process. Using software, computer-based tools, or online platforms, e-VSM able to monitor and assess improvement suggestions and digitally record value streams.This is to avoid major waste of time from transcribing. First Time Quality (FTQ) is a Calculation of the percentage of good parts yield at the beginning of a production run over total number of parts produced. It indicates to what extent parts are produced correctly the first time without the need for inspection, rework or replacement. eVSM increase FTQ work as *poka yoke* or error proffing in calculation of waiting time, lead time, process analysis and process efficiency.

Calculation: Lead time (LT) = Total Process Time (PT) + Total Waiting Time (WT)

Average (FTQ) = (FTQ1/100)x (FTQ 2/100) x (FTQ 3/100)x (FTQ 4/100)x (FTQ 5/100)100=%

$$Eg = (0.7 \times 0.8 \times 0.7 \times 1 \times 0.90) \times 100 = 35\%.$$

**Process efficiency** = $\dfrac{\text{Process Time (PT)}}{\text{Lead Time (LT)}}$ x100

Hand-drawn VSM maps are not always effective communication tools. Maps must sometimes be converted to power point for presentation (Gahagan, et al. , 2007).

Lean objective is elimination of waste. Waste defined as any activity with non value added. VSM is simple iconic diagram that describes the sequence of process to produce a product. However at the end of education session in the era of technology all this steps need to convert to slideshows (Gahagan, et al. , 2007). VSM traditionally is used for quick analyses streamline of product through a manufacturing system, from raw material to delivery (Solding, P., & Gullander, P,2009).References to learn the subject, nomenclature and iconography of VSM are *My lean awareness module*, ihsr (2015).The present paper discusses results of a comparison on the eVSM initiatives compare to conventional VSM. Within conventional VSM, processes are normally characterized with constant cycle times and processing times, based on average values or one-time measurements (Lian and Van Landeghem, 2007). Dynamic system behaviour knowledge is further essential for a what-if analysis of improvement measures and changes in a future state production system (S. Alvandi,et al, 2016).Production optimization can also be supported by digitalisation or digital tools that simplify and enhance information usage and availability (Meudt et al, 2017).This important in 4th industrrial revolution. A study

also done to see how depth managerial proceedings actually put VSM into practice as the complexicity of VSM compare to other tool like jidoka.(Andreadis et al ,2017)

Figure 1 below illustrates the root cause analysis that was done in the pre-implementation phase based on observation to identify shortcomings in the hand- drawn VSM prior to kaizen application. Factors method, staff, material and environment were analysed to assess the effect on eVSM.
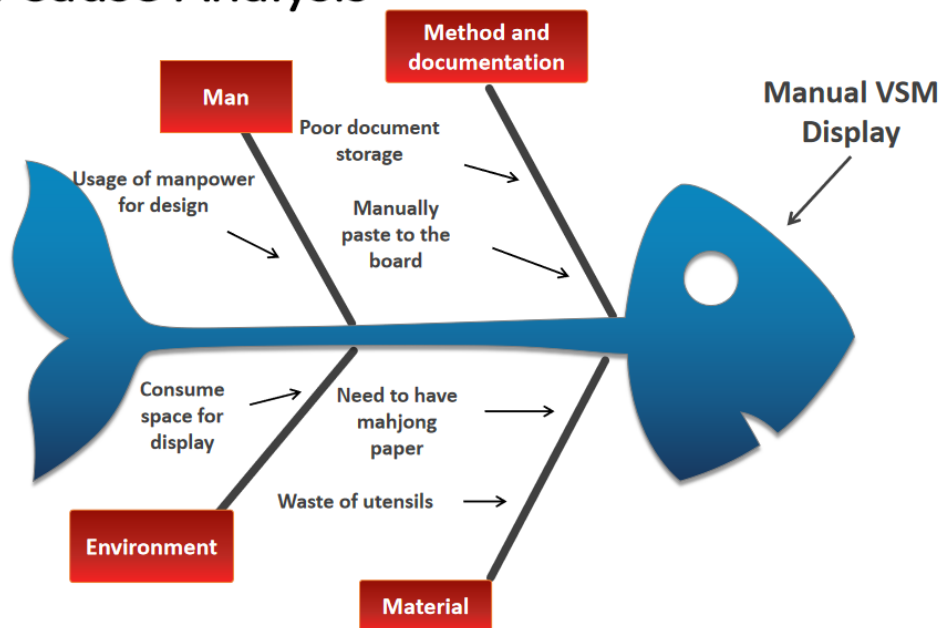
Figure 1: Root cause analysis in Hand- drawn VSM

2.0 Research Methodology

Study design

This was cross sectional design approach comparison among hand written VSM and eVSM until presentation from simulation. In study setting one VSM (**VSM of Ambulance fuel documentation flow)** as below (Figure 2) was selected and redo for both conventional and eVSM and the work processes taken until mock presentation. Duration each process was measured using stop watch and recorded. Objectives are to identify the operating situation of hand drawn VSM map to eVSM template, to identify lean tools and digitalisation of lean tools and to measure and compare duration between hand drawn VSM to eVSM implementation from drawing to presentation and from typing to presentation in lean course.
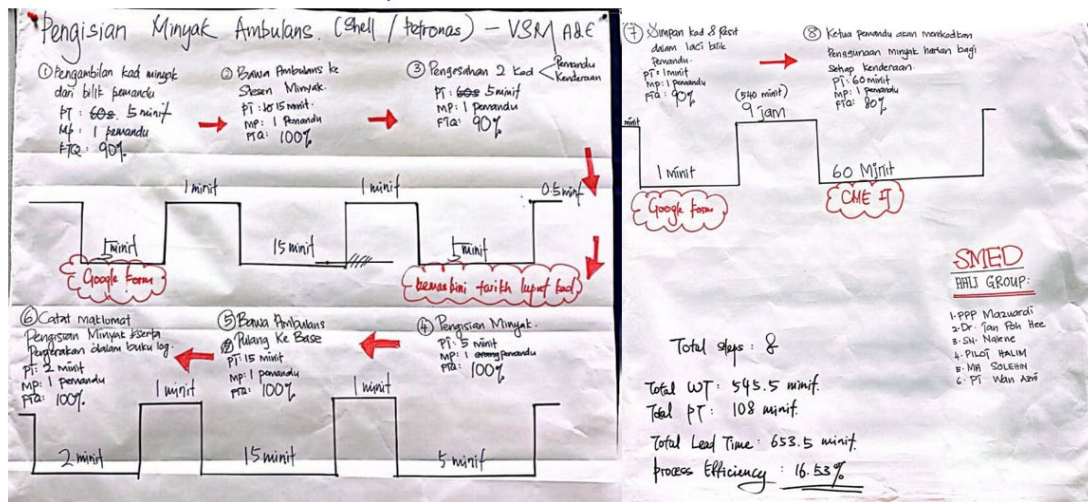
Figure 2: Hand drawn VSM of Ambulance fuel documentation flow

3.0 Result and Discussion

Comparable time was done and shown in (figure 3, 4 and table 1) from documentation till presentation between manual value stream mapping (VSM) and electronic-value stream mapping (eVSM) a total of 7 processes (figure 3) with total process time (TPT) of 56 minutes and total waiting time (TWT) of 48 minutes, resulting in a process efficiency (PE) of 53.85 %. The post electronic-value stream mapping (eVSM) revealed a total of 2 processes (figure 4), with TPT of 15 minutes, TWT of 0 minutes and the PE of 100.00%. The PE increased by 46.15%. Non-value added (NVA) activities identified were inventory, motion, extraprocessing, transportation and non-utilized talent. This result generated from simple process. However, from study variability is one of strong limit to look in the VSM process in order to enhance lean manufacturing (Braglia, 2009).

In manual system participants need to draw and calculate process and time for efficiency. To simplify the process e VSM were used to enter the whole process and autocalculate for total waiting time, total processing time, lead time, and process efficiency. Moreover analysis on non value added, value added and value enable also calculated.Muda reduction was explained in Table 2. Excell format was used to preplan the value stream mapping structure (figure 5 and figure 6). eVSM was used under guidance in every lean health care course at Bukit Mertajam Hospital and lean health care state level course. This include awareness and refresher course. Duration of teaching can be shortened from two days to one day and cost reduction as shown in table 3.The content also can be share using google sheet. This make spread of content easier in teaching session and ultimately make healthcare worker understand and know how to use VSM tool. VSM was used in report observations that seem to play significant roles as inhibitors and facilitators for proper intervention processes in seven hospital wards in Denmark, Iceland and Sweden (Winkel,et al, 2015).

Customer satisfaction survey was done among 15 users in international lean healthcare course 2023 from different category and different duration exposure. For hand- drawn VSM scaled

from 1 to 5 in feeling better and for eVSM scaled as 4 to 5 (refer figure 7) . All users agree for eVSM be continued (refer figure 8).
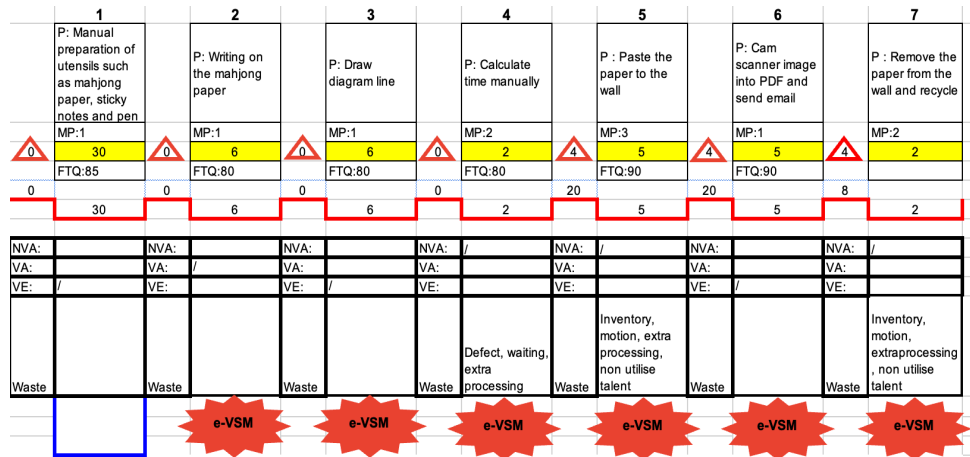

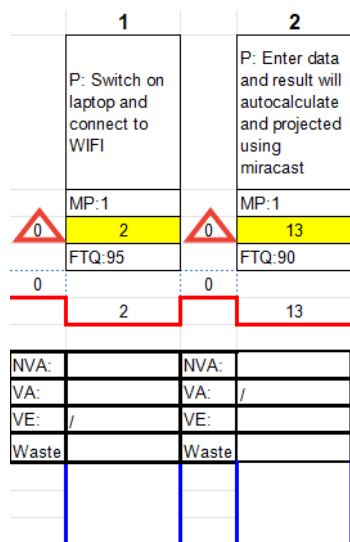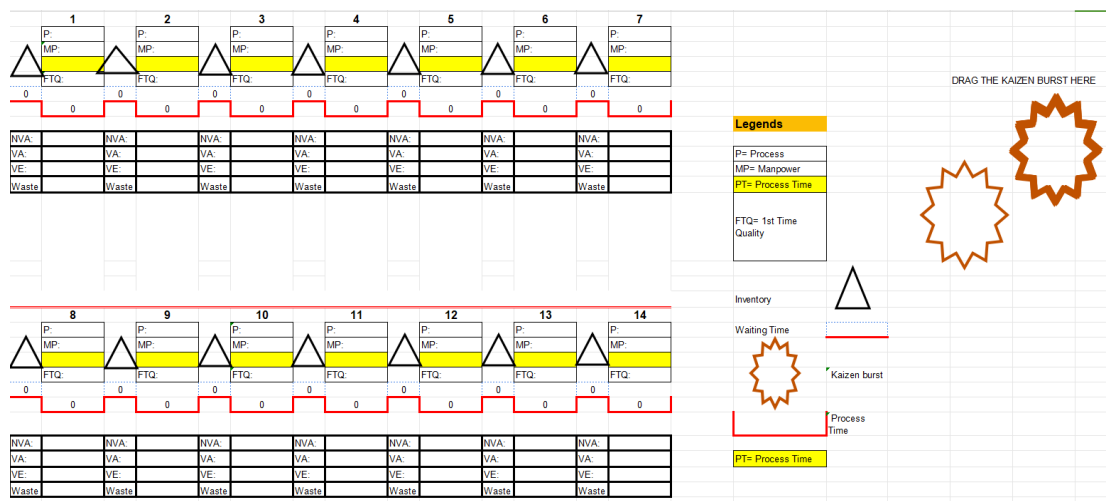**Figure 3: VSM of hand drawn VSM of Ambulance fuel documentation flow**

Figure 4: VSM of eVSM of Ambulance fuel documentation flow

Table 1: Result pre and post VSM and eVSM

METRIC	PRE	POST
TOTAL WAITING TIME	48	0
TOTAL PROCESSING TIME	56	15
LEAD TIME	104	15
PROCESS EFFICIENCY	53.85%	100.00%
NON VALUE ADDED TOTAL	3	0
VALUE ADDED TOTAL	1	1
VALUE ENABLE TOTAL	3	1

Figure 5 : eVSM icons and features

TWT	0
TPT	0
LT	0
PE	

NVA TOTAL	0
VA TOTAL	0
VE TOTAL	0

Figure 6 : Autoanalysis will display in a table

Table 2: Muda reduction in eVSM

MUDA REDUCTION IN eVSM

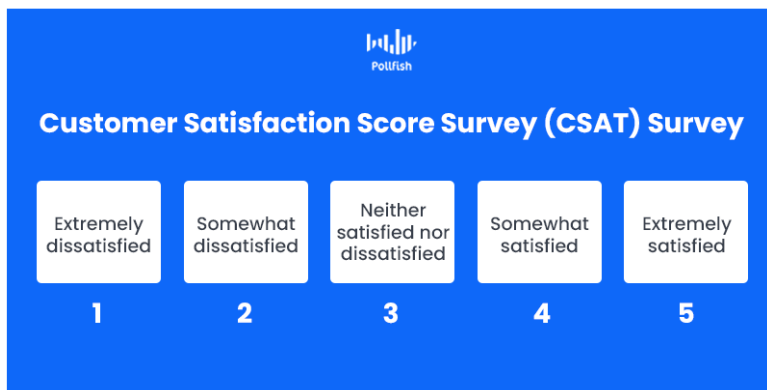| MUDA	VSM	eVSM
D (DEFECT)	Need to use another paper if any wrong process	Can delete and ad on in excell
O (OVERPRODUCTION)	Cost for mahjong paper is rm 17 for 1 bundle Cost for food RM495 per day	Cost by using self lap top or Phone Duration of teaching can cut down to 1 days
W (WAITING)	Time waiting for distribution of paper, paste and take out from wall	No waiting for paste and take off from wall
N (NON UTILIZING TALENT)	Time for doing the line of process	Line of process already prefilled
T (TRANSPORTATION)	Post course committee need to send all mahjong paper to store	eVSM upload to google drive
I (INVENTORY EXCESS)	Mahjong paper in a store	eVSM upload to google drive
M (MOTION)	Participant need to move to paste VSM to the wall	eVSM projected using miracast
E (EXCESS PROCESSING)	Participant need to retype VSM process for kaizen office meeting or publication	eVSM readily used for kaizen office meeting or publication

Table 3 : Cost reduction in eVSM for lean awareness course

Total Saving utensils & Food for course

Utensils	Price
1. Mahjong Paper	RM 17.00/ 50 pcs
2. Long Ruler	RM 2.00
3. Marker	RM 5.00
4. Pencil	RM 0.50
5. Rubber	RM 0.50
6. Stick on Note	RM 5.00
TOTAL SAVING	**RM 30**

FOOD SAVING
- RM 11 x 45= RM 495

TOTAL COST SAVING RM 570

PollFish

Customer Satisfaction Score Survey (CSAT) Survey

Extremely dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Extremely satisfied
1	2	3	4	5

Figure 7: Score for Customer Satisfaction Score survey (CSAT)
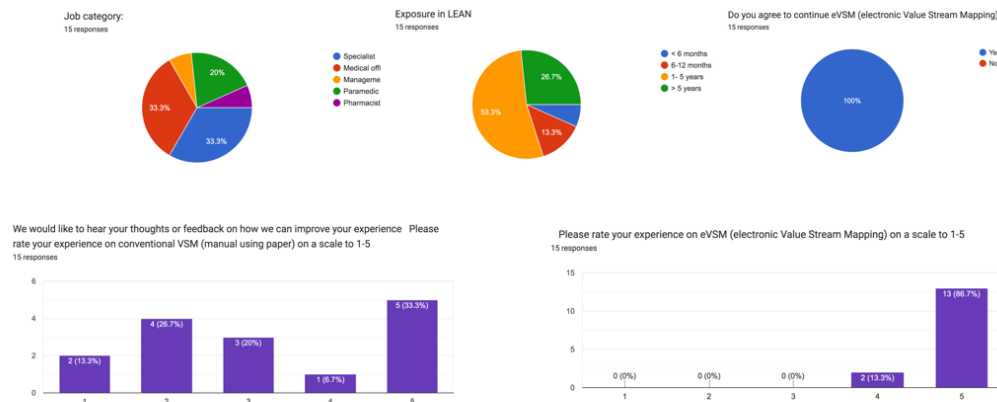
Figure 8 : Customer satisfaction survey

4.0 CONCLUSION

eVSM is part of lean digitilisation in lean tools. This benefits both presenter and facilitators. eVSM give a convenient environment to presenter and ease facilitators in lean course. The overall benefit of eVSM could be harnessed by expanding to other services outside healthcare. Applied lean knowledge among health worker is vital; thus continuous lean training are needed. (Graban, 2016). We recommended that eVSM will be implemented as digital tool in lean teaching throughout Malaysia.

As this only involved simple one flow comparison in ED Bukit Mertajam Hospital, it is necessary to expand the study (Daultani, et al., 2015) to other parts of the country and region so as to have better understanding of implementing eVSM. It is also recommended that high sample size is obtained to increase knowledge and accuracy on customer satisfaction test . The test also can include both participants and facilitators. Other potential ways to test in complex flow plus involvement of enviromental value (Alvandi, et al, 2016).

5.0 Acknowledgement

6.0 References

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