

Chapter 3

Value Chain Analysis

1. Thermoplastics

Thermoplastics are heat-sensitive materials, which are solids at room temperature like most metals. Upon heating, the thermoplastics begin to soften. Once the melting point is reached, continuous heating will transform the thermoplastic to a liquid. Allowing a thermoplastic to cool below its melting point result in solidification or freezing of the plastics. Successive heating and cooling cycles will cause repetition of the melting-freezing cycle. The fact that thermoplastics melt is the basis for their processing into finished parts. Thermoplastics may be processed by any method which causes softening or melting of the material. Examples of the major processes are injection moulding, extrusion, rotational casting, calendering, and blow moulding.

In the commercial sector, thermoplastics are further classified into 2 broad categories:

(i) Commodity Thermoplastics

Commodity materials make up the bulk of thermoplastic consumption in the world. In Malaysia, the situation is no different. Commodity plastic is a low cost material. The normal market price is about US\$ 600 – 800 per matrix ton for PE material. Examples of commodity materials are, Polyethylene (PE), Polypropylene (PP), Polystyrene (PS), Polyvinyl chloride (PVC), Polyethylene terephthalate (PET) and etc. These materials found their application in plastic bags (PE), plastic containers (PP), carbonated drink bottle (PET), PVC pipes, and television-casings (PS).

Today, Malaysia produces all kinds of commodity thermoplastics. According to a survey by Malaysia Plastic Manufacturing Association, 81% of Malaysia's thermoplastic consumption is produced locally. In 1997, the total thermoplastic consumption in Malaysia was 1.12 million metric ton (MT). Total production in Malaysia was about 0.91 million MT.

(ii) Engineering plastics

Engineering plastic is the next preferred of thermoplastic raw material when the commodity thermoplastic cannot provide the required properties for the end product. Engineering plastic material has the characteristic of high heat resistance, good mechanical properties, better chemical properties, optical properties and fire behaviour. Engineering plastic offer the opportunity to replace conventional metal, ceramic etc application with a lower cost. Examples of engineering plastics are Polyamide (PA), Polybutylene terephthalate (PBT), Polyoxomethylene (POM), Polycarbonate (PC), Polyethersulphone (PES) etc. Engineering plastic found its application in automotive engine air-intake manifolds (PA), telecommunication connectors (PBT), compact disks (CD), aeroplane cabin parts (PES) and etc.

2. Injection Moulding Machine

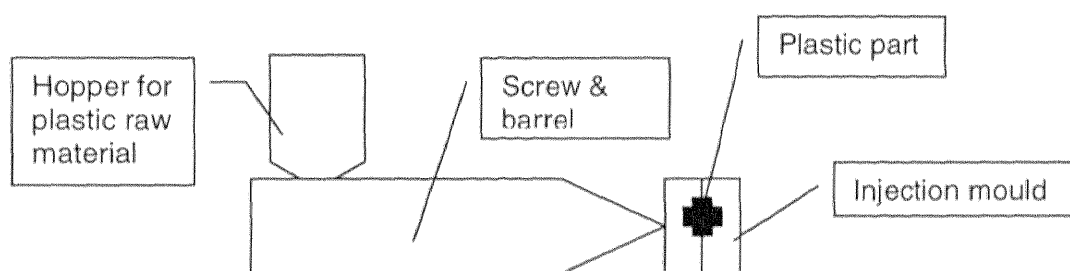
An injection-moulding machine has two basic components;

1. An injection unit whose main function is to melt the thermoplastic and transfer the molten material into a cool mould by injection.
2. A Clamp unit, which holds the mould, shuts against injection pressure and releases the part when it is solidified.

Injection moulding is the most important moulding method for thermoplastics. Thermoplastic injection moulding is a process by which plastic raw material is melted in a screw-barrel and subsequently injected into a mould cavity by the

injection moulding machine. Once the melted plastic injected into the mould, it cools to a shape that reflects the form of the cavity. The resulting form usually is the finished part required no additional work prior to assembly into or use as a finished product. Many details, such as bosses, ribs, and screw threads can be formed during the one-step moulding operation.

Figure 5 : a simple diagram of an injection moulding machine + injection mould



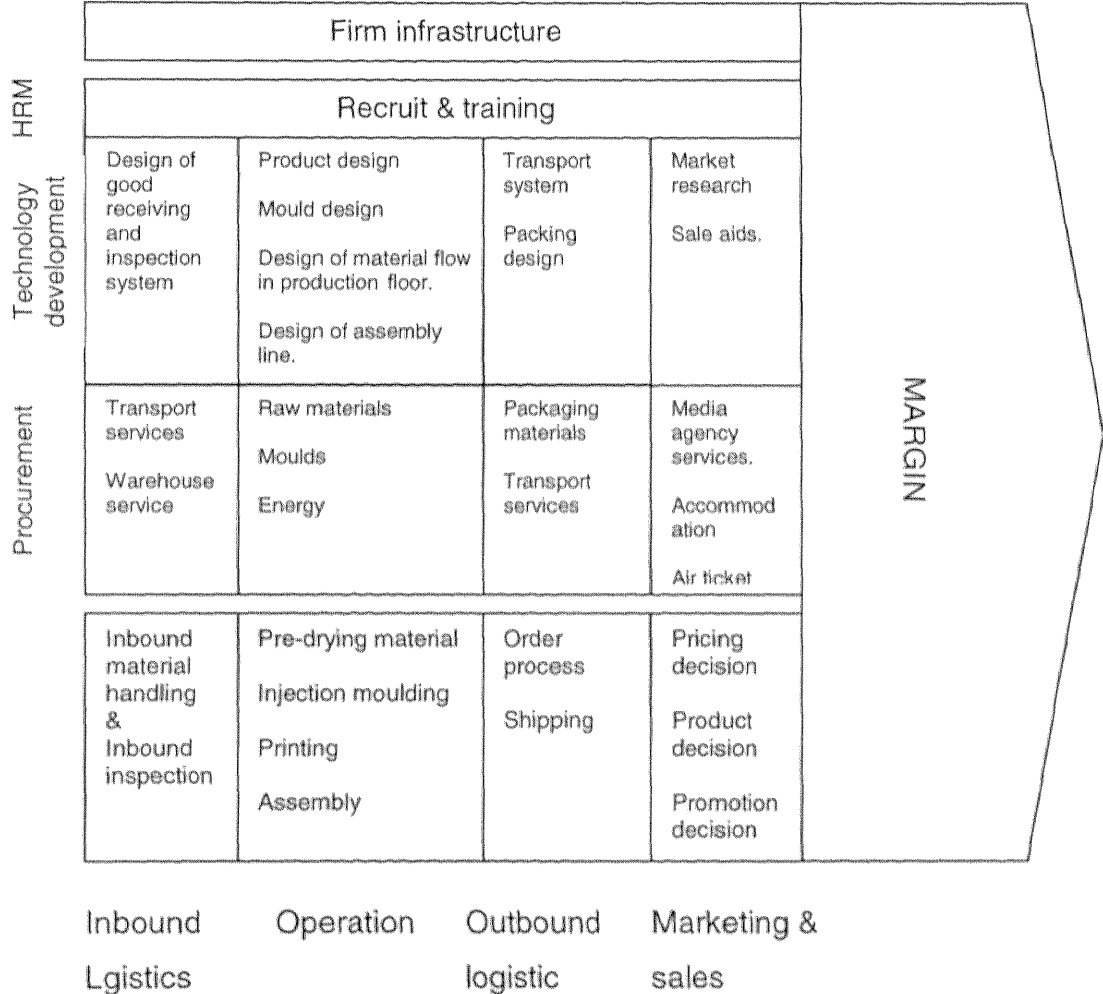
3. The Value Chain in Plastic Injection Moulding Business

The value chain of the thermoplastic injection-moulding sector is a collection of interdependent activities performed by different organisations in the plastic industry. They include the injection moulding services, plastic product design services, mould design services, mould fabrication, raw material manufacture, transport services, logistic services, etc.

For this discussion, we shall focus on the value chain involving the activities around the plastic injection moulding companies. In general, we can distinguish between two types of business activities for the injection moulding companies; that is, the injection moulding company which manufactures own product and the custom moulder.

(i) Value chain for own product manufacturing

Figure 6 : Typical value chain for company manufacturing own product.



A typical injection moulding company, which manufactures its own products, has the ownership of the products they manufactured. The birth of plastic product could be started by copying an existing product or modified on present design or simply coming from a concept. In general, 5 key activities involved, namely product design, mould making, injection moulding process, secondary process and marketing & sales.

(a) Product design

Product design is the first step in the development of any components.

Functionality and the aesthetic of the finish product are some of the important requirements for plastic components. Having a clear idea what the finished product is supposed to look like and how it functions is crucial. A technical person will lead the task to come out with some product design. For small and medium sized company, the owner himself normally plays this role. For a big sized company, an experienced technical person or an engineer is assigned to produce a product design. Product design includes material selection, process specification, engineering specification for each component, test method if applicable, etc.

Before the product design is finalised, the assembly process design and mould design will also be considered. Once the product design is finalised, mould making begins.

(b) Mould making

The mould is an important tool for successful injection moulding process.

In Malaysia, the majority of the plastic injection moulding companies do not own mould making facilities. Except for basic mould making facilities. A company with in-house mould manufacturing facilities can make its mould design, mould material selection, design the mould system to suit the material, the process and the machine etc. Mould making is a time consuming process. A simple mould may take 2 – 3 months to complete. Complicated mould may take 6 – 7 months for completion. Mould making requires highly skilled mould maker. A good mould will ensure smooth production in the next stage.

(c) Injection moulding process

After the production mould is ready. The next step is the injection moulding process. Before a plastic material can be processed, it normally required pre-heating or pre-drying to remove moisture adsorbed by the plastic pellets. After pre-drying, the plastic material will be transferred to the hopper at the injection moulding machine for processing. A typical injection moulding cycle takes about 10 – 60 sec, depending on the product.

(d) Secondary process

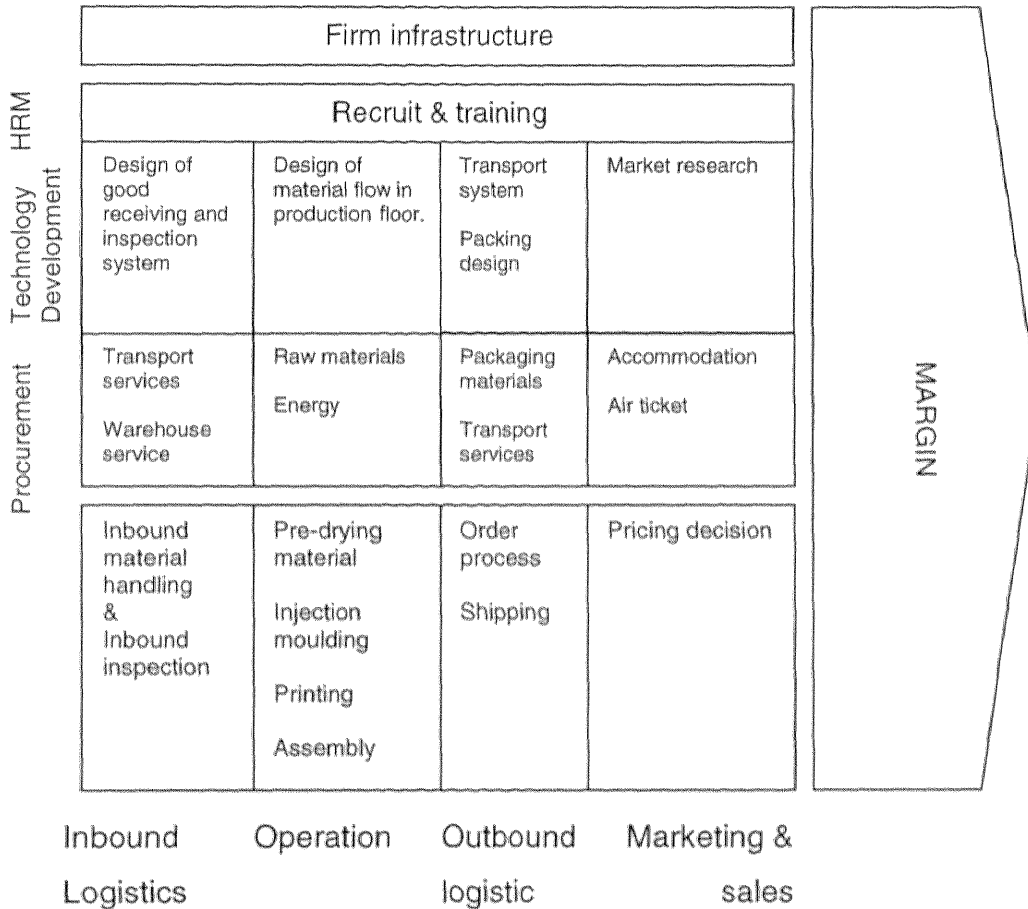
In Selangor, most of the injections moulding companies produce household wares, kitchenware, stationary, promotional items, pet products etc. These products require secondary process for decoration or for providing information e.g., print alphabet on the computer keyboard. Examples of secondary process are silk-screen, pad-printing process, hot-foil stamping, etc. Injection moulding company needs to invest in the secondary process machine and source raw materials like ink, paint and foil for its production. Certain plastic products like dustbin and plastic toys require the assembly process.

(e) Marketing & sales

An injection moulding company which manufactures its own products may market product via local distributor, oversee agent or own marketing team selling their own brands. According to the survey in Selangor. In 1997, there are about 22% of the injection moulding companies in Selangor export their products overseas. All of them are relatively big plastic injection moulding companies with workforce ranging from 50 – 200 persons. These companies advertise their products in trade magazines as well as in the Internet.

(ii) Value chain for a custom moulding service business

Figure 7 : Typical value chain for custom moulder



Custom moulding is a kind of service business. Practically, custom moulder would like to sell their injection moulding services to any customer who needs its services. The unique characteristic of a custom moulder is that custom moulder has no ownership for the plastic product they manufactured. The main value added for customs moulder is transforming plastic raw material into a useful plastic component. In general, 4 activities are important, namely Product design, mould making, injection moulding process and secondary process.

(a) Product design

In Selangor, a majority of custom moulders provides moulding services to multinational companies in the electrical and electronic industry. Examples of product manufactured are television casing, computer monitor housing, VTR chassis, videocassette recorder front panel and telephone. According to my survey in early 1998, the multinational companies carried out the product design works themselves. However, big-scale custom moulding companies do provide product design services to their clients. According to industry feedback, their clients are limited to local customers only.

(b) Mould making

Plastic injection moulding companies equip with mould making facilities are more attractive for custom moulding. As far as possible, customers like to have their mould manufactured locally because of the lower cost involved and the easy mould maintenance later. Mould design and mould making have high value added for customers. A good mould can avoid secondary process like trimming. Furthermore, a good mould gives zero defects in injection moulding process. Companies without mould-making facilities will try to tide-up with a good mould manufacturer to enhance their services.

(c) Injection moulding process

Injection moulding process is the core service in a custom moulding value chain. A quality custom moulder will master the technical knowledge in processing and handling of the plastic materials. In fact, custom moulders are encourage to undertake technological development through direct transfer of technology or know-how disclosure process. Developed countries are more advance in plastic application than the local industry. Their industry diversity brought about great opportunities for exploring the potentials of plastic technology. The custom moulding business provides local plastic industry the opportunity to experience technology development. Technology capability can be embodied in different form of assets such as capital equipment, human skills or knowledge,

organisational system and managerial procedures. To be competitive, custom moulders are required to be able to handle a much wider range of plastic raw materials and to be knowledgeable in moulding complicated plastic parts. Customers also expect them to be flexible in the moulding processes. It is not unusual that customer may provide the custom moulder with an imperfect mould and expect them to provide total solution.

(d) Secondary process

In the custom moulding business, secondary process like spray painting is common for company provides moulding services to colour television manufacturers. Silk-screen printing is normal to serve customers in audio industry. In certain cases, laser-printing services is required. Moulding Company in Selangor also provides special painting process, which produce texture finish on the plastic surface.

Sub-assembly is an extended service provided by the moulding company, for example, the assembly of the front panel for videocassette player.

As a short summary, we can see that custom moulders' value added is mainly restricted to the moulding process and the secondary process. So far, there was hardly any chance for them to extend their value added into product design. In order to be competitive in custom moulding business, custom moulders are required to design their manufacturing processes as flexible as possible to suit their customers.

In the case of companies manufacturing their own product, their value added is much more because they have the ownership to the plastic products. Their value added can be extended beyond production process and secondary process. Under this situation, they can keep the production facilities relatively rigid but be flexible on their product design. Keeping the product design flexible is certainly

cheaper than keeping the production line flexible. Flexibility in design is based on human creativity, flexibility in production set-up is based on availability of machinery which is capital intensive. In addition, own product manufacturers may use the marketing tools to create brand image and make price decision for the plastic products.