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Executive Summary

The following report outlines the relation between supply and demand chain and value chain. It defines the role and significance of an engineer in the organization. From product conceptualization to product delivery, an engineer provides insights in the interactions between buyer and supplier and how these ensure optimization of product design and manufacturing processes. Engineers apply their technical skills and leadership qualities to achieve desired goals. In this report I have outlined the role of an engineer in context to *Sydney Light Rail*.

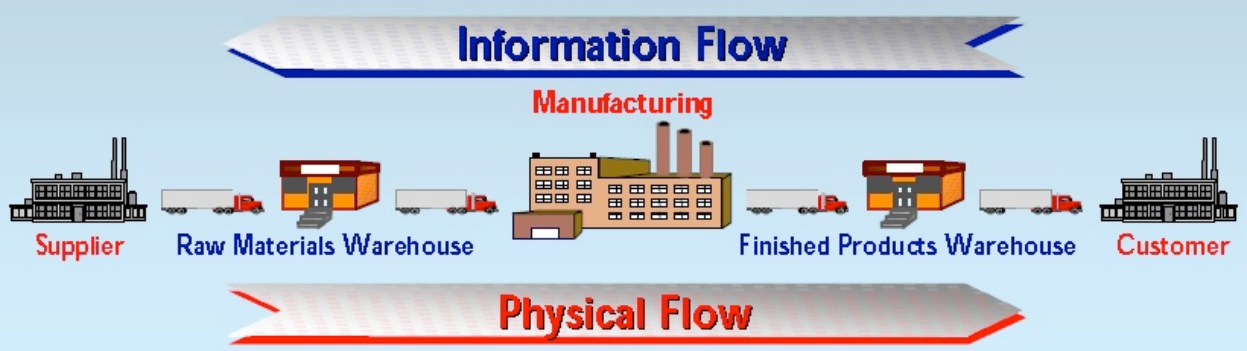

Figure 1- Value Chain

Value Chain : "It is describes the full range of activities that are required to bring a product or service from conception, through the different phases of production, involving a combination of physical transformation and the input of various producer services and delivery of final produce/ services to the consumers" - *R Kaplinsky, M Morris (2001)*.

Supply Chain: The Stages involved in fulfilling customer demands is supply chain. it is the physical flow of material as shown in *Figure 1*.

One of the important component in light rail is rail Tracks, iron ore is supplied to the steel plant it is processed (iron ore converted to rail tracks) shipped to the customer.

Demand Chain: To manufacture rail tracks we need to identify the costumer's needs like quantity required , shape, size etc. this backward flow of information is called demand chain.

1. Infrastructure Australia Role

Infrastructure Australia is an advisory body formed in year 2008 to review infrastructure projects. Facilities that makes the business activities viable such as, transportation, communication , energy supply systems ,distribution networks etc. are essential for development of the nation.

Infrastructure Australia advises Australian government and private sectors on the following:

- Australia's present and future needs for infrastructure.
- Strategy development and planning.
- Mechanisms for financing infrastructure investments.
- Prioritizing infrastructure projects.

1.1 Impact on Australian economy

Water, energy, indigenous facilities, transport and broadband are vital components for the economies success of in the modern world. Well designed infrastructure investments have future economic benefits, can raise productivity, economic development, while providing significant profits. However, strategic infrastructure investment is critically important as *over investment* can lead to projects that are unproductive and therefore have low marginal returns.

Building infrastructure has some of the following impacts on Australia's economy :

- Expands productive capacity.
- Increase productivity.
- Diversification of economic capabilities.
- Build global competitive benefits.

1.2 Social cohesion

The key elements of social cohesion are s*ocial capital, social mobility and social inclusion.*

Figure 2- The Components of Social Cohesion

A group or a society is said to be in a state of cohesion when its members are bonded to one another and to group as a whole. The aim of cohesive society is members well-being, marginalization and fights exclusion, promotes sense of belonging, trust and offers its members the opportunity of upward mobility.

2. Sydney Light Rail

Peak hour traffic in the CBD has always been a pressing issue for commuters. With increasing number of professionals travelling towards the city for work by road, traffic conditions have become extremely volatile. Sydney Light Rail offers a solution for the same issue along with being a cheaper means of transport and reducing pollution. The Sydney Light Rail can travel along streets, uses overhead electric cables as a power source, uses standard gauge tracks, are quite in operation and are designed to run on a vibration free track. The Light Rail System also blends well with the urban landscape.

Usage of the Sydney Light Rail would help in reducing the number of accidents to a certain extent as well. With its pros come some cons as well. While constructing a Light Rail solution, the planning team would have to keep in mind not to add congestion to areas of high population density, height and the location of over head power cables should not interfere with the residential population's supplies etc.

2.1 Challenges in Supply Chain for Engineers

- **Reliable Manufacturing Operation**

Suppliers need to be strategically chosen such that they have reliable local operations and provide global quality standards. The supplier should also have a global network so that it can respond to and support the supply chain's needs efficiently, with priority.

- **Shorter Lead Time and Better Throughput**

Considering lean methodology of operation, suppliers should be chosen such that they have shorter product life cycles and ensure timely delivery to support the operations.

- **Supplier Base Consolidation**

Consolidation of the supplier base eliminates variances and overheads in the supply. The supplier should be equipped with solutions and experienced in supplier-based consolidation processes.

- **Using appropriate metrics**

It is always advisable to find and implement the right metrics in supply chain management. Supply chains, product lines and departments should all rely on the same calculations and definitions. Having too many or too few metrics can lead to difficulty in benchmarking.

- **Efficient Warehousing**

All product supplied by suppliers should be stored and transported efficiently. Improper warehouses and losses in transportation to site can lead to increase in the total cost of the project or structural imperfections in the end product.

3. Role of Engineer in Resolving Supply Chain issues

A supply chain consists of a supplier, producer and consumer. Supply Chain Management allows an organization to outline and understand the flow of materials, information and capital from a system's perspective.

3.1 Tasks of Engineer

- **Initial Allocations**

The design phase starts with conceptualization and identification of key components and subsystems. During this phase, the engineer reviews all available products that can be used. Sometimes, the technology required to achieve performance goals may not be easily available. In these cases, the conceptualization phase includes subsystems or components that would require some increased investments in technology. The initial allocations are considered to be complete only when hardware and/or software items have fulfilled performance requirements.

- **Sourcing Strategy**

After initial allocations, a strategy is developed to procure critical components. In this phase, decisions are made for the following:

a) Production development strategy – in-house or outsourced.
b) Supplier relationship required for fabrication and design of the product.
c) Time required to develop the technology required in product development.
d) Sourcing strategy for high-risk components.
e) Supplier identification.
f) Investments required in product and process technology.
g) Investments to be made in supplier development.

- **Supplier Selection**

This phase requires an initial investigation and assessment of the suppliers' capabilities. It should be established that the supplier has sufficient knowledge of the product and process. Following supplier assessment one or more suppliers are selected and they participate in product development tasks.

- **Specification Re-balancing**

Supplier and sourcing organizations should assign their engineers to work towards balancing product requirements. The sourcing organization should incorporate the supplier's knowledge of the product and manufacturing processes and capabilities. To optimize system performance, factors like product performance, cost and quality should be factored into the system specifications and requirements.

- **Development of Manufacturing Processes**

By the end of specification rebalancing, the supplier and procuring organizations should have a set of specifications that are acceptable to both. While developing the manufacturing process the engineers from both sides should work towards understanding the effect of the selected manufacturing process on product cost, schedule, quality and reliability.

- **Visibility into Supplier Performance**

The procuring organization should routinely collect metrics like incoming supplier quality, supplier in-process quality etc. Metrics should also be collected to ensure that the components' performance in the factory matches the performance on field. Having suppliers participate in the production meetings would allow the procuring organization to adopt proper strategies to deal with delivery or quality problems.

- **Problem Resolution**

Problems should be addressed in a timely fashion. Both, the supplier and procuring organizations, should agree to the solutions identified. If problems are not resolved at proper times, they could lead to losses in sales, revenues and customer satisfaction for the procuring company.

4. Conclusion

This report outlines that effective value chain management helps an organization to attain lowest costs, quicker product development cycle, effective distribution cycle, smarter investments and best technology practices. An engineer is instrumental in providing product related knowledge, effective management and leadership. These resources play an important role in maintaining and developing the value chain of the organization, which, in all essence, is a combination of supply and demand chain. Engineers are also responsible for enabling a healthy culture change by emphasizing on knowledge sharing which in turn helps in avoiding double inventories and improve waste management.

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