

## VALUE STREAM MAPPING: A COMPLETE REVIEW

Neelabh Gupta<sup>1</sup>, Nikhil Yadav<sup>2</sup>, Dr. Anil Kumar Sharma<sup>3</sup>  
<sup>1</sup>M.Tech Scholar, <sup>2</sup>Asst. Proffesor govt Wonen Engg. College, Ajmer,  
<sup>3</sup>Associate Professor, Jaipur Institute of Technology.

**Abstract:** The majority of the activities and undertakings, both value added and non-value added, required to bring a thing (a thought, information, product or service) from its initiation through conveyance. These incorporate activities to process information from the client and activities to transform the product on its way to the client. Value streams change in scope: reach past the undertaking to single process measure. This paper surveys the idea of the value stream mapping, its images, system and gives the entire thought regarding the same.

**Keywords:** Value Stream Mapping, Production Process.

### I. INTRODUCTION

Value stream mapping is a visual portrayal of all the sub fabricating exercises, including the flow of material and information and in addition parcel estimate, which happens along the value stream chose for a product or family [1]. The value stream mapping process will probably uncover that a lot of non-value-added exercises which eventually assumes the part of misfortune are available in current processes. These exercises devour monetary and HR and includes critical measure of lead-time without including value. Nonetheless, a portion of these exercises are extremely important in the process because of inbuilt restriction of the organization; therefore the thought is to limit their effect. [1].

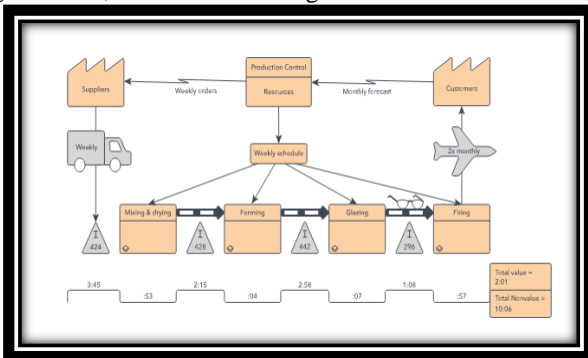


Fig. 1 Value Stream Mapping

It encourages you more than simply the single-process level, i.e. welding, assembly, fastening, painting, instrument evolving and so forth in production. You see the flow. It encourages you see more than non-value added movement. Mapping encourages you see the wellsprings of non-value added exercises in your value stream. It gives a typical dialect to looking at manufacturing processes. It settles on choice about the flow proper, so you can be capable talk about them. Something else, numerous detail and discourse on your shop occur as a matter of course. Its fix together lean idea and strategies and devices [1]. Figure 2 beneath demonstrates the value stream images used to portray each process of manufacturing or assembly.

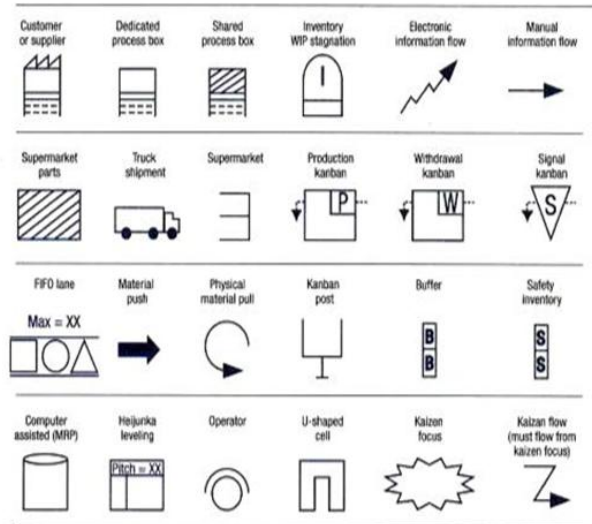


Fig. 2 VSM Symbols

Value stream mapping is a flowchart strategy to delineate, investigate and enhance the means required to convey a product or service. A key piece of lean procedure, VSM audits the flow of process steps and information from origin to conveyance to the client. Similarly as with different kinds of flowcharts, it utilizes an arrangement of images to delineate different work exercises and information flows. VSM is particularly helpful to discover and take out waste. Things are mapped as including value or not including value from the client's point of view, with the reason for finding things that don't include value.

It's important to remember that clients, regardless of whether outer or inward, think about the value of the product or service to them, not the efforts it took to deliver it, or the value that may flow to different clients. Value stream mapping keeps up that core interest. A normal process is to draw a present state VSM and after that model a superior route with a future state or potentially perfect state VSM. You can begin off portraying by hand and afterward move to VSM software for better correspondence, investigation and collaboration.

Value stream mapping in the manufacturing condition has been talked about since the strategy was utilized at the Toyota Motor Corporation, and was known as "material and information flows." Toyota centers around understanding the flow of material and information over the organization as an approach to enhance manufacturing performance. Pictorial portrayals with process maps are approaches to speak with various gatherings in an organization. Along these lines, value stream maps can give an entire perspective of how work are done through the whole systems.

II. VALUE STREAM MAPPING SYMBOLS AND COMPONENTS

A value stream map is comprised of a three unmistakable looking parts: a process map, a corresponding course of events and information flow. The process map is included the means and the information related with the means of your process. The timetable naturally works from the process map and ascertains the information entered. The information flow additionally clarifies the collaboration and action between the stations of your value chain.

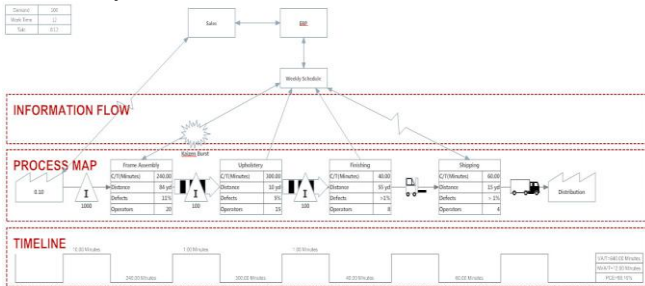


Fig. 3 Value Stream Mapping Symbols and Components

There's typically likewise a container in the upper left corner of any value stream map that rundowns the constants of the value stream map. You include the Demand, the units every day that must be delivered for example, and the Hours, the time accessible to complete the work, and the Takt, the musicality required to take the necessary steps, is naturally computed for you.

Value stream mapping utilizes an arrangement of exceptional images to imagine a process.

Process. A process is spoken to with a square shape and the word "Process". To influence the value to stream map more decipherable, a process will often spoke to the aggregate processes of a whole office.

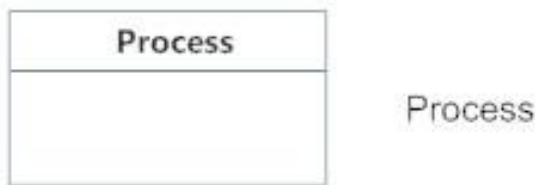


Fig. 4 Process Symbol

Inventory. A triangle with an "I" inside represents the exchange of inventory during the process.



Fig. 5 Inventory Symbol

Shipment. A shipment of raw materials from suppliers are represented with blank wide arrows. A pushing of materials from one step in the process to another is usually marked with a black arrow with three white squares inside. Shipments made using external suppliers is represented with a truck or another vehicle where applicable such as boat or train.

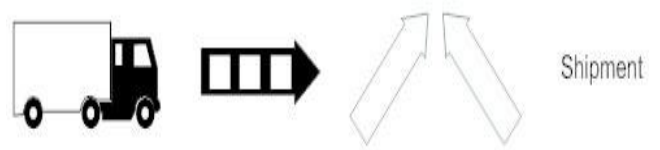


Fig 6 Shipment Symbol

Suppliers and Customer. Suppliers and customers share a similar image that resembles a dynamic, geometric portrayal of a factory. A provider for the most part will stamp the start of a process and will be found to one side of the value stream, while a client is often found as the last advance, to the furthest right of the value stream map..



Fig. 7 Supplier/Customer Symbol

Electronic flow. A line with a crisscross in the center alludes to electronic information and information trades. While a great deal of value stream mapping centers around raw materials and products, electronic trades ought to likewise be analyzed in light of the fact that they can be the base of deferrals and waste



Fig. 8 Electronic Flow

Kaizen burst. A Kaizen burst, also known as a Kaizen blitz, refers to a short burst of activity that solves a problem with intensity and urgency. Appropriately, it's represented with what looks like a cartoon explosion.



Fig. 9 Kaizen Burst Symbol

Go see. A go see refers to confirming something visually during the process and it's often represented with a pair of glasses.



Fig. 10 Go see Symbol

Quality. A quality problem anywhere along the chain can be marked with an octagon, like a STOP sign, with the letter Q inside.



Fig. 11 Quality problem symbol

III. VALUE STREAM MAPPING METHODOLOGY

To begin enhancing productivity by recognizing waste and after that expelling it by actualizing lean guideline in the

business there is no other instrument superior to VSM. The Value Stream Mapping strategy (VSM) is a perception instrument under the umbrella of Lean Manufacturing (Toyota Production System) apparatuses. It helps in understanding and enhancing work processes, the objective of VSM is to distinguish, show and lessening waste in the process. The different strides in the VSM technique are appeared in Figure 12 and are examined in the accompanying areas. The process investigation is completed by gathering the information from different enquiries with aptitude in shop floor, workers and straightforwardly partaking in estimating the season of different processes.

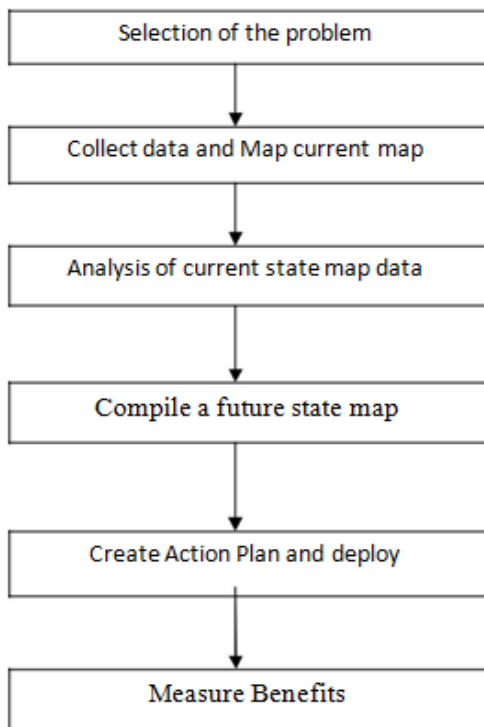


Fig. 12 Methodology of Value Stream Mapping

For any manufacturing process there must be squanders, to recognize these waste the following ventures to neglected:

1. Identify every one of the means along the process chain - This implies distinguishing the value stream, is utilized to recognize exercises where value is added to the product
2. Make those processes flow - The value added product must flow persistently from the through and through without intrusions, makeshift routes, pausing, scrap and stoppages.
3. Make just what is pulled by the client - The client should pull the product from the source as required instead of pushing the products onto the client.
4. Strive for flawlessness - After executing above advances the group ought to be consistently expel squanders as they are revealed and seek after flawlessness through nonstop change.

IV. VSM TOOLS

The principal tool, process activity mapping, encourages in creating answers for diminish waste. Fig. 13 is the map drawn according to Hines and Rich. To begin with, break down and examine the flow of processes, at that point record in detail all things required in each process. Next, list each process and categorize into activity writes (e.g., task, transport, examination and storage); darker shade box demonstrates the sort. At that point, recognize any waste in the processes and think about a superior and more effective approach to rework the process.

#	STEP	FLOW	MACHINE	DIST(M)	TIME(MIN)	PEOPLE	OT	IS	SD	COMMENTS		
1	RAW MATERIAL	S	RESERVOIR				O	T	I	S	D	ADDITIVES
2	KITTING	O	WAREHOUSE	10	5	1	O	T	I	S	D	
3	DELIVERY TO LIFT	T		120			O	T	I	S	D	
4	OFFLOAD FROM LIFT	T			0.5	1/2	O	T	I	S	D	
5	WAIT FOR MIX	D	MIX AREA		20		O	T	I	S	D	
6	PUT IN CRADLE	T		20	2	1/2	O	T	I	S	D	
7	PIERCE/POUR	O	MIX AREA 12		0.5	1	O	T	I	S	D	
8	MIX(BLOWERS)	O			20	1/2	O	T	I	S	D	BASE MATERIAL BLOW& ADDITIVES
9	TEXT #1	I			30	1+1	O	T	I	S	D	SAMPLE/TEST
10	PUMP TO STORAGE TANK	T	STORE TANK	100		1	O	T	I	S	D	DEDICATED RESERVOIR
11	MIX IN STORAGE TANK	O	STORE TANK		10	1	O	T	I	S	D	
12	J.R. REST	I			10	1+1	O	T	I	S	D	STAMP& APPROVE

Fig.13 Hines and Rich Map

The second tool, supply chain response matrix, helps identify the critical lead-time activities constraining the process, in order to target these activities for improvement. Figure 14 shows an example supply chain response matrix. The horizontal axis indicates the lead time for the product. In this example, the cumulative lead time is 42 days. The vertical axis shows the cumulative inventory in the supply chain, which represents an additional 99 working days, thus the total lead time is 141 days. Each of the activity lead times can be targeted for improvement.

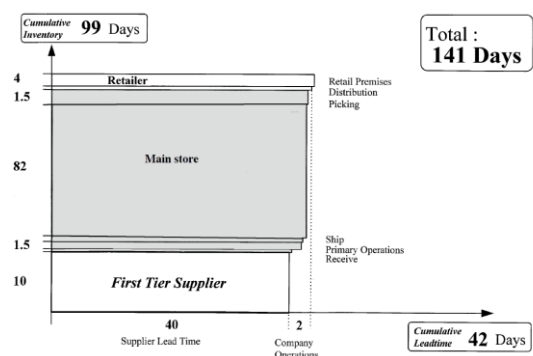


Fig 14. Supply Chain Response Matrix, Hines and Rich (1997)

The third tool, production variety funnel, aids in understanding how products are produced and how a company or supply chain operates. This tool helps the mapper to target inventory reduction and gain an overview of the company. Figure 15 shows the production variety funnel of a brewing industry case.

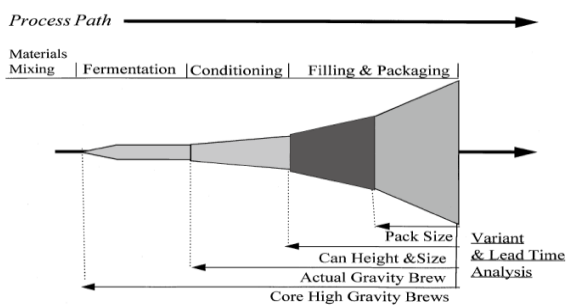


Fig.15. Production Variety Funnel, Hines and Rich (1997)  
 The fourth tool, quality filter mapping, helps to identify where quality problems occur. There are three types of defects: the first is product defect, which is when defects are not caught by inspections and are passed to customers. The second is quality defect, or service defect, e.g. inappropriate delivery (early or delay), or any defect associated with customers' experience. The third defect is internal scrap, which refers to product defects that have been caught by inspection checks. Then the three defects are mapped out; Figure 16 is an example of a quality filter map.

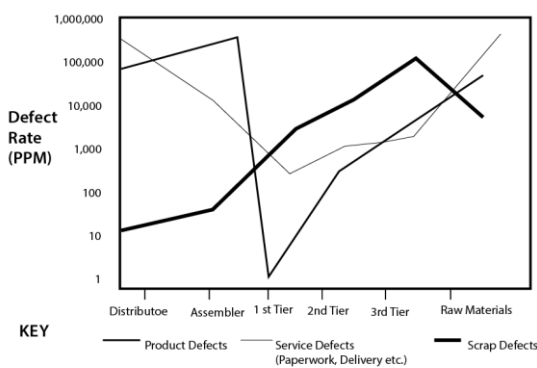


Fig. 16 Quality Filter Map

Using the mapping process, it is easier to identify where defects are occurring and to make improvement to minimize waste. The fifth tool, demand amplification mapping, helps in analyzing demand variability. A demand amplification map shows how demand changes along a supply chain, and analysis and decisions can be made using the information. Figure 1.17 is a demand amplification map of one Food Company. Two curves are plotted: the lighter shaded one is actual customer sales while the darker curve represents orders placed with the supplier to fulfill this order. From the map, the variability of supplier orders is much higher than the consumer sales. Analyzing the demand changes along the supply chain helps in managing the fluctuations or redesigning the value stream.

#### V. RELATED STUDY

W. D. Lin, E. S. Chan and L. F. Kwan, [1] This paper intends to enhance the money to money (C2C) process duration in a machining office utilizing coordinated values stream mapping (VSM) and discrete occasion reproduction (DES) strategies. C2C has been utilized as a metric to quantify the viability of working capital particularly the money administration. This paper outlined that the incorporated

VSM and discrete occasion recreation procedure can be a powerful tool for C2C process duration change. The strategy is depicted through a contextual investigation of a machining office. The outcomes demonstrate that through the coordinated VSM and discrete occasion reenactment procedure the C2C process duration could be enhanced fundamentally.

V. Hjalmarsson and L. Olsson[2] By portraying organizations through their processes it is conceivable to get an entrenched general comprehension of the organization. This contextual analysis depends on the day by day tasks of a little coordinations organization spent significant time in worldwide transportation. We perform Value Stream Mapping in order to propose upgrades prompting lessened processing time. A while later a Data Envelopment Analysis based strategy is utilized to compute the leanness score of the present system and gauge how much the leanness can increment by the proposed enhancements. Results demonstrate that waste created by awful workplace format and over-processing can be wiped out. A recommended arrangement is to acquaint institutionalized processes and with put resources into specialized instruments in order to robotize production. According to this investigation the business is 45 percent lean at give and could basic enhancements soon progress toward becoming 61 percent lean lastly achieve a perfect state at 100 percent leanness if production is computerized.

Q. Liu and H. Yang[3] Lean production is one of the activities that are connected by numerous makers to get the upper hands in the undeniably aggressive worldwide market. Value Stream Mapping (VSM) is one of the key lean tools to distinguish the opportunities for other lean methodologies and for waste end in the production system. Since the performance of the supply chain would altogether impact that of individual accomplices, the usage of lean reasoning ought to likewise stretch out past the limit of the manufacturing plant to the entire value chain. This paper presents the VSM and the broadened VSM utilized for portrayal, examination and distinguishing proof of change activities inside and remotely with regards to a footwear manufacturing venture. It can be seen from the examination of the "underlying state", "current state" and "future state" VSM that the inventory and other non-value added exercises inside the manufacturing plant can be lessened by the dispatch of lean activities inside. In any case, the market responsiveness and intensity would not be improved generously except if the expanded VSM is taken into the execution of lean.

R. Melsas and A. Rosin[4] Energy proficiency is the concentration for various organizations. On a worldwide scale, it is identified with environmental change and activities towards decrease of ozone depleting substances, for example, Paris Agreement Within the United Nations Framework Convention on Climate Change. According to the assentment, every area has its objectives on lessening of ozone depleting substance outflows. By the United States

Environmental Protection Agency, the offer of ozone depleting substance emanations from the vitality sector is around 25%, which is the biggest offer. As far as training, the ozone harming substances can be lessened by the utilization of vitality on the customer level. The current end client's vitality productivity approaches often center around the parts of the purchaser unit effectiveness instead of on the vitality proficiency of the entire system. Misfortunes in establishments and productivity of subsystems before and after the customer unit could be impressive. Therefore, usually, strategies are not utilized for both load protection and booking investigation. We propose an enhanced value stream mapping technique to assess vitality sparing of the entire system, by elaborating the heap planning strategy portrayed in our past paper. Therefore, we propose a technique for discovering misfortunes in three distinct perspectives: decrease of misfortunes before the purchaser unit, lessening of misfortunes in the shopper unit and diminishment of misfortunes behind the customer unit. The enhanced technique is depicted through an exploratory case in an evaporator plant with a basic process for woodchip passing on and stocking. At last, we contrast the technique and other vitality proficiency and pinnacle cutting assessment strategies. The advantages of the strategy are that it consolidates distinctive load forming procedures into one technique for vitality funds.

A. M. Faisal[5] Labor-concentrated little and medium-sized endeavors (SMEs) assume an important part in invigorating business and export in creating nations like India. Labor-serious little and medium-sized undertakings, for example, Leather, Textile and Garment, attempted to actualize the lean manufacturing for enhancing the intensity. The goal of this paper is to actualize the lean manufacturing utilizing value stream mapping (VSM) for calfskin little and medium-sized ventures (LSMEs). The reproduction models were broke down to comprehend the present state and future state mapping of VSM. VSM is observed to be a fitting introductory tool for usage of lean in LSMEs.

R. Melsas, A. Rosin and I. Drovitar[6]Demand side reaction empowers cost enhancement for vitality systems and modern customers. In numerous nations, it isn't generally utilized a result of execution many-sided quality. One of the answers for applying request side reaction is modern process booking according to the vitality advertise needs. From the vitality system perspective, process planning infers stack booking. The point of this paper is to give an answer for stack booking by executing value stream mapping, which is a sufficiently straightforward for production administration. Leaders in the business ought to have an unmistakable comprehension about constructive outcome from stack booking and its impact to production result and process accessibility. Value stream mapping is a notable process advancement tool from lean production reasoning. The point of value stream mapping is to shorten the lead time of mechanical processes and to diminish the middle of the road stock sums. By supplementing value stream map with process vitality power and vitality stored in middle of the road stocks, we can

advance load booking potential outcomes. Our approach gives a tool that is reasonable and traceable for industry-disapproved of chiefs. At last, we display a genuine test case for the new procedure, which depends on the production process of a region warming plant.

G. Aadithya, [7]With expanding enthusiasm for vitality administration in ventures, the process of vitality examining has turned out to be convoluted. At show, there are no productive tools to help the non-value including vitality reviewing. This paper introduces a tool which will soothe the refinement in tending to this major fragment. Proposed vitality inspecting process is organized in view of Energy Value Stream Mapping (EVSM) methods. The viability of the proposed strategy has been approved utilizing a test system with a most extreme request of 450kVA and 3.5% diminishment in Energy utilization was reported.

D. Stadnicka and R. M. C. Ratnayake[8]In order to accomplish quick conveyances by means of short lead times, organizations need to search for various manufacturing potential outcomes. Intrinsically, Value Stream Mapping (VSM) helps in distinguishing waste in manufacturing processes and additionally related business processes concentrating on limiting conceivable time wastages. There is an exchange off between costs versus shorter manufacturing or general lead time. The primary test is the end of waste to shorten general manufacturing or business process (BP) time and related expenses. The VSM has been ordinarily used for manufacturing process investigation. It is commonly watched that work force in modern organizations endeavoring to upgrade the general cost and lead time concentrate just on manufacturing related waste lessening. There are huge wastages created from general BP, which likewise straightforwardly or by implication impact lead time to move past the foreseen edge limits. Henceforth, this original copy places effort into building up a straightforward approach for VSM for examining and researching drawbacks in the general BP. A contextual analysis has been performed in collaboration with an airplane save parts manufacturing firm (AMF). A straightforward approach has been created utilizing the contextual investigation to explore the wasteful aspects exhibit in the citation arrangement process (QPP). Notwithstanding the approach, the subsequent current state map (CSM), future state map (FSM), lead time (LT), processing time ( $T_p$ ), process cycle productivity (PCE), value added activity change (VAI) and non-value added activity change (NVAI) have all been broke down.

## VI. CONCLUSION

In conclusion we say that VSM is different than conventional recording techniques, as it captures the information at individual stations about station cycle time, up time or utilization of resources, set-up time or change over time, work in process inventory, man power requirement and the information flow from raw material to finish goods.

REFERENCES

- [1] W. D. Lin, E. S. Chan and L. F. Kwan, "Integrated value stream mapping and simulation for cash-to-cash cycle time improvement of a machining facility," 2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Singapore, 2017, pp. 2063-2067.
- [2] V. Hjalmarsson and L. Olsson, "Quantifying leanness combining value stream mapping with a data envelopment analysis based method — A case study at a swedish logistics company," 2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Singapore, 2017, pp. 740-744.
- [3] Q. Liu and H. Yang, "Lean implementation through value stream mapping: A case study of a footwear manufacturer," 2017 29th Chinese Control And Decision Conference (CCDC), Chongqing, 2017, pp. 3390-3395.
- [4] R. Melsas and A. Rosin, "Use of value stream mapping for evaluation of load conservation and peak clipping possibilities," 2017 IEEE International Conference on Environment and Electrical Engineering and 2017 IEEE Industrial and Commercial Power Systems Europe (EEEIC / I&CPS Europe), Milan, 2017, pp. 1-6.
- [5] A.M. Faisal, "Simulation modeling and analysis of value stream mapping for the implementation of lean manufacturing in labour-intensive small and medium-sized enterprises," 2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT), Chennai, 2016, pp. 3567-3569.
- [6] R. Melsas, A. Rosin and I. Drovitar, "Value stream mapping for evaluation of load scheduling possibilities in a district heating plant," 2016 IEEE 16th International Conference on Environment and Electrical Engineering (EEEIC), Florence, 2016, pp. 1-6.
- [7] G. Aadithya, "Application of energy value stream mapping as auditing tool for non-value added industrial energy management," 2016 3rd International Conference on Electrical Energy Systems (ICEES), Chennai, 2016, pp. 62-66.
- [8] D. Stadnicka and R. M. C. Ratnayake, "Simple approach for Value Stream Mapping for business process analysis," 2015 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Singapore, 2015, pp. 88-94.