Whether it’s a supermarket, a furniture maker or a chip producer, every company is constantly looking for the most cost-efficient logistics strategy. It is not only the cost of material and labor that determine an item’s production costs but also the storage and transport of parts, for instance.

Managing the flow of goods around a product, from the start of the supply chain to delivery to the customer is central to the Logistics Management Systems (LMS) program.

“Logistics strategies have always been important, but they have become more complex in the past twenty-five years,” says Nico Dellaert, PhD, director of LMS. “Capital-intensive industries in particular, like Philips and ASML, outsource most of the components for their products to other companies. There may be up to a hundred suppliers for one product, mainly located in Asia. Good management of the supply line requires a lot of logistical planning.”

The demand for logistics experts has been considerable ever since the program began. LMS students carry out their end project at all kinds of companies like ASML, the National Railway, Philips Lighting, KLM and Heineken.
PO-CHUN (LIONEL) YANG  
MSc, PDEng (2007-2009)

weekends tend to be few, and that is something I had to get used to. My main project at ASML centered on the supply chain of parts for lithographic systems. Companies often use a Material Requirement Planning (MRP) system, checking what parts they need and estimating when they should be ordered to get the product finished in time. And when market demand changes, the planning of the materials in the MRP system is adjusted.

Some years ago demand for ASML high-tech systems declined. MRP planning meant that a lot of materials stacked up from the supply line could not be used straightaway. They had to be stored, an expensive exercise. I investigated how the logistical planning could be made more cost-efficient and then made a supplier chain control framework, a way of better controlling the supply chain. In complex equipment around eighty percent of the production costs are contained in about twenty percent of the parts. If purchasing of that critical twenty percent can be better planned, the total cost can be reduced. So I recommended making an initial selection of those critical parts, giving them greater focus. By splitting the production of them into various stages, whereby ASML had more communication and coordination with the respective suppliers, the supply line can become more efficient, flexible, transparent and less uncertain.

Actually, planning the whole supply chain is a combination of ‘make to order’ and ‘make to stock’ planning. Some parts you would like to have in permanent stock so you can get started immediately when an order comes in (‘make to stock’). This is good for performance to the customer but it does require a lot of storage space. Other parts you make when a customer provides specific requirements (‘make to order’).

If the turnaround point in the planning of the supplier line lies early in the manufacturing process at ‘make to order’, this can easily prompt a delay. This is even more likely the more uncertainties the production process has. On the other hand, you avoid purchases that are superfluous in retrospect. In the planning system, you have to account of both cost-efficiency and performance.

I made a simulation model that calculates the consequences of a given choice for both aspects. The results of the simulation and the supply chain control framework function as a basis for subsequent projects geared to improving ASML’s planning system.

If I had opted to go to work in Taiwan after my studies, my professional life would have turned out quite differently. In Taiwan I often worked twelve hours a day for months on end, and sometimes even longer. This leaves little time for yourself. Here I have learned to enjoy life. Dealing with people from different cultures has been just as important as acquiring knowledge. It is an experience that has really changed me.

The program has really changed me'

IMPROVED LOGISTICAL PLANNING OF SUPPLY CHAIN FOR ASML

Some LMS subjects were real eye-openers for me. I learned which factors you have to take account of in planning at a large company, something I just did not get in my Industrial Engineering study in Taiwan. The social skills I acquired were equally important. In Taiwan I was always very shy. Here I got some insight into my performance within a group and I learned to give presentations.

In the first year we did different design projects as a team. This was a very valuable experience for me involving, as it did, students from various cultural backgrounds. I noticed how each culture brought a different behavior with it. In Taiwan people consider it normal to work overtime whereas the Dutch generally have a nine-to-five mentality. Their weekends tend to be few, and that is something I had to get used to. My main project at ASML centered on the supply chain of parts for lithographic systems. Companies often use a Material Requirement Planning (MRP) system, checking what parts they need and estimating when they should be ordered to get the product finished in time. And when market demand changes, the planning of the materials in the MRP system is adjusted.

The new planning concept embraces much more than shifting the customer order disconnection point and the scenario planning tool. I reckon that it will take about another year and a half before the new planning concept can be fully implemented. We then expect to offer our customers a higher delivery performance with lower stock costs and risks in the supply chain.

‘Balance between delivery performance and stock costs is a logistical challenge’

ASML develops high-tech lithography machines for chip manufacturers. Developing a new generation of machines takes years and ‘time to market’ of new technology is essential. New generations of machine types succeed each other fast and the machines of a new generation undergo several engineering changes to meet customer requirements.

ASML purchases more than ten thousand parts from over six hundred suppliers. We assemble these parts into modules and then into machines that are fine-tuned and tested before transport to the customer. The cycle time in the pipeline for ordering parts, assembling and testing machines is much longer than the customer order lead time, which makes it necessary to forecast future demand. That is not easy since the semiconductor industry is a very dynamic market. Furthermore, the ASML lithography machines are highly configurable, customer specific. Flexibility is needed to respond fast to unforeseen changes in market demand. Therefore, we work structurally on reducing the cycle time in the factory and in the supply chain. In addition, we plan capacities and stocks in the chain to achieve the required flexibility. Finding the right balance between delivery performance and supply chain stock costs is a logistical challenge. As we think that improvements can be made in this area, we decided a couple of years ago to develop a new planning concept with TU/e and CQM.

One of the first questions concerned the optimum decoupling point between ‘make to stock’ and ‘make to order’. The higher upstream this lies, the lower the stock costs but the longer the delivery time. Lionel designed a simulation model to quantify the consequences of this choice. Following Lionel other TU/e people have worked further on the planning concept. Lionel created the infrastructure, in fact, and his successors have put various planning methods under the microscope since.

The insights developed by Lionel are still very practicable. Building a simulation model takes months of research time, so it is difficult for us to make people available to do this internally. However, this is not the only reason why we appoint trainees from the Stan Ackermans Institute. We also want to find out about the very latest insights being developed at TU/e. The trainees help us gain that expertise.

As a sequence to Lionel’s end project another SA1 trainee has developed a prototype of a ‘scenario planning and optimization tool’ that provides insight into the balance between delivery performance and stock costs. The prototype helps us to draw up the right requirements for the definitive scenario planning tool.