UOB-SMU
Asian Enterprise Institute

High-mix Low-volume (HMLV) Environments: Challenges and New Journeys

Wemark Techno Engineering Pte Ltd is a home-grown company that was established in 1984. Today, it is a group of companies that offer various integrated engineering solutions such as:

- Turnkey contract manufacturing
- Design and custom fabrication services
- Precision machining services
- Design and manufacturing of clean-room products & equipment
- Project management and system installations for equipment suppliers

Headquartered in Singapore, Wemark currently has two main business divisions – namely Contract Manufacturing and Engineering Services.

The Contract Manufacturing business division focuses on high-mix low-volume turnkey manufacturing of equipment and parts for the defence, oil & gas and process industries. Wemark now has integrated facilities under one roof for CAD/CAM, precision machining, laser cutting, heavy fabrication and electro-mechanical integration. Wemark also has a secondary production site in Johor, Malaysia.

The Engineering Services business division focuses on providing installation, hook-up and commission services in two major areas –- Plant Utilities, and Material Handling Equipment. For Plant Utilities, Wemark is the in-house contractor for several Fortune 500 manufacturing companies, where it provides engineering services for installation and maintenance of, for example, pipings, ductings and energy-saving solutions. For Material Handling Equipment, Wemark is the preferred installation contractor to three of the world's top five Material Handling Equipment vendors.

To serve its customers better, Wemark has recently embarked on an aggressive drive to grow the company through machinery acquisition, organic growth and mergers & acquisitions of related engineering companies.

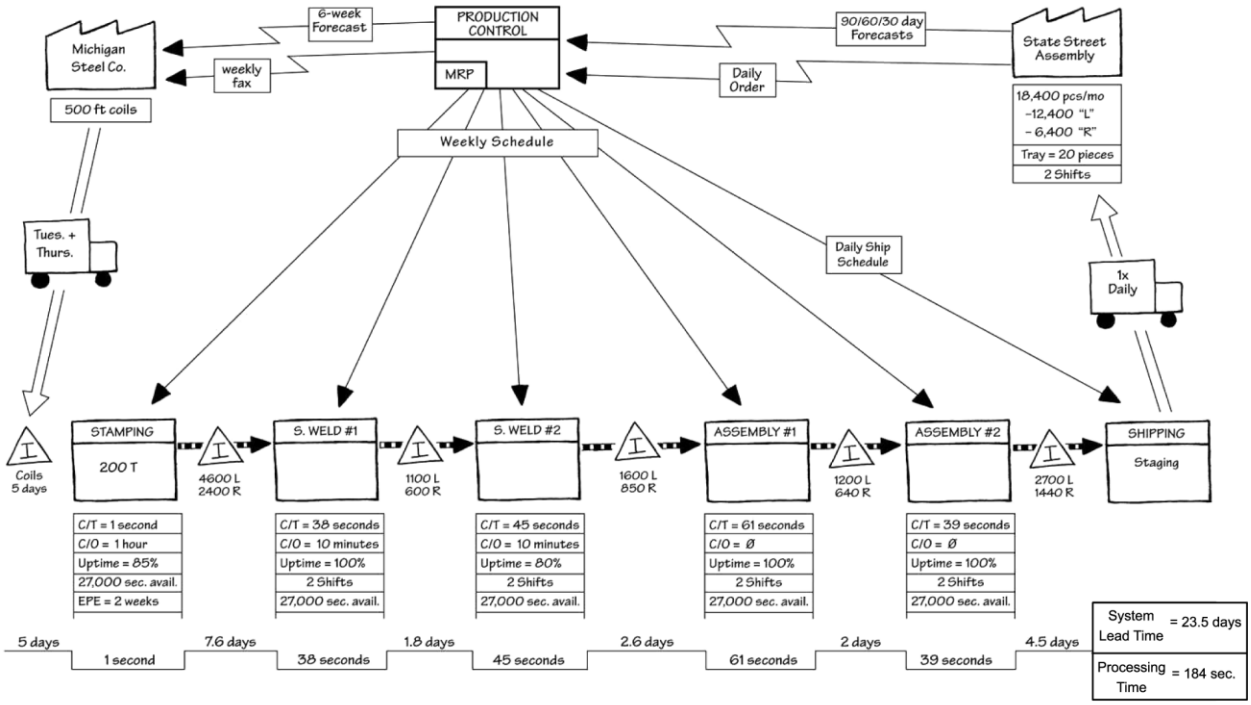
Wemark is very aware of the complexities stemming from high-mix low-volume (HMLV) environments and understands that if those challenges could be overcome, it will certainly give the company a competitive advantage. As part of its growth strategy, Wemark commissioned the UOB-SMU AEI to perform an analytical study using scientific techniques to:

1. improve the flexibility of high-mix low-volume operations and
2. streamline the flow and routing of jobs of the manufacturing process

Two teams of five student-consultants each were assembled.

Really understand your operations. And your people.

The project started by first walking the floor in order to produce a value stream map (VSM). A value stream map captures and details all information pertaining to the daily operations (see Figure 1 for an example). This helped the teams quickly understand how manufacturing operations actually work within Wemark, and also provided a system of check and balance on plant productivity to the management. The key take-back here was the identification of gaps that could potentially be addressed as part of the action plans.



Note: C/T = cycle time; C/O = change-over time; EPE = every part every ____

Figure 1: An Example of a Value Stream Map (Source: James Womack, "Value Stream Mapping", 2006)

The next step was to understand the skill sets of the staff in order to (i) identify their primary and secondary skills; (ii) provide cross-training, thus enabling flexibility in production, and (iii) develop talent and leadership potential. To do this, the team interviewed the employees and mapped out their skill sets (see Figure 2 for an example). This will be used to track the personal development goals for knowledge and skills.

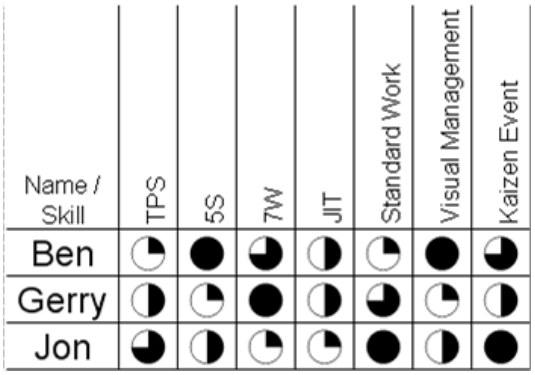


Figure 2: An Example of a Skill Set Matrix
(The shaded area depicts the level of development in a particular skill. For example, Ben is skilled in 5S and Visual Management.)

Both these techniques are inherently visual, and help the company to communicate its goals easily to a heterogeneous workforce.

Following this, a plethora of numerical analyses was carried out to provide an account of bottlenecks, capacities, throughputs, utilisation levels of key resources and waiting times, to name a few. A common question that typically comes to mind in an HMLV setting is the production batch size. With a large batch size, we require fewer setups and this prevents us from producing a mix of items. With a smaller batch size, we require more setups and this prevents us from leveraging on a full production run. What we need to determine is an optimal batch size that will minimise the waiting time and provide a nice balance between utilisation and the number of setups. To do this, it helps to visualise how waiting times and flow times (that is, the time it takes to complete a batch) react to differing batch sizes (see Figure 3 for an example). A few key points should be observed:

1. If the batch size is too small, the waiting time and flow time spike
2. There is an optimal batch size which provides a minimum waiting and flow time (look for the dip); this batch size can also be increased slightly without too much of an impact on time
3. As batch sizes become larger, the time it takes for the entire batch to be completed increases exponentially, so watch out for this!

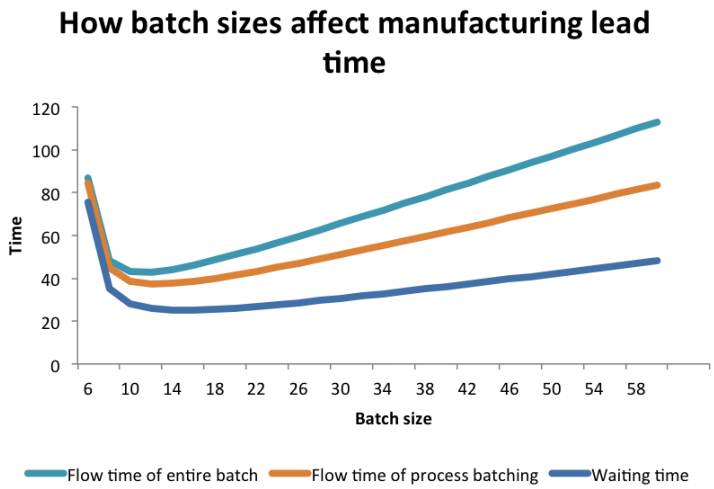


Figure 3: It is important to identify a suitable batch size to prevent overly long waiting times. A suitable batch size in this graph would be one that has the shortest time. In the graph above, the batch size would be about 10.

"Change isn't easy"

A production line in a company that provides manufacturing services can be viewed quite aptly as a bloodstream. If it gets choked, everything grinds to a halt and that is never good news for any company. Change is therefore a daunting task. As Mr Zyron Goh, COO of Wemark, said, "Change isn't easy but I plan to start slowly and adopt the recommendations – one at a time". He has already begun to introduce into Wemark the first recommendation – of having a skill-set matrix for his production workforce, with a view to re-organising the existing fabrication teams into smaller specialist teams that can better react and adapt to new projects and specifications from customers.

The experience with SMU has also been a positive one for Wemark, with Mr Goh stating that he was "really impressed with how quickly the students were able to learn about Wemark's manufacturing business". He was impressed with the insights that the students were able to share on both Wemark's current state and potential upsides, and the recommendations provided on how to embark on the implementation plan.

He also commented on "the methodical approach used by the students during the projects to obtain hard facts about the current situation, and their analyses of the captured data to obtain a baseline state of the business." All this led to and built a very compelling case for the key insights and recommendations provided in the project.

The beginning of a new journey

Project Advisor Dr Koh Niak Wu said that he has had a wonderful experience working with the student-consultants. They displayed "tenacity and perseverance in pushing their limits, working well under pressure when it came to the crunch". He also complimented UOB-SMU AEI for their efforts in engaging the industry, and creating an impact with their flagship SME Consulting Programme.

From the student-consultants' perspective, they have gained very valuable real-life analytical consulting experience, as well as how to manage tight deadlines amidst their current workload. Through this programme and under the leadership of Dr Koh, they are now "ahead of their peers"; they have learnt the

importance of communicating the project requirements and progress among the team members, and more importantly, they have learnt to manage the client's requirements and expectations through clear communications.

"One of my key desired outcomes from the projects was a way to "manage the madness" of an HMLV manufacturing business – and now, I feel that I've been given the key to start that journey!" - Mr Zyron Goh, COO, Wemark Techno Engineering Pte Ltd.

Project Advisor: **Dr Koh Niak Wu**

Student Consultants:

Reactive Capacity Team

Xu Qian
Bachelor of Business Management

Nicholas See Tong
Bachelor of Business Management

Hasisha d/o Muhamad Nazir
Bachelor of Business Management

Pauline Lee
Bachelor of Business Management

Wang Yidong
Bachelor of Science (Information Systems)

Virtual Layouts Team

Jeremy Lim Yan Tat
Bachelor of Business Management

Tan Chun Wee
Bachelor of Science (Economics)

Lim Zhi Jing
Bachelor of Business Management

Tanya Larasati Utomo
Bachelor of Business Management

Tecson Pelagio Paolo III Banez
Bachelor of Business Management