

Top glove business case study: manufacturing processes



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Introduction:

Top Glove (TG) is the largest rubber glove manufacturer in the world and it started to operate in Malaysia since 1991. Initially, there is only one factory in 1991 with three production lines, but the company has expanded and grown dramatically to become the world's largest rubber glove manufacturer where is it today with the following position:

The World's Largest Rubber Glove Manufacturer

Top Glove is a listed company in year 2001 in Bursa Saham Kuala Lumpur, and on a short span of slightly more than a year Top Glove Corporation Berhad listing has promoted successfully from the second Board to the Main Market of the Kuala Lumpur Stock Exchange on May 16, 2002. The company now has a shareholder fund of RM846 million or USD247 million with an annual turnover of about RM1. 53 billion or USD447 billion as at 31 August 2009. It is also one of the component stocks of the FTSE Bursa Malaysia (FBM) Mid 70 index, FBM Top 100 index and FBM Emas Index.

Philosophy

The Business Philosophies of Top Glove's are they work for their Customers; Their take care of the interest of their Shareholders; They ensure that their Employees continue to contribute positively to the company and their take good care of the welfare of their employees and lastly, they work closely with their Bankers, Suppliers, Business Associates, and Government Authorities and Friends.

The corporate Mission of Top Glove is to be a World Class Glove

Manufacturer Providing Top Quality Products with Excellent Services through

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Continuous Improvement and Innovation. While the Slogan “ We strive to be the world’s Leading Manufacturer with Excellent Quality Glove Products and Services That Enrich and Protect Human Lives” is the guide for Top Glove Moving toward their Vision.

Top Glove’s Business Directions is to Approach to produce consistently high quality gloves with efficient low cost and to earn two healthy dollars by spend one efficient dollar.

In Top Glove Quality Policy, The way they doing business is emphasis on Quality and Productivity, with the duties to Continuously Improvement and Innovation, and the target towards Zero Defective in their production.

Top Glove Corporate emphasis the value of increasing Global Customer Satisfaction, as they are doing the thing right at the first time and on every time; with Integrity and Total Commitment to their corporate, customers, and the community around the worlds. Besides that, Top Glove desired to produces the products that are Excellence in Quality and Competitiveness nevertheless, without ignoring the environment and keeps doing their corporate social responsibility.

Addition, Honesty, Integrity and Transparency are Top Glove business Ethics.

Lastly from the words by Top Glove Chairman-Tan Sri Dato’ Sri Lim Wee Chai: Our business rules are, “ We do not lose our Shareholders’ money; do not lose our health; do not lose our temper; and do not lose our customers.”

Principal activities

Top Glove's Principal Activities are based on manufacturing and trading of High Quality Latex made Gloves. In depth, their company's Principal Activities are from producing and selling concentrate latex, manufacturing of gloves, trading of glove, provision of management, Property investment, investment holding and trading of machinery. Additionally, the countries of incorporation are majority in Malaysia and the others are in the People's Republic of China, United States of America, Thailand and Singapore.

In Top Glove's Annual-report stated in Directors' Report. The principal activities of the company are investment holding and the provision of management services. Besides, the principal activities had described in Note 12 to the financial statement. Where, there have been no significant changes in the nature of the principal activities during the financial year.

Strategy to compete

Customers' satisfaction is the focus of Top Glove and it had placed a lot of emphasis in Research and Development to produce a wide and diversified range of high quality and value-added glove products in order to fulfill the expectation of their customers. The company also collaborates closely with the government agencies and Ministries to keep itself abreast of the latest development in rubber research technology. The company also uses state-of-art high technology and efficient automatic glove manufacturing machine to obtain the most products manufacturing yield and to remain as one of the most cost-effective and highest quality producer in the industry. With all these advantages and strategies, the company is able to compete with the competitors and stand out in the industry.

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Production Processes of Top Glove(TG) Company:

One of the successful reasons that TG Company can succeed in their business is because they have a strong and good production process in their latex glove making. They believe that they must have the most modern and advanced glove manufacturing machineries if they wished to be continuing as a world-class cost effective glove manufacturer. They have invested substantially in the machineries that are needed to ensure that they can fully adopt the latest manufacturing techniques for all their production lines. Other than that, they to ensure that they can consistently produce high quality latex gloves are also using a continuous engineering process.

Competent and experienced personnel also contribute in smooth production line and consistency in quality of the latex gloves even though they have modern machineries. In addition, an on-line quality control measures have been instituted throughout the manufacturing processes to ensure the highest quality products.

The latex is a white, milky liquid that comes from rubber trees, which is either from native or hybrid trees. Mostly, TG gets its latex from buying through the rubber market while the remaining latex is from their own rubber plantation. The latex will be harvested from rubber trees when the tree's trunk is swollen and also every day, after the rain has stopped during the rainy season. The latex is a natural product and it will coagulate easily, therefore it needs to be harvests from the rubber trees as soon as possible and then send to TG factory to be manufactured.

When the latex is sent to the TG factory, the latex will be manufactured with a standardized method that is set by the company itself. The flow of the production process of latex glove in TG Company is former cleaning, coagulant dipping, drying, latex dipping, leaching, beading, vulcanizing, post leaching, slurry dipping, stripping, tumbling, and quality control.

Former Cleaning

Before the latex can be process to the coagulant dipping process into hand-shaped, the glove formers need to be cleaned before it can be used to form hand-shaped latex gloves. A quality production of exam gloves includes the environment of latex glove factory is clean. This also means glove formers must be cleaned to ensure there is no dirt or debris anywhere because it will affect the final product to possibly have defects like holes. Firstly, glove former must be dipping into an acid bath and then rinse with clean water. Secondly, an alkaline bath is used by dipping the glove formers in them to neutralize the acid and again rinsed in clean water. Lastly, an important step that is the glove formers are brushed to ensure the surface of the glove formers is consistent and eliminate pinholes on the latex gloves after it form.

TG factory have multiple production lines that produce batches of disposable gloves. If there is any dirt or debris on the glove former, it can result in the manufacturer being forced to trash the entire batch of latex gloves. This reason shows the importance of glove formers that must be regularly inspected and cleaned before the molds are dipped into coagulant tanks.

Coagulant Dipping

After the glove former is cleaned, it will be coated with coagulant (eg. calcium nitrate) and be dipped into the coagulant bath to help the latex mixture adhere to the formers and to help ensure the latex is distributed evenly. The glove formers are dipped into the coagulant tank under TG workers' control to extract the protein from the previous glove dipping and this dipping is done once for every production cycle.

Drying

Drying is one of the stations in production process of latex gloves manufacturing whereby the coagulant converts the liquid latex film into a wet-gel on the glove formers and will eventually travel through a series of ovens to dry the gloves and end the coagulation process. In brief, it is a process of drying the gloves from wet to readymade gloves.

Latex Dipping

Latex dipping is one of the stations in the production process of latex gloves manufacturing and the tank is filled with compounded latex. A latex layer will be formed on the glove former after it goes through this tank. The thickness of the latex glove is determined at the coagulating and dipping stage. The longer the time the glove former travels in the coagulant tank, the thicker the latex gloves will be formed. TG Company will ensure that the latex gloves that produce is high quality and safe to be use.

Leaching

This leaching stage can called as the pre-vulcanization leaching. It also known as “ wet gel leaching”. Residual chemicals and proteins on the

surface of the gloves are put into the leaching process to be removed after the drying of latex mixture. A longer leaching line can wash out latex proteins more effectively. Besides that, the water must be hot and fresh enough to make the proteins dissolve better. This step is a critical step to minimize the occurrence of latex sensitivity. The water temperature, process duration, and water exchange rate will affect the effectiveness of the process. Good leaching line can result in a good and quality latex glove.

Beading

Beading is a process whereby up to a dozen chemicals are added to help in next manufacturing process of latex gloves. The chemicals added are antioxidant that prevents deterioration of the rubber molecules in the final product by heat, moisture, and ozone. Chemical accelerators are also added to help control the next vulcanization process.

Vulcanization

One of the discovery key in manufacturing rubber is the vulcanization process. It is a curing process in the production process of latex gloves whereby the latex particles are modified by adding in accelerator chemicals to it. When all the materials are heated, sulfur atoms are chained with the rubber molecules to form a cross-link that gives strengths and elasticity to the physical properties of the rubber. This process ensures the rubber will not be torn and melt easily.

Post Leaching

This process is similar to the wet-film leaching previously, but it is a little different whereby it is carried out on the dry/vulcanized latex film. Therefore,

it is also known as “ dry-film” leaching. Time and temperature is the most important element to ensure effectiveness in the process of water extractives reduction. Latex gloves may be leached up to 24 hours to ensure its effectiveness.

Slurry Dipping

This stage is also known as “ wet even powdering”. The slurry tank containing the cornstarch solution can prevent latex gloves from sticking in the tank. The slurry is also referred to as wet powder. The benefit of this powder is acting as preservation of the latex gloves and to assist in the latex gloves donning process. TG Company has followed the international method in the specific stage whereby the latex gloves will go through more ovens for further drying and additional rinsing cycles where the powder will be removed. The process of removing the powder is to avoid latex allergic reaction.

Stripping

At this stage, the latex gloves are stripping from the glove formers. There are two types of methods, which are manually or automatically stripping the latex gloves from the glove formers. TG’s latex examination gloves are stripped by fully automated stripping machine. By using this fully automated stripping machine, TG can increase the quality and safety of the latex gloves they produced. The latex gloves will be sent to the next phase of the latex glove manufacturing process for final drying.

Tumbling

The tumbling process at latex gloves manufacturing process is to remove excessive powder on the gloves. The latex gloves are putting into the commercial dryers to ensure that the powder is more evenly distributed and excess powder can be removed.

Powder-Free Gloves

Powder-free gloves stage is a technology to prevent stickiness of gloves by avoiding powder usage completely by going through chlorination or polymer coating process. This is one of the important technology processes in manufacturing latex glove nowadays because most of the glove makers are producing the latex gloves with powder-free. Top Glove produces latex powder and powder-free gloves. Basically, the powder-free latex gloves are transformed from powdered gloves when the powder is removed. Before the latex gloves dried, the powder helps the latex gloves give uniformity as well as to prevent the latex gloves from molding together. The tackiness on the glove surface can be removed by rinsing the latex gloves in water. Then it is placed into a chlorine bath to transform the powdered latex gloves to powder-free latex gloves. The glove is turned inside out and the process is repeated. The powder-free gloves are placed back into the dryers when the bathing process is completed.

Quality Control

TG carries out its quality control in total quality management system. In total quality management system, the process includes regular testing of raw materials, close monitoring the manufacturing process, continuous

improvement on quality control, maintain regular quality control, complying with stringent quality standard, target for zero defects, good instructional labeling, efficient work standardization, continuous improvements in packing and loading, close monitoring of production process, tensile strength machine, innovative auto-stripping system, visual air pump test, water tight test, physical dimension test, protein test and powder test in their manufacturing process of latex gloves. The visual air pump test, water tight test and physical dimension test will be carried out in this quality control stage while the other test will be carry out during each manufacturing process of the latex gloves. The air pump test serves to check for holes and visual defects in gloves while the watertight test serves to check for pinholes rate on the latex gloves. Each country will have their own acceptable quality level (AQL) in allowing the company to export product to their country. For example, the companies that want export their gloves to United States, a 2.5 AQL in the watertight test or better. The physical dimension test is used to measure the dimension of the gloves whether to know the measurement does meet the inspection level of 4.0 that set in AQL.

Packing

Packing is the final stage in the manufacturing process of latex gloves. TG packs their latex gloves in flat and efficient layer-by-layer to ease the dispensing of gloves in order to avoid latex gloves difficult to dispense from each gloves later. This type of packing method can reduces waste and makes latex gloves easier to take out from the box. For example, we can dispense tissue from a tissue box easily and the idea is applied to the latex

gloves' box dispensers. This layered technique is often use by all glove manufacturers.

Lastly, when all production processes are completely carried, the latex gloves will be keep in TG warehouse for labeling and then send to their particular customers. In addition, the latex gloves are also being exported to other countries. The production processes of Top Glove are repeated for all the production lines and to ensure the latex gloves that are produced are in high quality and safe for use.

Strength of the Production Process:

The machine technologies that TG used to make their production processes of latex gloves are result in superior quality and it is safe to use by all consumers. The production process in TG adopts the latest manufacturing techniques by using the modern machineries. Other than that, the production processes in TG helps their company to increase precision and productivity in their latex gloves production. This is due to the advanced and modern technology that applied in the production processes. In addition, the production processes also increase the flexibility in producing latex gloves. The production processes will also increase the process stability during the manufacturing process of latex gloves. It is because the production processes are carried under a systematic production processes. The products will be produced gradually by following specific production processes and to ensure the product is high quality produced.

The efficient production processes is able to help TG in saving a lot of production cost. It is because the efficient production processes can ensure

that they can produce latex gloves effectively and efficiently. Then, the production processes also helps TG in reducing the number of workers. This is due to most of production processes are fully operated by the machine technology. This helps TG to save cost in the workers.

Weaknesses of the Production Process:

TG needs to invest heavily in buying the modern machineries and need to hire more experienced personnel in their production process. TG uses modern technology in carrying out their production processes to make latex gloves. The machineries that bought were extremely expensive. Thus, the maintenance of the machineries is expensive and if there had any minor or major accessories spoiled; it will be costly to the company to repair it back. It is because the accessories that are used in the machines are not for common use by other manufacturers within the same field area or other field areas and it is difficult to look for substitutes for that specific accessories. TG always checks and maintains the effectiveness of their machineries to prevent it from being spoiled.

In addition, TG also needs to hire more experienced and skilled personnel with higher salary to operate the specific machineries and carry researches. Some machinery needs special skilled and experienced personnel to take charge and TG does not simply hire a worker to operate the manufacturing machineries. The experts for such operations in the latex industry are much fewer in other fields. Thus, TG needs to spend more money to hire those experts that operate their operations.

Facility Layout:

The layout of a company is very important because it establishes an organization's competitive priorities in regard to capacity, process, flexibility, cost, as well as quality of work life, customer contact, and image. An effective layout can help an organization achieve a strategy that supports differentiation, low cost, or response. The objective of layout strategy is to develop an effective and efficient layout that will meet the firm's competitive requirements. Layout design has the following purpose:-

- Higher utilization of space, equipment, and people
- Improved flow of information, materials, or people
- Improved employees morale and safer working conditions
- Improved customer/ client interaction
- Flexibility (layout need to be change from time to time)

TG is a company that used work cell layout to produce its products. Work cell layout means an arrangement of machines and personnel that focuses on making a single product or family of related products. A work cell reorganizes people and machines that would ordinarily be dispersed in various departments into a group so that they can focus on making a single product or a group of related products. Once the work cell has the appropriate equipment located in proper sequence, the next task will be staff and balance the cell. Normally it involves two steps. First, determine the takt time, which is the pace (frequency) of production units necessary to meet customer orders:

Takt time = Total work time available/ Units required

Second, determine the number of operators required:

Workers required = Total operation time required/ Takt time

By doing so, the company can increased equipment and machinery utilization due to better scheduling and faster material flow. Diagram below shows the layout of Top Glove company and the description of the components inside the layout:-

<http://turnkey.taiwantrade.com.tw/En/DB/layout%284%29.jpg>

The space of the layout is 80m (length) x 50m (width) x 8m (height) which can be categorize as a big company.

Waste water- All the unwanted or wastewater will stored in this area.

Latex storage- This is the place to store latex that use to produce latex gloves. It place near to the dipping line and chemical dispensing compounding ball mills because it easy for mixing work which need to combine other raw material and chemical substances with latex to produce the latex gloves.

WC- This is the place for workers to refresh themselves.

Tools/Maintenance- Places that put or keep the tools and equipments that used to produce the glove and for maintenance purpose. All the tools and equipments will be keeping in a specific place that easy the workers to find it.

Chemical storage- All the chemical substances, which are dangerous, will keep here to avoid any accident happen and make sure the workplace is safety. This room is just nearby of the chemical dispensing compounding ball mills to make sure that the compounding work can be carry out smoothly.

Dipping line- This is the place where machine is design for examination and surgical latex gloves, which include the process of auto washing, coagulants agents dipping, latex dipping, drying, and beading, fore leaching, vulcanizing, post-leaching, wet powdering, cooling, and stripping.

Chemical Dispensing Compounding Ball Mills- The place that carry out the work of compounding or mixing of the raw materials, chemical substances, latex and many other to produce the gloves.

Chlorination- A process of producing powder free gloves by treating these gloves with chlorine. It also removes the first layer of protein to an acceptable level.

Tumbler Dryer- It is a machine that tries to dry up the gloves after all the compound mixed together.

Sterilization- The place that sterilizes the gloves using Gamma irradiation to eliminate all microbial life, including highly resistant bacteria spores.

Worker Canteen- Places for workers to have their meals.

Plant Officer- This is the office for plant officer who supervise the production work of the company.

Q. C Room- All the finished gloves will send to this room for checking before send to customer. The workers will checked the gloves one by one and see whether there are any rejected glove that do not meet the quality standard of the company.

Lap Testing- Lap for chemist to test for new formula or compound that can improve the existing glove or testing for new products. This is good for the company to fight with his competitors however; some cost may be incurred for the research and development work.

Packaging Area/Material- All the gloves that have go through Q. C checking will send here for packaging before sell to the customers. There are sufficient machine and material prepared for packaging work so that the glove will be pack nicely and keep in a good condition.

Show Room- Room to display the products of the company. Customers who interested in the products of the company can take a look on the sample that show in this room.

Company Office- Main office of the company where all the admin work of the company will carry out here.

Finished Product Storage- The finished products will be stored here and waiting to send to the customers by the trucks.

Strength of the Facility Layout:

Top Glove used work cell layout as their strategy to produce their products to utilize the capacity of the company, which may bring a lot of advantages

to the company. First, it can reduced work-in- process inventory which means there is less inventories or equipments needed to link up the work that is in different process because the work cell is set up to provide one piece flow from machine to machine. Second, less floor space required because less space is needed between machines to accommodate work-in-process inventory. For example, the tumbler dryer is place closely with the process of sterilization that uses to sterilize the glove's bacteria. Thus, it saves a lot of space between these two processes. Next, when the employees work in this kind of layout, it will heightened the sense of employees participation in the organization and the product which will encourage them to add responsibility toward the product quality because they directly associated with the products in their own work cell. For example, the employees who work as an operator in dipping line will feel motivated and carry out his work carefully when the manager empowered him to look after the machine or participate in any work that related to the dipping process. Lastly, increased equipment and machinery utilization is also one of the advantages because of better scheduling and faster material flow. When the glove is being chlorinate immediately it will proceed to the process of drying and after this it will go through the process of sterilization immediately as well. The fast material flow show that it utilize the machinery and equipment effectively.

Weaknesses of the Facility Layout:

However, there are still some weaknesses in this layout, which is the straight-line work cell layout as we can see in the dipping line. The workers in the dipping line are arrange in such way that sometime they will find that

it is hard to divided their work evenly and more worker is needed compare to the U-shape work cell layout. This may cause social loafing in the workplace, which means some worker may work less as compare to his colleague. This is not good to happen in the workplace because it will lower down the morale of other worker who works hard but he just gets the same pay as his colleague who is lazy. Next, from the layout of the company, we also notice that there is only one main gate for exist and entry but no other emergency or back door in the layout. This is also a weakness of the company because there is no other emergency door for workers to escape if any accident happens.

Goods and Service Design:

The other strategic of this company is goods and service design. Top Glove's main productions are rubber gloves, synthetic gloves and surgical gloves.

Top glove producing more latex glove as compare others glove, since latex gloves is a better choice of protection. The reasons are the latex is the main material in rubber gloves manufacture where it is the gold standard for durability. Where latex is referring to a milky, usually whitish, fluid obtained from over 1, 000 species of trees and plants. It is the most important raw material used for the production of latex gloves, natural rubber latex, which derived from the *Hevea Brasiliensis* tree species found mainly in South East Asia though they originated from Brazil. It demonstrates superior elasticity, strength and barrier protection. It outperforms vinyl as well as any synthetic rubber in terms of maintaining barrier integrity in routine and high risks procedures. Based on the researches, the latex gloves provide up to 9 times more protection during normal use than non-latex gloves. The glove size is

determined by measuring the circumference of the hand around the palm area with a tape measure. The usual size standard for examination gloves are of XS – XL, while surgical gloves are of 6.5 – 8.5. The gloves thickness measured by depth protecting skin from exposure to elements. It was measured on a single wall using a micrometer over several parts of the glove, typically at the cuff, the mid-palm and the finger sections. The types of gloves are latex gloves, nitrile gloves, vinyl gloves, medical gloves, surgical gloves, disposable gloves, clean room gloves, household gloves, general-purpose gloves, and polyethylene gloves (PE glove). For example, the nitrile glove is one of the synthetic gloves that are produced from the synthetic latex of Acrylonitrile Butadiene Copolymer type, which is resistance to oil and exhibiting rubber-like characteristics. Its elasticity is good but less superior as compared to natural rubber. It is generally more costly than natural latex gloves.

Strengths of the Goods and Service design:

The strengths of using this strategic which is the goods and service design are Top Glove's gloves are protect to lives and the price of it are low compare to other glove brands. When they manufacture the gloves, the gloves will test in the elongation or stretching test, to measure the strengths of the gloves. During extended surgeries, the practice of changing to a new pair of gloves prior to a critical procedure has been noted to reduce bacterial contamination.

Weakness of the Goods and Service design:

The weaknesses are poor donning techniques, which is can result in glove rips and tears. Healthcare personnel should take care to don gloves correctly
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and avoid excessive stretching. Thoroughly dry hands before sliding them into gloves.

Quality Management:

Quality is refers to the totality of features and characteristics of a product or service that bears on its ability to satisfy stated or implied needs. Every organization should manage and control of their product's quality. It is important to help the organization to build a well reputation in the industry. By doing this, customer will more reliability on such product and finally help to gain the market share. Top Glove is a manufacturer company that pays much attention on the product's quality. Top Glove committed and believes in top quality products, they are responsibility to ensure quality consistency and product reliability to all their customers and users.

Before the products go into the packaging process and sell to the market, Top Glove has implemented the quality inspection process to make sure that their products are producing at the expected quality level. Top Glove is strongly stresses on Total Quality Management (TQM) and the Quality Control tests are conducted from the point we receive our raw materials straight through the production processes and the finished products points. Compulsory pre-shipment inspections are carried out before the delivery of each order. Top Glove is emphasis on stringent quality control procedures in line with ISO 9001 and in strict compliance with ASTM and EN 455 standards.

Top Glove has using the tensile strength machine as the measurement of the stretch required to break the glove material. Glove without good vulcanized process tend to have higher tensile strength. Top Glove also has using the

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innovative auto-stripping system to removing the gloves from the formers, where they are turn inside out. By doing this, the productivity can be increase because it is faster than by using manual stripping. Air pump test has been used to check for holes and visual defects in gloves. Furthermore, water tight test also using by Top Glove to check on the quality of products which is a test that use to determine the AQL level of an examination gloves by checking on the pinholes of the particular gloves after filling up the gloves with 1000ml water and then check for any leakage in 2 minutes time. To ensure the quality of products, Top Glove has been conducted the protein test of the rubber. All natural rubber latex products contain protein. For latex gloves, it is the measurement o