



**ORIGINAL RESEARCH PAPER**

**Economics**

**LINKAGES AT ALANG SHIP BREAKING YARD, GUJARAT**

**KEY WORDS:**

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**Introduction**

Ship breaking or ship scrapping as defined by the U.S occupational safety and health administration (OSHA) is "any breaking of a vessel's structure for the purpose of scrapping the vessel, including the removal of gear, equipment or any component of a vessel" (U.S. Environmental Protection Agency, 2000).

A ship consists mostly of steel. At the end of its useful life, it becomes a source of ferrous scrap. The scrap is particularly reprocessed for manufacturing simple steel products such as steel rods used in civil engineering. A large portion of the waste generated following the demolition or scrapping process is largely returned to good use. Useable equipment is such as pumps, motors, generators etc are sold as it finds alternative applications and the scrap steel is reprocessed (Andersen, 2001: 1-2).

Ships were historically broken at regulated European dry dock facilities by skilled workers. After 1970's the high cost of environmental controls and employees safety standards shifted the work onto cheaper shores. As a result, during 1980's these countries delocalized their activities to developing countries. Besides, the availability of cheap labour in developing world, the adoption of stringent environmental norms by developed countries acted as the major reason for the shift of these activities toward the developing countries. The ship breaking industry creates enormous employment opportunities and generates income, as it also provides with recycling of products and scrap materials for further production. According to 2001 OCED report on ship scraping, "ship demolitions remove large volume of obsolete tonnage from fleets, recycle many of the materials used in ships construction and are a major employer in the main ship breaking areas" (International Federation of Human Rights, 2000:4).

On average a ship has an active life span of 25 to 30 years. After it fails to meet the safety requirement, it is sent for breaking. The ship is sold through international broker or via cash buyers. Until 1960's, ship breaking activities was highly mechanized and concentrated in industrialized countries like United States, the United Kingdom, Germany and Italy. The United Kingdom accounted for 45 percent of ship breaking industry. During 1960's and 1970's ship breaking activities shifted to semi-industrialized countries, such as Spain, Turkey and Taiwan mainly because of availability of cheaper labour and also the existence of re-rolling mills in these countries. About 79 countries were involved in ship breaking activity. Asian yards come into existence during 1980's. Despite their late establishment, at present this region account for over 95 percent of the industry. Alang ship breaking yard of India has become eminent industry holding first position in Asia and also in world market. Bangladesh holds second position after India. The present paper analyzing linkages of the ship breaking industry and also analyse the backward and forward linkages of the ship breaking industry of Alang.

**Linkages**

In this section an attempt is made to analyse the linkages in ship breaking industry. The input-output relationship between firms in economic terminology is known as linkage which implies the inter change between firms of goods and services in the production process. In this way the units involved gain full advantages from being attached to each other. The industrial products of one unit

are used as raw material and this is termed as technological linkage. This phenomenon is represented by the input-output matrix propounded by Leontief.

Linkage is a functional link between one firm and another based on input-output link, common labour pool, capital link, technology link etc. In geographical terminology, it is known as inter-relation and inter-dependency of one unit to another. In this mechanism the output of one unit become input for other and as a consequence both the units are benefited. Moreover such linked or related industries require specific types of labour skills and mobility among firms. These advantages accrued are known as economies of concentration (Pratap, 1985: 165).

The concept of linkage was first developed by Hirschman (1958) to provide explanation of development process in a country like England. Hirschman suggested linkage as a criterion for selecting key sectors. When a sector with high linkages is considered as priority sector, the basic assumption is that it induces growth in many sectors rather than the low priority sectors. That means the emergence of a leading sector and simultaneous development of different sectors gives rise to a great deal of transactions of input and output among them. This inter-industry linkages increase with the level of industrialization. An economy grows by generating various demands. The demand for output of industries is known as forward linkages, while the demand for various inputs is known as backward linkage. The linkages, whether backward or forward are of different types such as technological, production, financial and consumption linkages. The technological linkage would involve the supply of equipment, technical know-how and skills among various sectors. Consumption linkages refer to direct links with final consumers, mostly households by way of consumption linkage (Patrick, 1999: 95-96).

The linkages in the manufacturing processes present the most complicated phenomena. Linkages are of various types. Linkages exist among the intra-industrial and also in the inter-industrial complexes. In the intra-complexes it is of four types as propounded by Jarrett (1977), Estall and Buchaman (1968). These are vertical, horizontal or lateral, diagonal and technological linkages.

Vertical Linkages is an inter-link between single firms and each normally forming one stage in a series of operations. It is also known as industry or sequence or process integration. It is the combination of successive stages or process of manufacture of the finished article- beginning from raw material, passing through stages of manufacture to the finished product and distribution. The units combined together do not compete with each other but stand end to end, the one receiving the products of other as raw materials, finally forming to a one single establishment. The industry that significantly depicts vertical linkages is the steel industry. The material passes through several stages of manufacturing into steel or further into steel products.

Horizontal or Lateral linkage occurs when a number of industries produces goods which are finally assembled into a single large product. This type of linkage is integration of unit in which units of same character are engaged in same activity and complete the same level of attainment. This type of linkage provides external economies in buying, manufacturing and selling. In case of vertical linkage these external economies are lacking.

Diagonal linkage occurs when different goods are manufactured by different units and they are used by other industries. This process of linkage is also known as service-integration processes. Firm's contact with a number of different units producing various products. The best examples are washers, nuts and bolts, ball-bearing which are widely used in various manufactured products. Similarly tools and equipment of different kinds find wide usage in industry.

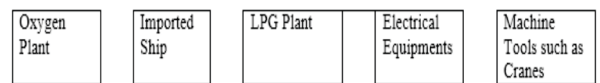
Technological linkage is a novel concept in which a single unit manufactured product is differently used as the raw material for other industries. This type of inter-industry dependence is best understood by input-output table. For example, steel is used in several other industries such as machine manufacturing, construction, transport equipment etc. Likewise steel wire may be used to manufacture nails, screws, chains, electrical fuses, cables etc. With the help of this method estimation of direct and total linkages are possible. The direct linkage gives only the relationship between the firms but the total linkages take into consideration the technology and the inter-industry dependence direct plus indirect.

Much of the literature on linkages deals with formal sector analysis even though the economy wide transactions comprises of both formal and informal sectors. When one intends to analyse a specific situation of an industry one has to take into consideration the peculiarities of that industry as it process the characteristics of both formal as well as informal sectors. The ship breaking industry is a recycling industry and not a manufacturing industry. Secondly, this activity depends to a large extent on semi-skilled and unskilled labour for its labour requirements. Thirdly, the labour working in this industry is largely migrant in nature.

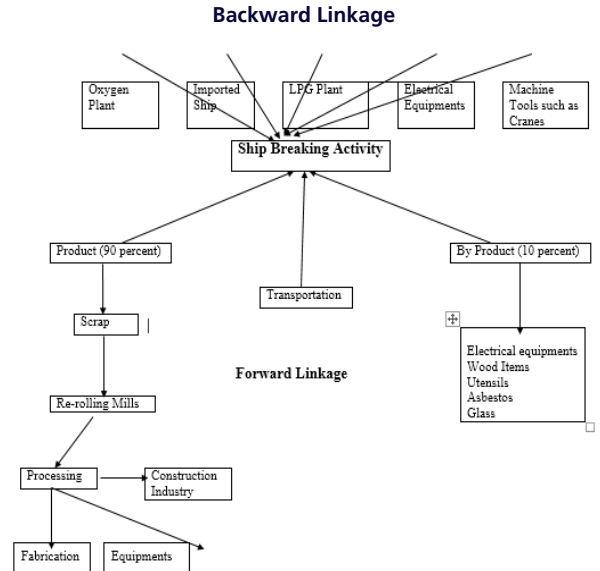
In developing countries, the informal sector is not an independent and exclusive sector. It is linked to formal sector and rest of the economy through various types of linkages. The formal sector is dependent on informal sector for cheap wage goods, service, cheap labour at lower price and sale of its input. But in terms of competition with formal sector, informal sector is at a disadvantageous position. But in certain fields the informal sector is predominant and formal sector does not compete and leaves to informal sector.

The intention here is to present the linkages of ship breaking industry. The ship breaking industry though is a recycling industry which has a great positive impact on the steel industry of India and also on the economic development of the region. The reprocessed steel forms 10-15 percent of the total steel production in India. It generates large scale employment, direct and indirect and also generates spread effects in many ways.

The major inputs to the ship breaking industry are the ships that are purchased from various countries across the world. The purchases are done through various agents of countries operating internationally. The purchasing of the ships, the finances come from various financial institutions. For the ship breaking activity to take place, GMB acts as a facilitator by providing sites and infrastructure as required. Various types of machinery and equipments are required for the ship breaking activity. In addition, oxygen and LPG gases are a requirement along with labour for the activity to generate product (90 percent) and by products (10 percent) in terms of value, which lead to lot of spread effects in terms of industrial growth and other opportunities for entrepreneurs. Flow chart 2.1 presents a brief picture of ship breaking activity, which is explained, in succeeding paragraph.



Flow Chart : Backward and Forward Linkages of Ship Breaking Industry



The ship breaking industry produces 90 percent of products i.e. steel scrap and 10 percent of by products such as electrical equipments, wood items, utensil, asbestos, glass etc. Therefore, the main output of the ship breaking industry is steel scrap, which amounts to 90 percent in terms of value.

The ship breaking industry of Alang plays an important role in the country in terms of revenue generation which is approximately Rs. 17 billion per annum (International Metalworkers Federation, 2006: 41). In modern times the steel products are used by various industries as well as household. Due to this the importance of ship breaking industry is increasing over a period. Apart from its importance to other industries of the economy, the ship breaking industry is important in meeting steel requirement in the country, accounting 10-15 percent of the steel production of India. Therefore, ship breaking industry is the first stage of growth of various industries in the region. A similar phenomenon has been noticed in Bhavnagar. There are 100 re-rolling mills, 20 oxygen and 12 LPG plants are established in the region or outside the region (International Federation of Human Rights, 2000). These industries generate vast employment opportunity for the workers and also generate demand for other related materials.

The ship breaking industry in Alang has clear-cut spread effects and has impact on the development of the region. Alang ship breaking yard can be considered as the starting point of the chain of industrial link in the region. Industry produces largely steel scrap and also useable items which are used in households. Ship breaking yard produce raw steel that was earlier being imported from other countries. After the cutting of ship into small plates and pieces the scrap is dispatched to re-rolling mills for further processing.

The ship breaking industry of Alang is linked to various small and medium industrial units through purchase of raw materials and sale of output. Ship breakers purchase LPG and oxygen cylinders from various plants which are used in the process of cutting. In the process of cutting a ship on an average 250 to 300 oxygen cylinders and 35 to 40 LPG cylinders. These are considered as basic ingredients for ship breaking industry. After cutting the ship into plates and pieces they send them to re-rolling mills which is directly link with ship breaking industry. There is indirect link with ship breaking industry is construction industries because they purchase steel products such as rods, bars etc from the re-rolling mills for construction work. In the region about 100 re-rolling mills are operating which generate employment of 80-120 workers per re-rolling mill.

The products of ship breaking industry are used by various small, medium and large industries to convert them into final products depending upon the nature of the products and their uses. Ship

breakers sell their products to various units within the region and also outside the region. For example, electrical equipments, wood items, motors, generators, utensils are sold to unorganised sector as these products are effectively repaired and converted into final products by these industries. On the other hand, steel scraps are mainly supplied to re-rolling mills, which is the part of organised sector. Therefore, raw material generated by ship breaking industry is sold to both organised and unorganised sector industries to convert into final products is considered of scraps and other items such as wood, generators, utensils etc.

### Backward Linkage

The purchase by an enterprise consists of different materials and these are purchased from different sources located in the region or outside the region. Inputs are to be purchased from different sources. It is observed that many a time purchase of input by the firm is not directly from the producers but from middlemen. Depending upon the nature of input used in ship breaking industry these inputs are classified into categories. These categories are (i) import of old ship, (ii) oxygen plants (iii) LPG plants (iv) machine tools etc. The industry also depends on various service providers locally or internationally.

These categories of inputs are purchased by ship breakers either within the Alang region or from outside the region. These inputs are important in the process of dismantling of ship. The most important input for ship breaking industry is the availability of non-useable ships in international market for scrapping. Ship breakers purchase non-useable ships as raw material to convert them into various outputs, which is used by number of industries as raw material. On the other hand, equipments, machine tools, LPG and oxygen cylinders are another important input for ship breaking industry. These inputs are required in the process of cutting the ships into pieces. Most of the inputs are not available in Alang region hence linkages to other regions. Therefore, ship breakers purchase these inputs from outside the region. This inputs linkage shows how this industry is strongly dependent on other industries for various inputs. Overall it is found that ship breaking industry of Alang exhibits strong backward linkage in terms of requirement of inputs. The important activity of the industry, which is recycling naturally, exhibit high backward links as the industry is raw material intensive.

### Forward Linkage

Forward linkage in the ship breaking industry can be understood by analyzing the main user of the output of ship breaking industry. However, important output of the ship breaking industry is steel scrap, which is sold to small and medium re-rolling mills. Alang ship breaking yard is linked with various industries for selling its products. The sale of ship breaking industry to the different industries shows that the ship breakers do not face any problem or difficulty in selling their output. Further ship breakers have direct contact with the enterprise that purchases the output of the ship breaking industry. The main output of the ship breaking industry is directly sold to re-rolling mills, which is used as raw material for further processing. These re-rolling mills in the region or outside generate employment opportunities for skilled and unskilled labours, which show strong forward linkage. Further, re-rolling mills sell their products such as sheets, rods and bar to various industries. The processing industries, which largely consist of fabrication and equipment manufacturing in addition to the construction industry, are the ultimate users of the output of the ship breaking industry. The construction industry is growing at the rate of 10 percent per annum and the Indian construction industry accounts 5 percent of the GDP as against figure of 6-9 percent for most countries. The processed steel is also used in numerous other industries requiring steel and steel equipments.

Depending upon the destination of the output of the ship breaking industry to various industrial units, the sales of ship breaking industry are classified into region and industry. The entire output linkages of the industry are classified into two categories. These are (1) direct linkage i.e. re-rolling mills and (2) indirect linkages to a number of industries such as fabrication, equipment manufacturing and construction and a number of other industries.

From the above discussion on linkages of the ship breaking industry it is found that industry exhibit both direct and indirect linkages to different industries. Overall, it can be concluded that the ship breaking industry has strong backward as well as strong forward linkages with various industries within the region or outside the region. The ship breaking industry generates a direct employment of 30,000-40,000 and an estimated indirect employment upto 1.6 lakhs.

### Conclusion

Ship breaking is the process of dismantling obsolete vessel's structure for scrapping. The ship breaking industry produces both the potentiality for economic growth and also dangers of negative externalities. The ship breaking industry is a dangerous and high-risk industry with the risk of injury and accidents and also health hazards. A ship built 20-30 years ago constructed using various materials, the use of some of which is banned today. Therefore labours are exposed to hazardous substances such as heavy metals, cancer-causing chemicals like poly-chlorinated biphenyl (PCB), toxic paints, asbestos etc. Till 1970's ship breaking activities were concentrated in developed countries. But during 1980's this industry has shifted to developing countries due to strict environmental norms in developed countries.

The ship breaking process involves purchase of ships from international agencies of their. The ship breakers purchase ships of various types, such as war ships, oil tankers, passenger ships, cargo ships etc from both developed as well as from developing countries for dismantling. The dismantling of a ship is long drawn process. After purchase of ship, the ship breaker starts dismantling at the earliest to recover investment. There are various processes involved in dismantling of a ship, which starts from selection of ships, cutting and transfer of scrap to various industries for processing and for reuse.

In the process of ship breaking many health hazards are associated such as exposure to dangerous chemicals, risk of accidents etc. This industry is being slowly recognized as a hazardous industry. This is the one of the reasons that ship breaking industry is relocating from developed countries to developing countries. But the industry is survived in developing countries because it is still economical to break ships.

In the last decade more than 95 percent of ships breaking activities were conducted on the beaches of Bangladesh, India, Pakistan and China. Out of total ships dismantled in world, India ranks first in terms of percentage of vessels and tonnage, which is 58.25 percent and 45.09 percent respectively. In India 10 ship breaking yards are in operation. But the main ship breaking centre lies on the west coast at Alang in Gujarat state. Alang ship breaking yard is known as the world's largest ship breaking yard. This yard has the infrastructure to dismantle all types of ships. Alang ship breaking provides employment to skilled and unskilled workers ranging around 30000. There are various activities and industries that depend on ship breaking yard which generate employment to the tune of 1.5 to 1.6 lakh workers in downstream as well as in upstream industries.

Alang ship breaking is the starting point of the chain of industrial link in the region. This industry has wide linkages to other industries. The industry exhibits strong backward links to various industries for procurement of raw materials and also strong forward links to various industries for the sale of output. The products of ship breaking industry are used by various small, medium and large industries as raw material to be converted into final products. The ship breaking industry in its very nature is linked to various industries in the region. The ship breaking industry even after exiting for more than 25 years has retained some informal characteristics. The industry is unique in a number of ways.

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