Chapter 1

Introduction

The best firms around the world are discovering a strong new supply of competitive advantage. It's known as supply-chain management and it encompasses all of these integrated activities that bring products to plug and make glad customers with cost and quality. If cost per piece of manufacturing is lower compared to competitors greater will be profit to company. The Supply chain management Program integrates topics from producing operations, purchasing, transportation, and physical distribution into a unified program, made provide SCM, then, coordinates and integrates all of those activities into a seamless method. It embraces and links all of the partnering the chain. In addition to the departments inside the institute, these associates embrace vendors, carriers, and arbitrator companies and in turn systems providers. One of the ways to optimized supply chain management is import substitution. It helps to organization to reduce cost, time, documentation, taxes & manpower involved to tackle documentation and taxes. It also help to co-ordinate activities like Just in time (JIT) and increases the efficiency of organization. Import substitution policies for deliberate and accelerated industrialization in less developed countries were bound to come into conflict with neo classical view of efficiency through free trade. Proliferation of import substitution in much of third world raises fundamental question as to whether existing pattern existing pattern of protection are consistent with their strategy of economical development. In other word, import substitution policies are the best mean of achieving the desired industrialization. What is opportunity of cost alternatives foregone or only simply perceived are static losses in by gain in dynamic efficiency and productivity of resources.

Supply chain management is that the streamlining of a business' supply-side activities to maximise client worth and to realize a competitive advantage within the marketplace. Supply chain management (SCM) represents an attempt by suppliers to develop and implement provide chains that area unit as economical and economical as potential. Provided chains cowl everything from production, to development, to the knowledge systems required to direct these
undertakings. The part of supply chain that's near the client is termed downstream supply chain. Downstream provide chain includes retailers and stores, the opposite half that's near the suppliers is termed the upstream provide chain. Downstream and upstream area unit relative terms, DC is downstream with relation to a plant however it's upstream with relation to a distributor. Materials during a SC, like water, typically result upstream to downstream. Since the fabric flow is visible.

During a typical method of providing chain management, raw materials area unit procured and things area unit created at one or a lot of factories, shipped to warehouses for intermediate storage, and so shipped to retailers or customers. Consequently, to scale back value and improve service levels, effective provide chain ways should take into consideration the interactions at the assorted levels within the provide supply chain, the provision SCM, that is additionally named because the supply network, consists of suppliers, producing centers, warehouses, distribution centers, and shops, likewise as raw materials, work-in-process inventory, and finished product that flow between the facilities. This definition leads to quite a lot of observations.

Fig (1.1) internal supply chain
In above diagram the internal bring in SCM (mainly) bet the depth of purchasing products distribution shows that the transfer of goods takes place from purchase dept, distribute dept, raw material to different products dept and gives final products to distributes to hand over it to the customers, suppliers –Purchasing shows that two-way transport of raw material, if there’s any fault in the raw material company can return it to the supplier, Distributor – customer.

India is developing country. So many new technologies have scope to settle down. In the initial mechanism, learning happens through the incorporation of latest intermediate merchandise unreal abroad within the native production chain. The utilization of the foreign intermediate product conveys the embodied technological capability of the foreign producer. For instance, an example could be a shoe producer that decides to change to foreign animal skin as a result of its higher physical property permits the creation of additional labyrinthine shapes, enabling the assembly of shoes with bigger price supplemental.

This mechanism is simple to operation and check at the mixture economy level. But, economics identification of the development at the firm level needs careful thought of however the training can truly occur. To raised perceive learning mechanism, recall the instance of the engine computer program that decides to import engine blocks owing to the tighter tolerances, because it starts to figure with the foreign provider, it becomes attentive to the technologies that square measure superior to those of the domestic suppliers. Still, to the extent that the firm is within the business of engine assembly, not casting producing, the attention of the new technology is all that may pass to the domestic economy, as a result of the computer program has no direct use for this new data, no productivity improvement are occur (beyond the one delineated higher than within the context of the primary learning mechanism). But, another cluster of companies may benefit from this awareness. The domestic casting makers, native suppliers of equivalent intermediate merchandise have sturdy incentives to adopt technologies that modify them to raised with and eventually displace foreign suppliers. Failure to imitate the foreign import could threaten native providers profit, market share, and even survival.
Additionally, conditional on ability, a domestic shopper can seemingly like a neighborhood provider to far off one as a result of a neighborhood dealings poses fewer supply considerations and fewer currency exchange risk.

Therefore, native purchasers have associate in nursing incentive to assist native suppliers find and exploit technologies that modify them to via foreign suppliers. In fact, the management literature has long acknowledged this role that offer chain relations play in transferring data to and building the capabilities of suppliers. This development is very salient in somewhat geographically isolated regions, like in Asian countries, Automotive or machinery manufacturers Bosch Ltd. Nasik, has policy to have import substitution to reduce the uncertainty of the future. Doing the import substitution are the key tool in Bosch used now days. For department of common rail assembly of injector in Bosch Ltd. Nasik, Main contributor for consumable cost and the material cost. In this thesis we will only focus of Consumable cost and it’s one of the toughest one in present competitive world. There is systematic ways in Bosch, where you will come to know the trend of consumable cost such as the Value stream mapping and value stream design, KPI and PD hut (Policy deployment hut). After using such tool which is directly link to supply chain and lean manufacturing concept and help to import substitution policy, by using this it is derived that common rail test cable is one of the high cost tooling which contributing high cost per piece. Test cable which is use for functional testing of common rail injector. In the target to reduce the consumable cost by reducing the cost per piece for injector there are following two ways

1. Choose negotiation with the prevailing provider of check cable manufacturer.
2. Choose import substitution by utilizing the power of native merchandiser in Asian country.
Being a monopoly of German firm those supply the test cable to all other Bosch plants of manufacturing the common rail injectors, above probability No. 1 will be rejected.

Alternative remain is to do import substitution. The Supply chain management Program integrates topics from manufacturing operations, purchasing, transportation, and physical distribution into a unified program. Productive give chain management, then, coordinates and integrates all of these activities into a seamless methodology. It embraces and links all of the partners at intervals the chain. To boost the departments within the organization, these partners embrace vendors, carriers, and third-party corporations and knowledge systems suppliers. It helps to organization to reduce price, time, documentation, taxes R&D, personnel involved to tackle documentation and taxes. It together facilitate to co-ordinate activities like merely in time and can increase the efficiency of organization.

Import substitution policies for deliberate and accelerated industry in less developed countries were bound to inherit conflict with fashionable classical scan of efficiency through trade. Proliferation eventful substitution in well endowed of assortment raises basic question on whether the existing pattern of protection area unit in line with their strategy of economical development. In different word, import substitution policies are only mean of achieving the specified industry profit. What’s price of alternatives or entirely perceived area unit static losses in by gain in dynamic efficiency and productivity of resources. India is developing country, such an oversized quantity of latest technologies having scope to relax, at intervals the first instrument, learning happens through the merger of recent intermediate.

Product fancied abroad at intervals the native production chain. The utilization of the foreign intermediate product conveys the embodied technological capability and the foreign producer. For an example, Associate in nursing engine producer would possibly conceive to import the casting, as a result of the foreign supplier controls the tolerances further tightly than house suppliers. Because of the tighter tolerances, the engine assembly methodology runs further smoothly and productivity rises. Whereas this mechanism for productivity growth is intuitive, two reasons might build it rare through empirical observation. First, a modification in
productivity happens on condition that the foreign intermediate wise are usually obtained for fewer than the whole value to the producer of the new technology embodied in it. Since they are of superior quality, one would expect that the foreign casting product price quite native substitutes.

Productivity thus rises on condition that this increase in price could be a smaller quantity than the profit it generates for the client. Second, withstanding learning happens; it's very robust to measure econometrically as a result of its most likely lost with necessary endogeneity problems. In fact, it's straightforward to acknowledge that the selection to import is maybe getting to be contemporaneous with unobserved (to the econometrician) positive productivity shocks. These reasons discourage associate in nursing examination of the impact of imports on the shoppers of foreign product and advocate attention on a remedial mechanism for learning from imports. The second mechanism for learning from mercantilism is exposure to foreign technology. an inspired vogue fancied in associate in nursing extremely explicit region is learned elsewhere, as an example, by reading a patent, reverse engineering a product, or licensing a technology. Since productivity usually depends on the native stock of data, learning the new vogue raises productivity by increasing the native data pool. This mechanism is easy to operation and check at the mixture economy level. But, economics identification of the expansion at the firm level needs careful thought .

Therefore, native shoppers have an incentive to assist native supplier’s and effort technologies that alter them with foreign suppliers. In fact, the management literature has long acknowledged this role that provide chain relations play in transferring information to and building the capabilities of suppliers. This development is particularly salient in somewhat geographically isolated regions, like in Asian countries, state and in complicated provide chains like automotive or machinery makers Bosch Ltd, Nasik, has policy to maximize the profit through maximize the Import substitution to scale back the uncertainty of the long run. Doing the Import substitution import substitution square measure the key tool in Bosch used currently
days. For department of common rail assembly of widget in Bosch Ltd Nasik, Main contributor for expendable value is check cable that is use for useful testing of common rail widget.

1.1 Ways of optimizing Supply Chain

Supply chain can be optimizing by many ways, some of them are mention below for reference.

- Analyzing the value stream (VSM &VSD) through business case concept
- Ship to Line, Ship to Stock, Vendor manage inventory
- Manufacturing what is required (Kanban).
- Optimizing Transportation (Milk run).
- Import substitution
- Removing bulky stores to Supermarket.
- Develop continuous flow to avoid piling of material.

A company having nice client service has a noticeable advantage over the competition. To square out amongst today’s sharply competent marketplace, an organization ought to maximize each chance that presents itself and SCM is one of them. If an organization is Olympian the clients expectation in additional, the client retention and also have an effect on word of mouth subject matter. A decent SCM can facilitate in adding to the client satisfaction in following ways:

Supply chain management is primarily involved with the economical integration of suppliers, factories, distribution centers, warehouses and stores so merchandise is created and distributed within the right quantities, to the correct locations and at the correct time to attenuate total system price subject to satisfy some service needs. Suppliers, factories, distribution centers (DC), warehouses square measure the physical entities of an offer supply chain (SC). These entities relate to every different through the flow of merchandise; Raw materials square measure
bought from suppliers, they processed into merchandise at factories, merchandise square measure sent to DCs/warehouses for storage till delivered to customers. It’s usually understood that factories/plants method the materials whereas warehouses/distribution centers can only store the materials.

1.2 Concept of import substitution

Import Substitution manufacture, a theory used by developing or rising market nations that want to extend their independency and reduce their dependency on developed countries. Implementation of the idea focuses on protection and incubation of domestic child industries, so that they could emerge as a foreign product and build the native economy a lot of self-sustaining. Import substitution is one in all the event ways that began to prevail as a variety of manufacture in most developing countries within the post-war amount. In India Import substitution known themselves ideologically thereupon strategy, and commenced to implement it within the resultant years; actually, that was the sole strategy related to the ideology of development originated with the Import Substitution method in India. Nevertheless, however that method occurred in India as countries and why it had been not terribly productive area unit still not acknowledge. In India, like several developing countries that adopted a philosophy of state intervention with import substitution policies, is finding that economic reform will typically be a slow, progressive method. Complications continue. Domestic producers can resist tariff reductions that subject them to enhanced competition. Government bureaucrats can attempt to maintain the facility and influence. They are inheritable in periods of considerable government involvement in economic higher cognitive process. The reforms thus far square measure a positive step however should be extended and accelerated, if Asian nations are to catch up with developed countries, in the coming years then this strategies needs to promote by government. India to implement the import substitution trade on an oversized scale; afterward, the implementation of this strategy was noted, among different countries, in Gold Coast and up to the Nineteen Eighties import substitution was ascertained within the different sub-Saharan countries.

The manufacture method in India occurred in two phases: the initial stage, a really early one still throughout victimization, within the latter amount, manufacture, as in geographical area, may be a politically aware strategy aimed towards overcoming underdevelopment. Within
the crucial substitution followed the dynamic typical of any import substitution process. That strategy lasted till the half of the eighties attributable to a structural adjustment policy that powerfully rejected of that manufacture system for the region. Outward-looking development policies encourage not only free trade but also the free movement of capital, workers, enterprises, the multinational enterprise, and an open system of communications. The advocates essential import substitution (IS) – the protectionists – believe that import substitution of domestic production of antecedently foreign easy trade goods and extend this later to a wider vary of additional subtle factory-made things – all behind the protection of high tariffs and quotas on imports. within the long-standing time, IS advocates cite the advantages of bigger domestic industrial diversification and also the final ability to export antecedently protected factory-made product, as economies of scale, low labor prices, and also the positive externalities of learning by doing cause domestic costs to become additional competitive with world costs. Import substitution is the determination of the locality (position) of the object.

In industry, import substitution is the way to adapt products to non native environment. In telecommunication, import substitution is a technique for determining the location GSM cell phone user. In mathematics, import substitution is certain technique in abstract algebra, whereas in acoustic sound import substitution describes how our ears find the direction of the sound source. In web design, import substitution refers to the adoption of language, content and design to reflect local and cultural sensitivities. In this project term Import substitution is used in the terms of Indian economic meaning i.e. adapting products and processes to non native environment as requirement and counterpart of worldwide globalization. Import substitution is process / activity carried out to develop the component or part in the country of destination was required.

The Process has much importance in India as it can eliminate duties and taxes obligated by the country of origin, thus reducing the landed cost of component e.g. If we procure a part from foreign country the cost of part will contain.

- Labor Cost.
- Manufacturing Cost
• **Taxes & Imported Duties**

While same part if we procure from country of origin (India) the labor Cost will less and import duties will get eliminated. Thus making same component cheaper Import substitution also helps to optimize the supply chain by reduction in procurement time.

**1.3 About Bosch**

Robert Bosch GmbH or Bosch being a German transnational engineering and electronics companionship headquartered in Gerlingen, by Stuttgart, Germany. GmbH is short for Gesellschaft mit beschränkter Haftung a German word meaning ‘Company with limited Liability’. It is a legal entity very common in Germany, Austria and Switzerland. It emphasizes the fact that the owners of the entity are not personally liable for the company’s debts. It is the world’s largest provider of automotive elements. Bosch’s core product area unit automotive elements (including brakes, controls, electrical drives, natural philosophy, fuel systems, generators, starter motors and steering systems), industrial products(including drives and controls, packaging technology and shopper goods) and building products(including home appliances, power tools, security systems and thermo technology). Bosch has quite 350 subsidiaries across over sixty countries and its product area unit sold-out in around one hundred fifty countries. Bosch used around 306,000 staff and had generated €46.1 billion in sales in 2013.

In 2009 Bosch was the leader in terms of patents at the German patent and trademark workplace (GPTO) with three, 213 patents. Bosch extends its international footprint through company acquisitions and investments in new plants. The Bosch brand represents an easy generator coil and casing, one amongst the company’s 1st product. Most of the company’s plants and staff area unit settled in Deutschland (112,300 employees).In spite of this Bosch is a worldwide company having wholly owned subsidiaries across the globe with North America subsidiary employing 24,750 people and generated $8.8 billion in sales in 2006. Indian subsidiary is third largest with 18,450 employees. Almost all Robert Bosch plant locations square measure each ISO 9001 certified (quality) and ISO 14001 certified (environment protection). Additionally thereto, their management is compliant with OHSAS18001
1.3.1 Concerning founder person of Bosch

Robert Bosch – the person, the businessperson, the Visionary, the socially minded leader who is willing to give his employees their fair due.”

-Robert Bosch

He was born on September 23rd 1861 in Albeck, Germany. He started his career with Precision mechanics apprenticeship in Ulm. He was also a non-registered student at Stuttgart Polytechnic. He got married twice and had six children from both marriages. In his early years, Robert Bosch and his associates built, repaired, and sold all kinds of precision mechanical and electrical engineering equipment. Robert Bosch knew the importance globalizing his products. So, in 1898 the initial sales workplace exterior Germany was opened in London followed by first factory set up in Paris in 1905. By 1913, Bosch generated 88% of its sale outside Germany. Sadly this was short lived due to outbreak of First World War leading to loss of all sites outside Germany. But even after this setback, Bosch is such a big name today, who knows what, would have happened if such a loss had not occurred. He had a special relation with his associates. He introduced the 8-hour working day and ‘Bosch-Zünder’ in-house newspaper. His work ethic can be summed up by his quotation:

“I don’t reimburse good quality salary because I contain a group of currency; I have a batch of wealth as I reimburse superior income.”

Robert Bosch was a visionary. Apart from his introduction of his high-voltage magneto ignition with spark plug, he had a vision for the moral, physical and intellectual development of
Robert Bosch GmbH is one among the leading German foundations that are illustrious for its promotion of natural and social sciences.

1.4 Historical Background

Robert Bosch started the company with a major practical invention in the form of magneto, associate early ignition electrical supply that provided the spark to ignite fuel in most of the earliest combustion engines in 1887. The production for motor vehicles started in 1898 and it led to first motor racing victory for Bosch magneto ignition in 1901. Bosch kept on improving on this and introduced battery ignition as successor system in 1925. Bosch produced automotive illumination scheme for cars (headlights, dynamo, watchdog and succession) in 1913 and for motorcycles by 1921. Upgradation was an integral part leading to development of fog lights, fitted headlights, H1 halogen light etc. In 2001 Lighting Technology division was sold. Bosch introduced everyday features and new technologies for cars in the form of starter (1914), horn (1921), battery (1922), windshield wiper (1926), servo brake (1927), direction indicator (1928), car radio (1932), car heating system (1936) etc. Bosch has been the driving force for diesel injection and has a great market share till date. In 1927, it introduced diesel injection for trucks followed by diesel injection for cars in 1936. Distributor-injection pump was introduced in 1960. High pressure diesel injection is the basis of all diesel engines running today. This was invented in 1989 by Bosch. Bosch then bought the patent for common rail system for cars from Fiat in 1997. The recent advancement in this field is Piezo injector which was introduced in 2004 by Bosch.
Some process moments of Hieronymus Bosch history were:

1. 1901 – 1st plant in city
2. 1902 – 1st commercially viable high-voltage sparking plug
3. 1906 – Production of a hundred, 000th magneto electric machine ignition
4. 1906 – Introduction of 8-hour operating day
5. 1910 – gap of plant in Stuttgart-Feuerbach
6. 1913 – begin of production of headlights
7. 1918 – Loss of all sites outside Federal Republic of Germany
8. 1929 – 1st television set from Fernseh noble metal division
9. 1932 – Formation of Junkers Research & development; Co.
10. 1932 – 1st power tool from Hieronymus Bosch
11. 1962 – Worcester Hieronymus Bosch cluster opens in European nation
12. 1964 – Henry Martyn Robert Hieronymus Bosch foundation
13. 1970 – Company headquarters move to Gerlingen
14. 1976 – 1st chemical element sensors
15. 1982 – Company acquires equipment division from Braun noble metal
16. 1986 – Traction system (TCS) on the market
17. 1995 – Introduction of Electronic Stability Program (ESP)
18. 1995 – Acquisition of Atco-Qualcast Ltd.
19. 2000 – DI-Motronic hydrocarbon direct injection system
20. 2000 – Acquisition of Rexroth
21. 2002 – complete relaunched with new brand
22. 2003 – Acquisition of Buderus noble metal
23. 2003 – The formation of Henry Martyn Robert Hieronymus Bosch Tool corporation
   and acquisition of S-B tool corporation and Green Mountain State yankee corporation
24. 2004 – Hieronymus Bosch opens new technology centre in Abstatt
25. 2006 – Hieronymus Bosch acquires Telex communications
26. 2007 – Bosch acquires health hero network
27. 2008 – Bosch acquires CST/berger
28. 2009 – Bosch acquires LR Nelson
29. 2009 – Bosch acquires Akustika
30. 2012 – Purchases SPX service solutions

1.5 Bosch in the worldwide
In 2013, Bosch recorded sales of €46.1 billion. 281,000 associates are working for Bosch in 225 manufacturing sites. Distribution of the Bosch group over the world is as follows:

<table>
<thead>
<tr>
<th>Region</th>
<th>Share of Sales</th>
<th>Associates</th>
<th>Manufacturing Sites</th>
</tr>
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<tbody>
<tr>
<td>Europe</td>
<td>55%</td>
<td>174,000</td>
<td>140</td>
</tr>
<tr>
<td>Americas</td>
<td>21%</td>
<td>73,000</td>
<td>52</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>24%</td>
<td>73,000</td>
<td>52</td>
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</tbody>
</table>

All of Bosch is connected with a common intranet which has its base in Singapore. All employees are in touch through intranet. Bosch is divided into four business sectors:

1. Automotive technology (UBK)
2. Industrial technology (UBI)
3. Energy and Building technology (UBE)
4. Consumer Goods (UBG)

1. Automotive Technology (UBK) → One of the world’s major suppliers of automotive skill. This sector holds 66% share of sales and has 9 divisions.

1. GS - Gasoline systems
2. DS – Diesel systems
3. CC – Chassis Systems Control
4. ED – Electrical Drives
5. Starter, motors and generators
6. CM - Car Multimedia

7. AE – Automotive Electronics

8. AA – Automotive Aftermarket

2. Industrial technology (UBI) – Leading in drive and control technology, packaging-process technology. This sector has 3 divisions.

1. DC – Drive and Control Technology

2. PA – Packaging Technology

3. PA-ATMO – Assembly and Special Machinery

3. Energy and Building technology (UBE) – Leading manufacturer of security, technology and global market leader for residential heating systems.

1. ST – Security Systems

2. Thermo technology

4. Consumer Goods (UBG) – Leading supplier of power tools and accessories. Also, leading supplier of household appliances. It has only one division.
1.6 Bosch in India

Robert Bosch had recognized the potential of India back in 1922 when the first Sales office was opened in Calcutta. But due to world war, it could not continue.

Then in 1953, manufacturing started in India in Bangalore plant. Today Bosch has 10 plants in India. Bosch India is the third largest subsidiary after Germany and America with 18,450 employees. Bosch was in collaboration with MICO, (Motor Industries Company) having a 51% share, so the company’s name was MICO-Bosch industries. Then in 2007 Bosch took over and is now known as Bosch Ltd.
1. Bangalore (BanP)

This is the headquarters of Bosch, India. It was the first plant located. Many products are made here under various divisions. Multi and single fuel injection pumps, common rail pumps, elements, delivery valves and components for the VE pumps are made under DS division. Construction tools, wood working tools and other power tools are manufactured sanctuary systems with bonfire uncovering, interference finding arrangement, and CCTV scrutiny are manufactured Floor standing boilers, Wall mounted boilers; Heat pumps are manufactured under TT division.

2. Nashik (NaP)

This plant was opened in 1961 and manufactures classic and euro Nozzles and injectors.

It is also manufacturing Common Rail Injectors and its parts.

3. Naganathapura (NhP)

This plant was opened in 1989 and manufactures starters and alternators for commercial vehicles, spark plugs, glow plugs, engine cooling fan module, regulators, single cylinder pumps and a few gasoline products.

4. Jaipur (JaP)

This plant was opened in 1999 and manufactures VE (mechanical), pumps for domestic market and export purposes.
5. Verna (Goa) RBIN

This plant is the latest plant opened in 2007 and manufactures packaging machines.

6. Ahmedabad DCIN

This plant was opened in 1975. It is under Bosch Rexroth India Ltd. – a combined undertaking of Bosch and Rexroth. The companionship materials customized solutions for powerful, scheming and touching. It is and combined for engineering applications. Ahmedabad serves as manufacturing facility and service center

7. Chakan (RBIC)

This plant was opened in 1997. Products like boosters, tandem master cylinders, valves, antilock braking systems (ABS) are manufactured.

8. Manesar (RBIC)

Plant was founded in 1993. TMC and Booster docking, Pedal module assembly is manufactured.

9. Chennai (RBDI)

RBDI is a joint venture between Bosch and Igarashi motors India. The plant was founded in 2008 with the objective of dealing electrical drives.

10. Coimbatore (RBEI)

This is the second location of RBEI and was opened in 2006. This plant provides Engineering and business services to Bosch worldwide.

Bosch, Nasik (NaP)

Bosch, Nasik (formerly known as MICO-Bosch) is located in MIDC, Satpur in Nasik city. Nasik is a prominent city of Maharashtra famous for its ‘Kumbha Mela’. Nasik plant has setup in 100 acres space. NaP produces injectors. These injectors are of two types. Apart from these the sub components of injectors like Valve set, Nozzle and Armature are exported to other plants. CRI injectors were introduced in 2005 in India. Before that conventional injectors were
the only manufactured parts. The plant has grown with time. In the beginning, there was only one building 101 for all the manufacturing and sales of conventional injectors. Today, the plant has 7 buildings:

• 101:

This is the oldest building of the plant. Conventional injectors are manufactured. The nozzles for these injectors (DLLA) are also manufactured in the building. The Plant Technical head (PT) and Plant Commercial head (PC) have their offices in this building.

• 102:

This building houses the HR department (HRL) for the whole plant. The maintenance department (TEF) has their office in this building.

• 103:

This building has office of CRI manufacturing department (MFC) and also there are 3 manufacturing lines of CRI.

104:

This building also has office of CRI manufacturing department (MFC) and also there are 2 manufacturing lines of CRI. Apart from this the sub parts for CRI, Valve set, armature and body are manufactured here. The respective offices for these departments are present here also.

• 105:

This building is the manufacturing site for CRI nozzles (DSLA). The offices of Quality (QMM) and CRI nozzle manufacturing (MFN 2) are present.
This is the newest building. It houses the offices of many employees of CRI manufacturing. Body for CRI is manufactured in the building. This is also the store area for incoming and outgoing material (CLP).

This building houses the offices of purchase department (PPD) and design department (ENI)
Apart from these buildings, the plant has two canteens where all employees and associates eat together. There is a fire department. There is a building for scrap material where customers bid and purchase for their use. A lot of plants and trees are grown to keep the plant clean and green.

The various departments in the plant are:

- **BPS**: To ensure BPS (Bosch Production System) standards are adhered to in the plant.
- **CFA**: Controlling Finance Administration. The department looks after accounts of the employees.
- **CLP**: Customer Logistics and Planning. All inward material from supplier and outward material to customer is taken care of by CLP department.
- **ENI**: Engineering of Injectors. All design related issues by supplier and required modifications is done by this department.
- **HRL**: Human Resources. All employees’ related issues are taken up in this department.
- **HSE**: Health, Safety & Environment.

**1.7 Vision of Nasik Plant**

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<tr>
<th>NaP Vision</th>
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<tbody>
<tr>
<td>➢ We are the <strong>most preferred partner</strong> to our customers based on our reliability and leadership in technology and quality</td>
</tr>
<tr>
<td>➢ We focus on our core competencies and continuous improvement for <strong>sustained and profitable growth</strong></td>
</tr>
<tr>
<td>➢ We <strong>involve, empower and motivate our people</strong> to shape our future together</td>
</tr>
<tr>
<td>➢ We, along with our business partners, are <strong>cost competitive</strong> through lean and effective processes</td>
</tr>
<tr>
<td>➢ We commit ourselves towards <strong>environment protection &amp; social responsibility</strong></td>
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<table>
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<tr>
<th>NaP Mission</th>
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<tbody>
<tr>
<td>Leadership in Production and Logistics of Cost effective diesel injectors through Innovative solutions and best in class Quality</td>
</tr>
</tbody>
</table>

“Cost Leadership + Speed are key strategic goals of NaP”
1.8 Product range in Nasik

The board of management was significantly keen to expand the company’s international business, giving the birth to the inspiration for a second location in Asian nation, in Nasik, in 1973. Mainly Bosch Nasik produces two major products.

1. Conventional injector
2. Common rail injectors
3. Nozzle for convectional type
4. Nozzle for Common rail type
This required critical child components for example nozzles, injector body etc. The child components are also getting manufactured in Bosch Nasik. Bosch Nasik having a lot of customer in every section of automobiles i.e. it starts from passenger cars, heavy duty commercial vehicles, trucks, three wheelers, gen sets, light commercial vehicles, and tractors. Although there are only two major products but there child components manufacturing of this injectors.

Child components for common rail injectors are CR Body, Armature group (which contain armature plate, armature bolt and its assembly), valve set (which contain valve and its piston then final its assembly before supplying to Common rail injector assembly. For common rail injector child components are critical hence most of them getting machine and manufacture within plant. For convectional injector now product is mature and proven in Bosch, Nasik since last 45 years and most of the part is given to supplier manufacture except the nozzle group. For both products Nozzle are get manufacture within Nasik plant and its critical one also. Most of the process developed by Bosch for Nozzle.

Products and Application

Conventional Injector

<table>
<thead>
<tr>
<th>Conventional Injector</th>
<th>BUSES</th>
<th>TRUCKS</th>
<th>LCVs</th>
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<tbody>
<tr>
<td></td>
<td>MARINE</td>
<td>LOCOMOTIVES</td>
<td>JWHEELER</td>
</tr>
<tr>
<td></td>
<td>TRACTORS</td>
<td>GENERATORS,</td>
<td>TILLERS</td>
</tr>
</tbody>
</table>

Common rail Injector 2-16

Common rail Injector 1-14
Fig (1.8): Bosch, Nasik Product and its application

Above photos show that basically this customer are divided majorly in three heads

1. LCV  2. HCV 3. SUV

1.8.1 About convectional injector

Conventional injector having lot of family, this is one of the oldest product what Bosch Nasik have. These injectors have design for Euro 1, Euro 2 generation. Euro 1 and 2 generation is also equivalent to Bharat stage norm 1 and 2. These norms made on the basis of Pollutions.
1.8.2 Cross-sectional View of Conventional injector

Function of convectional injector is simple compared to common rail injector. Basically these injectors are used where there is requirement of Bharat stage norm 1 and Bharat stage norm 2. These Bharat stage norms are equal to the Euro norms. Euro norms and Bharat stage norm define in order to control the pollution coming out from the vehicles, which are two wheeler, Passenger cars, Heavy commercial vehicles and SUV. In case of convectional injector
injection quantity depends on the cam shaft moment of engine and in case of common rail
injector purely based on electronic signal which comes through user speed.

You can see from the schematic diagram of the Convectional injector. Convectional
injector carrying following main parts.

1. Body (Holder)
2. Nozzle
3. Nozzle retaining nut
4. Inlet connector
5. Spring
6. Shims
7. Pressure pin
8. Distance pin

All mention child components are very critical and more its assembly also critical, for
assembly of this injectors, Bosch carrying some special purpose machines. Convectional
injector getting assemble as per the sequence shown in schematic of convectional injectors.
There are all to gather 7 assembly stations including its testing as well as the Final visual. After
assembly of this injector on special purpose machines this injector comes for testing. As this
injector application varies from 300 to 800 bars, its quit easy as compare to the common rail
injectors. When oil flows through inlet connector to spring at certain pressure, Nozzle needle
lifts the spring and allow oil to pass through the Nozzles, Machine detect the opening pressure
as well pressure of oil coming out of the injector. Spring are design in such way that it get open
at design pressure of the injector.
1.8.3 About Common rail injector

These new type of injectors are used in most passenger cars in now’s a day for diesel segment. These Common rail injectors are very efficient due to their precision of injection quantity in Engine. This common rail injector system has been developed to follow Euro norms and is less polluting. They are more precise because of the use of electromagnet for lifting of nozzle and they work at higher pressure. In Bosch, Nasik, Common rail injector is one of the growing product and the requirement also increasing day by day because of the government pollution control laws.

We all know in India still Euro 2 Implemented and for city like metropolitan cities like, Mumbai, Delhi, Chennai, Bangalore, Kolkata, Pune etc. The pollution law is stringent. In this cities Euro 2-3 implemented, where for diesel vehicles this is need to reach this Environmental control measures. In present market situation most of sale of the vehicle is in metropolitan cities. In market for diesel the requirement is for Euro 3 norms and that case Common rail injector requirement is increasing since last few years and it will go ahead the requirement of conventional injectors.
This impact is visible for the requirement in Bosch, Nasik production. Above Fig. shows that, how the requirement of common rail injectors shows increasing trend year by year and vice versa in case of the conventional injectors. Still the requirement is 50 % for both type of application injectors but in near future it will be the 70 and 30. This shows that “Common rail injector” will be the future for Bosch Nasik plant.

**1.9 Value Stream Mapping & Design**

Value stream mapping is a Lean process-mapping method for understanding the sequence of activities used to produce a product. We use value stream mapping to identify sources of non-value added time or materials; identify opportunities to increase efficiency; and develop a plan for implementing improvements. Value stream maps serve as a critical tool during the review process and can reveal substantial opportunities to reduce costs, improve production flow, save time, reduce inventory, and improve environmental performance. Conventional value stream mapping can overlook environmental wastes.

In order totally to grasp the various price streams during which the sponsors operate, it's necessary to map these intercompany and intra company price adding processes. These value-adding processes create the ultimate product or service additional valuable to the tip shopper than otherwise it might. The distinction between the normal offer or price chain and therefore the price stream is that the previous includes the whole activities of all the businesses concerned, whereas the latter refers solely to the particular elements of the companies that really add price to the particular product or service into consideration. Intrinsically the worth stream could be a way more targeted and contingent read of the worth adding method. Main specializes in to spot waste in individual price streams and, hence, notice associate degree applicable route
to removal, or a minimum of reduction, of this waste. The utilization of such waste removal to drive competitive advantage within organizations was pioneered by Toyota’s chief engineer, Taiichi Ohno, and sensei Shigeo Shingo and is destined basically to productivity rather than to quality. The explanation for this can be that improved productivity and cost competitive ends up in throw operations that facilitate to reveal additional waste and quality issues within the system. so the systematic attack on waste is additionally a scientific assault on the factors underlying poor quality and elementary management issues, this tool conjointly facilitate the determine the requirement primal substitution wherever value and time interval square measure additional for existing price stream. In inside producing context, there square measure 3 forms of operation that square measure undertaken consistent with fashionable trade. These are classified into:

(1) Non-value adding (NVA);

(2) Necessary however non-value adding (NNVA); and

(3) value-adding (VA).

The first of those is pure waste and involves supererogatory actions that ought to be eliminated utterly. Examples would come with waiting time, stacking intermediate product and double handling. Necessary however non-value adding operations could also be wasteful however square measure necessary below the present operative procedures. Examples would include: walking long distances to choose up parts; unpacking deliveries and transferring a tool from one hand to a different. So as to eliminate these forms of operation it might be necessary to form major changes to the software like making a brand new layout or arrangement for suppliers to deliver unpacked product. Such amendment might not be attainable like a shot. Value-adding operations involve the conversion or process of raw materials or semi-finished product through the utilization of toil. This might involve activities such as: assembly of elements, formation raw materials and painting body work. In our case we consider the waste is lead time as well as tool cost high, by doing the complete mapping of CRI assembly and testing
of common rail injector from star to end the high cost item noted and its delivery time also noted. One tooling identified on which we can do the import substitution which will reduce the lead time as well as the high cost incurred in it. There are seven commonly accepted wastes in the Toyota invention system (TPS), This Seven wastes we tend to do take into account in out Hieronymus Bosch Production system (BPS).

(1) Overrun

(2) Waiting time because of import

(3) Transport

(4) Inappropriate process

(5) Excess inventory because of lot of fluctuation in demand

(6) Excess cost because of dependency on foreign supplier

(7) Defects

Overproduction is considered the foremost serious waste because it discourages a swish flow of products or services and is probably going to inhibit quality and productivity. Such overrun jointly tends to guide to excessive lead and storage times. As a result defects might not be detected early, merchandise could deteriorate and artificial pressures on work rate could also be generated. Additionally, overrun ends up in excessive work-in-progress stocks that lead to the physical dislocation of operations with subsequent poorer communication. This state of affairs is usually inspired by bonus systems that encourage the push of unwanted product. The pull or kanban system was utilized by Toyota as the simplest way of overcoming this drawback. Once time is getting used ineffectuaciously, then the waste of waiting happens. In an exceedingly plant setting, this waste happens whenever product aren't moving or being worked on. This waste affects each product and staff, every disbursal time waiting. The perfect state ought to be no waiting time with a subsequent quicker flow of products. Waiting time for staff could also be used for coaching, maintenance or kaizen activities and will not lead to overrun. The third waste, transport, involves product being emotional regarding. Taken to associate extreme, any
movement within the plant may well be viewed as waste then transport minimisation instead of total removal is typically wanted. Additionally, double handling and excessive movements are doubtless to cause harm and deterioration with the gap of communication between processes proportional to the time it takes to feed back reports of poor quality and to require Corrective action. Inappropriate process happens in things wherever a fault complicated solutions are found to easy procedures like employing a massive inflexible machine rather than many tiny versatile ones. The over-complexity typically discourages possession and encourages the staff to overproduce to recover the big investment within the complicated machines. Such associate approach encourages poor layout, resulting in excessive transport and poor communication. The ideal, therefore, is to possess the tiniest potential machine, capable of manufacturing the desired quality, settled next to preceding and succeeding operations. Inappropriate process happens conjointly once machines are used while not spare safeguards, like poke-yoke or jidoka devices, so poor quality product are ready to be created. Excess inventory tends to extend time interval, preventing fast identification of issues and increasing area, thereby discouraging communication. Thus, issues are hidden by inventory. To correct these issues, they initial have to be compelled to be found. This will be achieved solely by reducing inventory. Additionally, excess inventories produce vital storage prices and, hence, lower the aggressiveness of the organization or worth stream whereby they exist. Excess movements involve the bioengineering of production wherever operators have to be compelled to stretch, bend and acquire once these actions may well be avoided. Such waste is effortful for the staff and is probably going to guide to poor productivity and, often, to quality issues. The bottom-line waste is that of defects as these are direct prices.

The Toyota philosophy is that defects ought to be considered opportunities to boost instead of one thing to be listed off against what's ultimately poor management. Therefore defects are confiscate on for immediate kaizen activity. In Bosch production system (BPS), it is the continuous and iterative analysis of system improvements using the seven wastes that results the seven value stream mapping tools. In a kaizen-style system. As such, the bulk of enhancements are of a tiny low however progressive kind, as against a radical or breakthrough sort. Waste removal within price streams because the focus of vale stream includes the entire
price adding (and non value adding) method, from conception of demand back through to material supply and back once more to the consumer’s receipt of product, there's a transparent have to be compelled to extend this internal waste removal to the entire provide chain.

1.10 Procedure for value Stream Mapping:

Value stream mapping act as effective tool to acknowledge areas of improvement inside price stream inclusive of provide chain to create whole system throw. a worth stream map identifies all the actions that take a product through the producing method, from getting raw materials to delivering the ultimate product. the thought is to draw, on one page, a "map" of the flow of fabric through production and therefore the flow of data from the client back to every production method and key provider. Once the worth stream is known, steps ar taken to optimize the producing method by distinctive waste. This adds price to your product and services which will simply set you except the competition. price stream mapping could be a low-tech, pencil-and-paper tool that enhances communication, business designing, and overall management. it is not only for the work either–it will be applied to each a part of} the organization The beginning is drawing a close image of every part of your operation to supply a "current state map"–the scenario because it exists these days. The whole producing method is prepared, as well as cycle times, down times, in-process inventory, material moves, and data flow methods.

The second step is identifying ways to improve your process flow that will eliminate waste and utilize time, talent, and equipment more efficiently. This invariably results in a better understanding of the entire manufacturing process. These improvements define the "future state map"–where you want to be in one month or a year from now. The third and final step is implementing the process improvements, which leads to reduction of work-in-process and production lead times, fewer defects, and faster responses to demand changes. Expect to get
defective parts down by 30%. Until you do a value stream map seven times on the same process, you aren't really lean.

### 1.11 Value Stream Mapping Definitions

Current State Map - Map of things because it exists these days i.e. “the current state” and use it to spot sources of waste and also the degree of (or a lot of typically the shortage of) flow among the assembly system. Future State Map - Map that shows how value stream might flow terribly with expected results. Value - The reliable performance of a product at rock bottom attainable price. price is that the relationship of operate to price. price Stream - the precise activities needed to style, order, and supply a particular product, from construct to launch, order to delivery, and raw materials into the hands of the client. price Stream Mapping (VSM) - Identification of all the precise activities occurring on a price stream for a product or product family. price Stream Manager – person behind the making a future state map and leading door-to-door implementation of the longer term state for a selected product family. Makes modification across the division and useful boundaries.

Waste – Any activity that consumes resources however creates no value for the client. Value Stream Mapping—A pencil-and-paper tool used: a) to follow a product or info (or both) activity path from setting out to finish and draw a visible illustration of each method (value and non-value) within the material and data flows. b) then to style a future state map that has waste removed and creates a lot of flow and c) to finish up with an in depth implementation arrange for the longer term state.

### 1.12 Icons for Value Stream Mapping
1.13 Supplier Value Stream Mapping and Designing:

The current state Where we begin this mapping and how does it work? Developing the map requires the user to draw a series of icons, each representing a distinct stage within the worth stream. There are three distinct icon types: material flow, data, and general icons. Material flow icons represent stops within the producing method (machines, assembly stations), outside sources (factories), inventories, push arrows, truck shipments, etc. information boxes that show key production metrics accompany material flow icons. Many different material flow and general icons exist. (A complete list of icons is accessible in "Learning to examine," associate guide printed by the Lean Enterprise Institute of Brookline, Mass.) Data lines are accustomed connect material flow icons to create a whole and united production system. The
lines represent every kind of data flow, together with manual, electronic, Kansans, go-see programming, and cargo leveling. Like material flow icons, data lines are among tiny, rectangular description boxes. These boxes detail the frequency of the knowledge flow. As it is true in most kaizen events, VSM ought to be conducted in a very cross-functional, team setting. The team ought to embody associates from all areas of the corporate moreover as a representative of the client.

Mapping the worth stream perpetually starts with clients demand, except for that product. The idea of lean producing is product families. We’ve got think about it for CRI worth stream, everything in a very lean organization (machines, R&D, marketing, engineering, and even maintenance) is organized around specific product families. Thus, the primary task for the mapping team is to outline that product family to map. This task in itself might need a replacement outlook on business and obligate the team to form choices before invitational the client in to start mapping.

Start the map by drawing a industrial plant icon and information enclose the highest right corner of the paper. Fill within the information box with a listing of client needs (remember that the worth stream relies upon product families, therefore be specific) like units per day, range of shifts, complexity break, and different production data. Bear in mind that the scope of a value-stream map encompasses far more than simply the industrial plant. It includes the whole worth stream from stuff to cargo of finished product. Therefore, the most effective place to start out is with the client, since the client is that the solely individual. United Nations agency will outline truth worth of the trade goods at hand. (The client icon on the map resembles a castle, representing the actual fact that the client is king.)

The next step is outlining the fundamental provider production method. Use a method box on the left facet of the map to represent suppliers. Usually, all suppliers cannot be listed, that the rule of thumb is to pick out the provider of the foremost very important parts or the
corporate that provides the foremost parts by dollar quantity. once the suppliers are drawn, list
the assembly details of the operation in a very information box. This data ought to be pronto
offered from your business department. The last step of the external map is to connect all the
icons with information flow icons. Draw the appropriate icon based on the type of information
flow. Figure 1 has electronic information flow, which is indicated with lines that appear as
lightning bolts. Other types of flow make use of different types of lines. Below each
information icon, draw a description box and fill in the frequency of information flow. The
external map is now complete.

1.14 Determine waste

Now that the present state of the worth stream has been mapped, waste throughout the
stream should be known and eliminated to shorten lead-time and improve the added proportion
- in different words, to remodel the assembly system from a batch and push into a one-piece flow
and pull. This can be really wherever the facility in VSM lies. VSM permits the user to examine
the waste throughout the stream and picture a future state that a lot of closely resembles lean.
However, the sole thanks to determine the waste is to know the seven components that don't
contribute to the worth of the product: production, inventory, transportation, waiting, motion,
over-processing, and correction (re-work).

All seven components are often known (if they exist) on the current-state map. Take a
glance. Overproduction are often known with inventory triangles when the last internal method
box and before cargo to the client (overproduction is any inventory the least bit throughout the
whole process). If the triangles exist, verify if the production is that the results of a pull demand
(built on to order and during a "supermarket") or a push demand (predicting or perhaps
guesswork what the client may order and building to the prediction). If the production is pull-
oriented, the system is extremely near lean. Merely make sure that takt time is being met (and
not exceeded) which the production can't be eliminated. If the system is push-oriented several
queries should be self-addressed (and that's a wholly totally different article). Inventory isn't a part of the lean conception, and it kills production lead-time. Lean producing needs one-piece flow throughout the assembly system. One-piece flow ensures a lot of shorter lead times and drawback identification before a whole week's price of product is factory-made incorrectly. If the machines, layout, and method cannot support one-piece flow, these factors should be investigated and improved. However, don't despair. Lean events typically need major changes at intervals a method, and also the advantages (improved interval, floor area reduction, and increased money flow) greatly outweigh the results (losing customers).

### 1.15 Outcome of value stream mapping of Common rail assembly:

As part of value stream mapping we map all process within value stream where in it was observed that in order to reduce further cost as well as waster due to lead time and waiting time just because of certain imported tooling. This tooling required for functional testing of common rail injector and having only one source for all common rail injector plant in the Bosch worldwide. Project defines under the KPI of cost reduction i.e. doing the import substitution of common rail injector test cable. This project has taken in order to find the yield in following points. This is yield also divided in terms of tangible and intangible.

Following are the tangible benefit by doing the import substitution of test cable.

1. Reduce the cost of incoming test cable
2. Reduce dependency on one supplier
3. Reduction of lead time for procuring ( waste for waiting for test cable )

Following are the tangible benefit by doing the import substitution of test cable.

4. Saving on foreign exchange
5. Developing internal department competency
6. Technical upgradation of vendor
7. Maximum utilization of available resources from value stream

1.16 Value Stream Designing (Future State)

The future-state map is simple to develop however needs determination and persistence to implement. This said, the event of the future-state map is crucial to supply a blueprint to the best state of lean. There’s a way to develop the longer term state. The primary step needs the calculation of takt time. Takt time is that the range of units needed by the client per unit of your time. To calculate takt time, use the subsequent formula: takt time = (net operational time / period) / (customer needs / period). Note that takt time isn't cycle time. However, for a lean method, cycle time and a tiny low potency commonplace ought to equal takt time. The importance of takt time lies within the goal of manufacturing one unit simply in time to switch a unit utilized by the client - in different words, a cycle time supported one-piece flow. If cycle time exceeds takt time, the method can generate WIP, waiting, excess motion, damage, and different waste. Again, changes within departments, machine cells, and warehouses presumably are needed to market one-piece flow and make sure that takt time is met. Reducing cycle time and making one-piece flow leads into consequent future state question: wherever will the assembly system use continuous flow? An example of continuous flow is an automatic line. The automation forces one-piece, continuous flow. True, the road presumably will be stopped - since continuous flow doesn't imply one hundred pc potency - however the character of the automation forces line support and engineers to balance the operation and guarantee continuous flow. In addition, the continual flow will proceed at a pace that guarantees takt time is met. WIP, excess waiting, material handling, and over-processing square measure eliminated with continuous flow.
1.17 Project definition

The future-state map from above is to develop the local source for test cable consumption. Doing the import substitution of test cable is one of the challenging task not only the criticality of the its function but local knowledge available for cracking the patented technology for doing reverse engineering.