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Application of Value Stream Mapping to Eliminate Waste in an Emergency Room

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Application of Value Stream Mapping to Eliminate Waste in an Emergency Room

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Abstract - Value Stream Mapping (VSM) is a lean/quality management tool which assists in establishing the current state of a process while aiding to uncover opportunities for improvement vis-à-vis the seven sources of waste. This research effort involves a review of existing literature pertaining to application of the VSM tool in hospital emergency rooms/departments. The paper will present the potential benefits emanating from application of VSM along with assessing its effectiveness in scenarios where it has been implemented already. Furthermore, challenges faced in implementation of the VSM tools are collated. Various solutions to address these challenges have been presented in the light of tribulations faced by today's healthcare industry.

increasing productivity, and ensuring job satisfaction (Womack et al., 1990). Lean took roots at Toyota Motor Company's shop floor in Japan about 50 decades. Over time the approach has spread into many organizations world wide regardless of their core businesses

The lean approach includes many principles and activities. These are shown in the figure 1. Essence of the lean approach, according to Burgess and Radnor (2008), involves: 1) identifying what creates value for customers and understanding how those requirements can be met, 2) developing a value stream for each product or process family and identifying waste, 3) maintaining a continuous flow by standardizing processes, practices, and procedures, 4) creating a pull system at all steps where continuous flow is not possible and 5) managing perfection by removing or eliminating non-value added activities.

I. INTRODUCTION

Lean principles originated with objectives of reducing waste, decreasing inventory and operating costs, improving product quality,

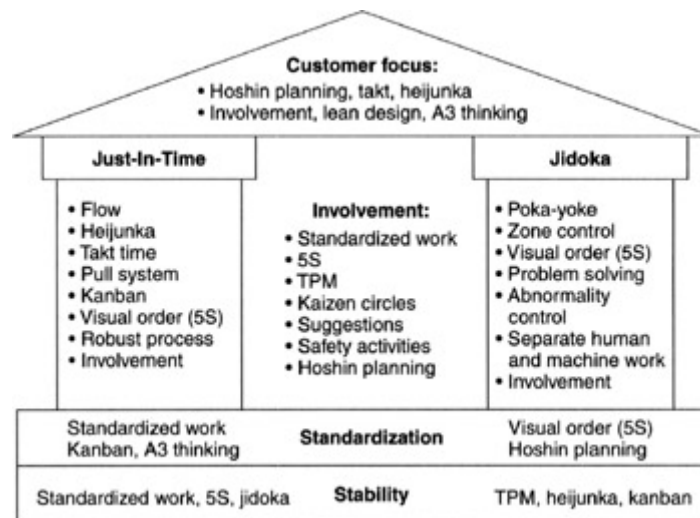


Figure 1 : Lean Principles and Activities (Pascal, 2007)

Value Stream Mapping - VSM - is a lean tool which assists establishing the current state of a process while aiding to uncover opportunities for improvement. The value stream mapping process could be divided into four steps: 1) identify a product or service family, 2) create current value stream to determine the current problem from the standpoint of the organization and customer, 3) create the ideal future state map, 4) identify corrective actions needed to close the gap between the current state and the ideal future state, 5) implement the

corrective actions, 6) create a new current state map to verify if problems identified in step 2 have been eliminated/mitigated. Importance of keenly vested cross-functional team work is indispensable to success of VSM process.

Keyte and Locher (2004) explain that the VSM approach, which has been traditionally used in manufacturing settings, could be applied to service settings, including administrative processes, as well. Kim et al. (2006) conclude that despite inherent challenges in implementing lean principles, they can help deliver "...high quality and efficient care to

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patients...” in turn the health care sector could “...anticipate the same high level of success that the manufacturing and service industries have achieved using this approach” (p.199). In service settings, creating a current or a future state value stream map for a specific process could involve following steps: 1) determine the start and end points of the process, 2) identify all stakeholders, 3) identify metric which could be used as a stand-in for the value flowing through the process, 4) create a process flow by identifying all preceding and succeeding steps to a specific step, 5) quantify in terms of the metric identified in step 3 amount of useful and wasteful work, 6) identify opportunities for improvement and, 7) identify improvement actions to address opportunities for improvement. Some examples of the metrics include time and, monetary load. Furthermore, a set of icons and symbols may have to be defined to concisely depict the process and the flow of value.

While making a quantitative assessment, in terms of the identified metric, following evaluation criteria could be employed to determine whether each process step is:

Valuable, meaning whether it actually creates value from the standpoint of the customer... Capable, meaning the degree to which a good quality result is achieved every time ... Available, meaning the degree to which the step is able to operate when it is needed ... Adequate, meaning the degree to which capacity is in place to respond to customer orders as needed ... Flexible, means the degree to which a process step can switch over quickly and at low cost from one member of a product family to another. (Womack, 2006, p.150-151)

A value stream map is illustrated in figure 2. Typical VSM symbols as shown in figure 3. Software packages such as Microsoft Visio, eVSM, iGrafx and, Edraw Max could be used to draw value stream maps.

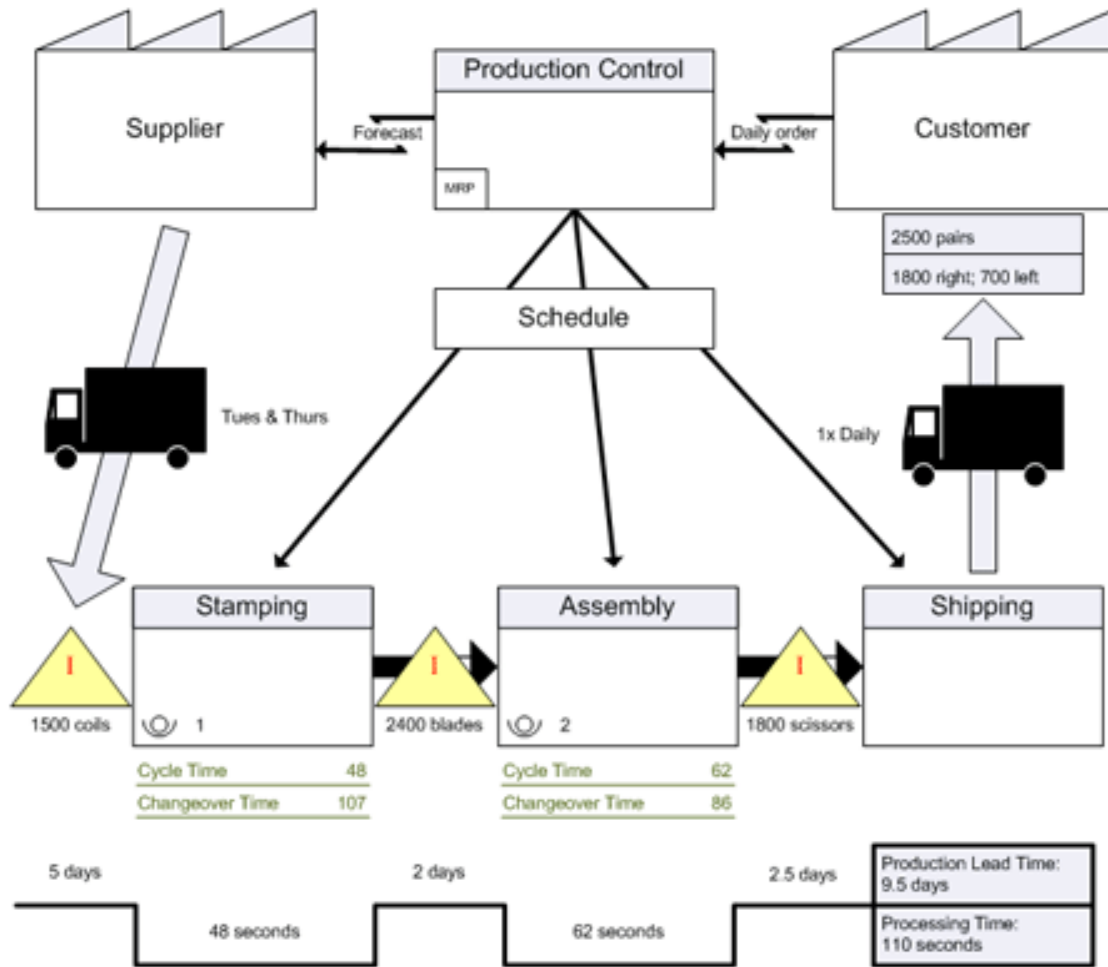


Figure 2 : An example value stream map (Microsoft, 2012)

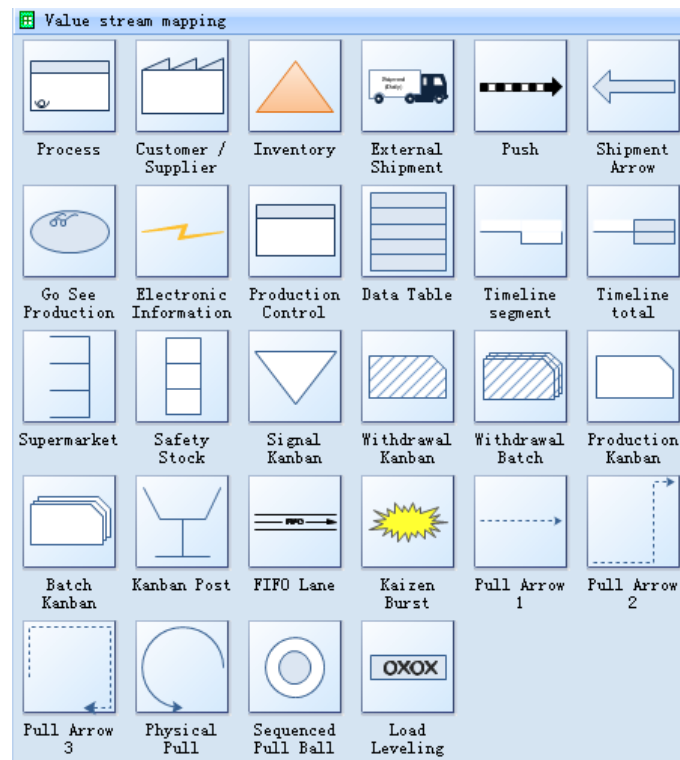


Figure 3 : Typical VSM symbols (EdrawSoft, 2012)

II. HEALTH CARE AND LEAN PRACTICES

Rother and Shook (2003) suggest that value stream encompasses all actions, value added and non-value added, from concept to production and beyond, required in taking a product or service to customers. They further explicate that value stream mapping entails following the production path of a test piece in order to draw a visual representation of every involved process including material and information flow. Values stream mapping can help to identify issues associated with seven types of waste (Hines and Rich, 1997) in the flow of value. Additionally, the value stream mapping assists in establishing effective solutions to minimize the non value added steps thereby creating a lean system.

A 2009 report published by Thomson Reuters that U.S. healthcare system wastes \$700 billion a year. Similarly The Boston Globe, in 2008, reported that waste in health care was close to \$760 billion a year. The waste among other factors has been attributed to 1) misuse, overuse, underuse, of services and equipment, 2) errors and mistakes along with associated rework, 3) lack of communication and coordination, 4) other special cause variation. These wastes fall in alignment with the seven wastes described by Pascal (2007).

Emergency rooms/departments are integral to modern health care system. Merriam-Webster define emergency room as a hospital room or area staffed and equipped for the reception and treatment of persons with conditions (as illness or trauma) requiring

immediate medical care. Much like the entire health care system the emergency rooms are rife with waste. Khurma et al. (2008) conclude that lean methodologies can be successfully implemented to address wastes associated with an emergency room including but not limited to transportation, over-processing waiting and motion. Similar conclusions were also drawn by Bush (2007) and Van Den Heuvel et al., (2006). Pursuant to the preceding discussion it can hence be argued that lean principles including VSM can be employed to systematically and systemically eliminate these sources of waste in the health care industry.

III. IMPLEMENTATION OF VSM IN EMERGENCY ROOM

Koelling et al. (2005) describe in detail the process of performing a VSM in an emergency room environment. They provide a theoretical and procedural basis of the VSM process which included emphasis on; 1) identifying the target system – services/process families – which needs to be improved, 2) constructing current and future state VSMS by using standard set of icons, symbols and arrows. The researchers constructed a process flow chart to properly chalk out the scope of their VSM related activities. The flow chart is supplemented with brief description of activities happening at each station. The researchers elucidate the methods to calculate cycle time, change over time, inventory time. The researchers acknowledge

challenges presented by health care sector might be different than manufacturing. However, they do assert that there is high probability of successfully leveraging VSM in a health care (emergency room) environment. Akin to Koelling et al., Manos et al., (2006) explain that VSM in health care should be associated with a continuous Plan-Do-Check-Act (PDCA) cycle.

Willoughby et al., (2010) studied wait time and service time for patients visiting emergency rooms. It was found the about half of the five hours spent by a patient in the emergency room was spent waiting. Using the VSM methodology the researchers calculated the value added, non value added and lead times for treating patients. Subsequently by applying the PDCA process the researchers inculcated many simple yet effective improvements. The researchers noted major challenges they faced included: 1) maintaining a smooth pace of lean activity during their project, 2) finding required human resources leading intermittent contribution to the PDCA, 3) lack of conviction on the part of workforce, 4) lack of expertise and training of the workforce with regards to assigned tasks and responsibilities and lean methodologies including VSM, 5) arbitrarily varying patient influx – lack of production leveling and 6) cost intensive data collection due to lack of automation. This research study puts forth a gamut of challenges which can make benefits realized by the researcher temporary. Eller (2009) although used different key performance indicators (KPI) has had similar success as Willoughby et al. However, Eller seems to treat the lean tool/VSM for singular use only. Clearly, without complete involvement of the workforce kaizen - continuous improvement - is not possible. Furthermore, VSM based activities might have identified the issues at a given time. Value stream improvement is not an event but it is an ongoing incrementally constructive process.

King et al. (2006) mapped the patient flow in a teaching general hospital with an objective to minimize "... complex queuing..." (p.396) and reduce waiting time in the emergency rooms/departments. The researchers leverage the VSM methodology, supplemented with staff experienced in performing their tasks, to identify possible improvements. Like some other researchers included in this review, King et al. also focused on the triage process. The triage process involves sorting and prioritizing the patients based on the severity of their illness. Experience of the medical staff was used to categorize the patients who were then treated under redesigned procedures/lines specific to their category.

The researchers identified that they felt initial resistance. However, actively involving the workforce and the customers in their improvement initiatives proved to very effective. Additionally, it seemed that the changes made were permanent and other departments which the hospital organization may soon follow suit.

This specific team adapted application of the methodology according to their requirements. The lessons learned from this study underscore the importance of the human involvement in the success of any lean initiative.

Similar to King et al., Kaale et al. (2005) adapted the VSM methodology to match their specific healthcare setting. This group of researchers aimed at reducing the wait time in the triage process. A key difference between King et al. and Kale et al. is the amount of decision making during the triage process. At least one of the improvement actions instituted by Kaale et al. (2005) seem to reduce the triage time by pushing the work to the next silo. Specifically, they determined that "...efforts should be implemented to minimize triage nursing evaluation time of critical patients with expedited room placement" (p.108). This approach could be a major issue in effectively implementing VSM and other lean principles across the organization. Lean approach needs to be all inclusive and not à-la-carte.

Studies by Dickson, Singh, Cheung et al. (2009) and Dickson, Anguelov, Vetterick et al. (2009) have been reviewed in conjunction. Both research papers and associated activities commenced their kaizen by drawing out the current state VSMs. This in turn lead to a through review and subsequent redesign of the process focused on reducing waste. The reduced of the non value added activities/inventory time involved usage both the PDCA and empowering the frontline workers. Furthermore, the future state VSM, based on improvement actions suggested by frontline workers, was successfully used to reduce patient length of stay and improve customer satisfaction. The researchers seem to be committed to continuous improvements. They kept improving at every iteration of VSM. The author highlighted the importance of the role played by the management. Two keys points which could prove debilitating to VSM lean activities, as pointed out by the researchers, include: 1) failing to make many small incremental improvements in the hope of waiting for big breakthrough and 2) not adapting the lean principles to local cultures.

Holden (2010) lists VSM as a significant lean tool. More importantly the researcher also lists nine key suggestions for useful lean implementation in an emergency room. These include: 1) entire organization should recognize that a problem exists and a solution is needed, 2) lean approach should be human-centered, 3) expertise in application of lean principles and work responsibilities is an absolute must, 4) top management should support the lean activities and should allocate any needed resources, 5) install lean champions who well respected socially and who can motivate others to join in, 6) adapt lean to local context and culture, 7) learn for past experiences, 8) focus on continuous improvement – lean is a never ending process not an event and 9) lean cannot be implemented in pockets – it

requires an holistic systems approach. These nine suggestions provide an important insight about challenges which an emergency room could face in effort to implement VSM and in turn becoming lean. If an emergency room (organization) fails to follow even one of the suggestions above results of a VSM activity, or any other lean principle for that matter, would be futile.

IV. DISCUSSION

The preceding discussion establishes that VSM could be applied successfully to an emergency room setting albeit some challenges. The challenges could be divided into two groups – intrinsic and extrinsic

Intrinsic to the workgroup: VSM facilitators should possess exhaustive knowledge of the conventions, symbols and lean philosophy. The knowledge increases with experience and broadening of perspective. A VSM facilitator should be adept in moderation and consensus building skills. Furthermore, work group team members in a VSM should have a working knowledge of the method. This can be achieved by introductory training. Team members need to have full confidence in the process for it to be successful. More importantly team members should comprehensively know the emergency room processes being evaluated. VSM like any other lean tool is human centered. Constructive feedback and open-mindedness towards incremental success would help the team in identifying the waste and subsequently eliminating it. VSM is a continuous improvement tool based on PDCA cycle. VSM practitioners should thus iteratively look for sources of waste in an effort to minimize it. Lastly, the workgroup should communicate their achievements to other colleague in order to inspire them.

Extrinsic to the workgroup: Management support to should ensure that the VSM workgroup comprises of employees who are closest to the problem. In an emergency room setting it could involve doctors, nurse, para-medical and other staff, security. Furthermore, the management should empower the employees with authority and responsibility to make the necessary changes in a timely manner. Management should support lean principles across the organization instead of cherry picking the tools and/or departments for implementation. Traditional VSM in an emergency room should be modified and enhanced to meet the unique circumstances. This could include adding more icons and/or usage of swim lanes to describe various stakeholders.

In conclusion, VSM could prove to be an invaluable tool in eliminating waste from an emergency room. However, the practitioners and their sponsors must ensure that the VSM should be used to: identify waste, plan waste reduction, reevaluate the level of waste in the improved process, in an organization wide, perpetual cycle.

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