Chapter 2

SHIP BREAKING INDUSTRY

2.1 Introduction

The process of breaking ships for the extraction of steel scrap for supply to the steel rolling mills has led to the beginning of an industrial activity. Ship breaking is the process of dismantling an obsolete vessel's structure for scrap. The process includes wide range of activities from removing all gear and equipment to cutting down as well as recycling the ship's structure.

This chapter deals in detail the background of the ship breaking industry in general and Alang ship breaking yard in particular. It also discusses the importance of the industry for the development of region as well as the economy. In addition, this chapter also examines the process of ship breaking i.e. the dismantling process and also their linkages to other industries. Finally, this chapter discusses the informal character of the industry while also surveying the literature dealing with the informal aspects or dimensions of this industry.

The present chapter consists of six sections. Second section examines the ship breaking industry in the world. This section includes the dismantling process of a ship and also highlights the nature of the activity. Section three examines the growth and development of Alang ship breaking industry. Linkages of the ship breaking industry is analysed in fourth section. This section analyses the backward and forward linkages of the ship breaking industry of Alang. The formal and informal characteristics of the Alang ship breaking yard are analysed in section five. This section includes the works done by various scholars on formal and informal characteristics of the industries.

2.2 Ship Breaking Industry

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.

Table 2.1 presents the number of vessels that were dismantled during 1994 and 2002. Out of 3854 vessels that were dismantled during this period 58 percent were dismantled in India alone. Table also reveals that out of top eight destinations for these ships six are Asian countries. More than 80 percent of ships dismantled were done in Asia. The Asian countries also account for more than 80 percent of tonnage of these ships. Out of 35,789,303 million tones of Ldt world wide, approximately 45 percent from the ships dismantled in India. The table clearly shows the important place of India and Asia in the ship breaking industry world over.

Table 2.1 Number of Vessels by Breaking Location and their tonnage, 1994-2002

Country	Number of Vessels	Total of Ldt (Million tons)	% of all Vessels	% of total tonnage
India	2245	16,135,949	58.25	45.09
Bangladesh	529	7,737,562	13.73	21.62
China	379	4,734,533	9.83	13.23
Pakistan	192	3,521,888	4.98	9.84
Turkey	109	379,641	2.83	1.06
Vietnam	29	372,882	0.75	1.04
Spain	18	59,439	0.46	0.17
Mexico	18	75,746	0.46	0.21
Other Countries	345	2,771,663	8.71	7.74
Total	3854	35,789,303	100.00	100.00

Source: Clarkson's Demolition Database, 2002.

Note: These are some of the major countries involved in ship breaking activity.

Light displacement tonnage (Ldt): the lightweight is the displacement, without cargo, fuel, lubricating oil, ballast water, fresh water and feed water, consumable stores and passengers and crew and their effects, but including liquids in piping.

2.2.1 The Dismantling Process

The dismantling of a ship is a long drawn process involving various stages from purchase of ship to the sale of scrap material recovered. The ship breakers purchase various types of ships from developed as well as from developing countries for dismantling in the ship breaking yards. After the ship is purchased, ship breakers start dismantling process and breaks down the ship as fast as possible to recover their investment. The ships offered for decommission are purchased by the ship breakers. Such unused ships are put for sale by both developed and developing countries. However, since the ships are purchased through international organization it is necessary for the purchaser to follow the rules and regulations of the country of origin as well as those of the country where the ship breaking activities will take place. Since ships are broken largely for procuring steel, the quantum and quality of steel becomes a major determinant for their purchase. Various types of ships such as oil tankers, war ships, passenger ships, cargo ships are available in the market for sale. Beside, steel the equipment i.e. machinery, electrical items, furniture etc are also obtained from the ships and sold in the market. Although there is no unique mechanism adopted for dismantling of ships, there do exist certain procedures and these procedures below.

a) Selection and Purchase of Ship

In the first stage complete information with regard to its type and origin is sought, beside its tonnage, years of service, maintenance undertaken as these factors play a crucial role in the selection and purchase of ships. For instance, Russian ships contain low grade steel due to poor or even lack of maintenance and run overtime. Such ships tend to have a clear loss of 20 percent of steel when compared to European ships where the loss is only 5 to 10 percent.

Further, the place of origin is also a determining factor as purchasers intend to reduce transportation time and also associated costs. Indian purchaser prefer to buy ships from countries like Thailand, Srilanka as the transportation cost is generally minimized

compared to those from far off countries. Hence international bidders hold bids in the Asian markets.

b) Transport

After the selection and purchase of the ship it sails off to the purchasing. The time of the journey varies from two weeks or more depending on the distance between the countries as its origin to the destination. However, the seller is liable to penalty if there is any delay in delivery. Once the ship arrives at its destination it has to fulfill the various administrative formalities in compliance with the needs of the destination country.

c) Administrative Procedure

Various administrative procedures are followed on the import of ships for recycling. Previously importers were not required to take permission to beach the ship on the coast. However in recent time ship breakers are supposed to obtain permission from number of authorities and also pay an import duty.

Once the ship arrives on the shore of the destination country, the purchaser has to obtain a gas free certificate for carrying on the breaking activities. This certificate is obtained after a through inspection of the ship is undertaken by the explosives department under the supervision of the custom department officials. It should be noted that according to Indian regulations all sensitive equipments i.e. military equipments such as telecommunication equipment, radars etc have to be destroyed.

It only after the completion of such administrative procedure generally within a week the port authority issues a permit for the ship to enter the country and to be beached. The captain then waits for the right time to perform the beaching operation.

d) Beaching Operation

Beaching operation depends on the tide. It is usually done on a full moon day when the tide is very high and thus facilitates the easy movement of the ship. The rainy season

is preferred for beaching as the tide coefficient is highest during this season compared to the winter season when the tide coefficient is least. The beaching operation is done under the supervision of the port officer.

e) Cleaning

Before the commencement of cutting process the ship breakers have to obtain another gas-free certificate for the entire ship. The second inspection of the ship is done after beaching and is different from the first one which is performed at sea. This is done to verify again the quantities of pollutants such as chemicals, fuel, explosives etc on the ship. Although the first inspection takes note of these matters, the second gas free certificate is usually done to ensure the safety of labours, as the cleaning operation usually performed manually.

f) Cutting

After securing the required certification, the cleaned ship is available for cutting. However before cutting the ship is stripped of all the equipments, tools, electrical items, and furniture as they too have market value. The cutting operation is carried out in stages to systematically retrieve the materials. Cutting of ship is done at two levels and these processes involve different levels of skills from the cutters. The first team of cutters works on the ship and cut the ship into slices that are then pulled up by cranes to the ground. On the ground, other team of cutters, fitter, pullers and pushers gradually cut and dismantle tons of steels into plates and pieces.

For cutting the ship, gas torches are used. The fuel which is used in gas torches is Liquefied Petroleum Gas (LPG) mixed with oxygen to increase the pressure and accelerate cutting operations. Depending on the size of the ship and quality of beaching operation, hundred of workers work round the clock to recover the steel scrap, equipments, generators, furniture, asbestos etc. The total dismantling process could take 3 to 6 months depending on the size of the ship.

2.2.2 Nature of Ship Breaking Activity

Ship breaking industry produces both the potentiality of economic growth and danger of negative externality. Ship breaking is one of the complex processes which involve many issues like environment, labour safety and health. The industry is being slowly recognized as the most hazardous industry. In the regard Paul Bailey opines, "The demolition of ship is a dirty and dangerous occupation. It is simply too risky a job for such a little pay" (Bailey, 2002). In the recent years much of the international debate on ship breaking has focused on health hazard and safety of the workers engaged in this industry.

The ship breaking activity shifted from high income countries (1960's) to middle income countries (1970-80's) and to low income countries (1980-90,s) due to growing environmental concern and stringent regulations in developed countries. During this process the ship breaking industry has transformed from being a capital intensive industry to labour intensive industry.

Thus the adherence to environmental norms, nature of the hazardousness of the activity and the technological cost has been major factors that have led to the relocation of this industry from the developed to the developing countries. It is being found that countries like India, Bangladesh, China and Pakistan have less stringent norms or legislation pertaining to environment and also the availability of huge labour force does not call for the need of costly technology. The relocation of the industry has thus transformed the nature of the industry from capital intensive to a labour intensive industry.

Various health hazards viz, exposure to dangerous chemical substances increase the risks associated with ship breaking industry. A ship contains number of chemicals such as Asbestos, Lead, poly-chlorinated biphenyl (PCB) and many more. After 1950, the ship building process have witnessed a major change as various chemicals, many of which are toxic have been used in its buildings. A ship contains a number of chemicals such as asbestos, PCBs and other hazardous materials and these have become common in

the process of ship building. Generally a ship of 10,000 LDT contains about 6 to 10 tons of asbestos. Hence it is very much evident that ship breaking industry carries beside risk, health hazard due to exposure to such chemicals.

The location of ship breaking industry and the nature of ship breaking activity has undergone a change in the last three decades. The industry survives in developing countries because it is still economical to break ships and the steel material is worth being recycled. This industry exhibits international links and has regional spread effects. This industry draws the required skilled and unskilled labours from the backward regions where employment opportunities are scarce and living conditions are poor. Such regions provide the industry with cheap labour contributing to the viability of the industry. Various hazardous material or chemicals are found in the process of ship breaking (see table 2.2)

Table 2.2 Hazardous Material in Ship Breaking Process

In the process of ship breaking various chemicals are found such as:
➢ Asbestos fibers, dusts
➢ Heavy and toxic metals (lead, mercury, cadmium, copper, zinc etc)
➢ Organometallic substances (tributyltin etc)
➢ Lack of hazard communication (storage, labeling, material safety data sheets)
➢ Batteries, fire-fighting liquids
➢ PCBs and polyvinyl chloride (PVC) (combustion products)
➢ Welding fumes
➢ Volatile organic compounds (solvents)
➢ Inhalation in confined and enclosed spaces
➢ Compressed gas

Source: IMF, 2006

2.3 Alang Ship Breaking Yard

At present, India has large share in ship breaking industry (OCED, 2001) and most of the activity is concentrated in Alang and Sosiya, the two villages situated in the coast of Arabian Sea in the district of Bhavnagar in Gujarat.

In India, upto the 1980's the ship breaking industry was concentrated in Darukhana yard near Mumbai. However, the activities were limited as it involved breaking of small-size ships. It was in the late 1970's that the MSTC decided to import non-useable ships and consequently the government decided to set up ship breaking yards. Ship breaking activities was recognized as a major source of steel supplier for the re-rolling steel plants. Subsequently in 1979 ship scrapping was recognized as an industry. The initiation of this move was also the growing demand of scrap from the large number of foundries and re-rolling mills. The state of Gujarat was one of the states where the demand for scrap was high for meeting the needs of the re-rolling mills. Therefore, the Government of Gujarat adopted policies in favour of ship breaking and set-up ship breaking yards on coast of Gujarat. This step was also backed by the reports of various committees that recommended the development of ship breaking activities.

Gujarat's has been blessed with one of the longest coast lines. Besides, it also has a long glorious past, dated to almost 3000 years, manifested by the maritime commercial ties that it had developed with countries such as China, Egypt, Sri-Lanka, Greece, African and Arabian countries.

Following the demand for steel and also the recommendation of various committees, the Gujarat Maritime Board (GMB) carried intensive survey of the coastal region and identified Alang as the most suitable site for developing ship breaking activity. The GMB as well as the groups of ship breakers endorsed the selection of this site for the following reasons:

1. The site falls in the high tide zone where the highest tide reaches upto 10 to 11 meters. This is considered to be most favorable for ship breaking activities.

2. This site is located in the Gulf of Khambhat and whose harbors are protected areas during rainy season which allows ship breaking activity.
3. The coast of Alang is sloping and has a long dry area which facilities reaching up vessels.
4. The seabed at Alang dries up very quickly even during monsoon, thus facilitating the handling as all kinds of material and equipment.
5. The area along the coast as Alang is free from other competitive users, like merchant shipping, fishing and even salt work.

Alang is a small coastal village as the district of Bhavnagar in Gujarat, dominated by a small population of fishermen and farmers. Presently, it has turned out to be one of the largest ship breaking yard not only in India but in the world. The yard stretches over 15 Km and actually covers two yards (Alang and Sosiya). The Alang ship breaking yards have the capacity to break VLCCs* and ULCCs** vessels, a facility not available to any other ship breaking countries in the world. Furthermore, unlike other countries where the ship breaking activities is capital intensive in India it is labour intensive. Being a labour surplus country labour is available in plenty and that too at competitive rate. Alang ship breaking yard provides large number of employment opportunities to number of skilled and unskilled labours. Moreover, there are many other activities and industries which are directly and indirectly dependent on Alang ship breaking yard, and the number of such workers directly and indirectly employed is estimated to be in between 1.5 to 1.6 lakhs (International Federation of Human Rights, 2000: 56). This also includes the downstream industries generated by the ship breaking industry such as re-rolling mills, foundries, oxygen plants, local scrap store, transportation companies and other small local businessmen and upstream activity such as brokers, service sectors etc. A survey conducted by the International Federation of Human Rights (FIDH) found that 100 re-rolling mills are functioning in the area and each generally employs between 80-120 and thus employing about 8,000-10,000 workers.

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* Very Large Crude Carrier: Tanker of 160,000-320,000 Dead Weight Tonnage.
** Ultra Large Crude Carrier: Tanker of 320,000 Dead Weight Tonnage.

The existing site of Alang-Sosiya ship breaking yard (ASSBY) comprises of 183 plots of different sizes. The break up of these plots is as given below. Table 2.3 which clearly indicate that more than half of the plots are of larger sizes which are used for breaking ships of higher Ldt, while the small size plots are used for breaking medium sized ships of lower Ldt. All these plots are developed by Gujarat Maritime Board which is also the owner.

Table 2.3 Distribution of Plots of Alang Ship Breaking Yard

Plot Size	Number
120 x 50 Mt	10
80 x 45 Mt	24
50 x 45 Mt	56
30 x 45 Mt	93
Total	183

Source: Gujarat Maritime Board

Gujarat Maritime Board (GMB) is an autonomous institution which monitors all the ports of Gujarat and is responsible for the development of ship breaking yard at Alang. All the plots are owned by the GMB which lease out the plot to the ship breakers. The initial lease period is for ten years which has to be renewed thereafter. Upto 1990's, the Gujarat Maritime Board played a direct role in the business as it used to buy the vessels from the world market and dispatch them to the ship breakers on first-come, first serve basis. However, with the opening of the markets in the post 1990's the ship breakers compete in the open international market to purchase ships.

On February 13th 1983, M. V. Kota Tenjong was the first ship to be beached at Alang. Thereafter, ship breaking at Alang has grown in number and reached world-class status. Table 2.4 gives the number of ships beached and average ship LDT. During 1982-83, 5 ships were broken and the average output was 24,716 Ldt. It was a small but a good beginning of ship breaking activity at Alang. In year 1983-84 and 1984-1985, the number

of ships broken was 51 and 42 with an average output of 259,387 and 228,237 Ldt respectively. This rise continued till 1987-88, however a sudden decline in the ship breaking activity was recorded in the year 1987-88, but thereafter the activities marked an upward swing. Upto 1991-1992, total number of ships broken were 601 and total output was 3,514,783 Ldt. From February 1982 to January 2005 Alang ship breaking yard processed 4,135 and total Ldt recovered was 29,875,654 million tons with an average 180 ships with 1,298,942 Ldt per year. The rise in the breaking activities is attributed to the cost advantage involved in the breaking large ships. Alang and Sosiya have become the destination of all type of ships viz, oil tankers, war ships, cruise ships etc that have surpassed their active economic life span. Presently it has become the largest yard for ship breaking activities placing India on the top of the world's list in terms of ship breaking activities.

Table: 2.4 Ships Broken at Alang Ship Breaking Yard

Year	No. of Vessels	Light Displacement Tonnages(Ldt) (Million Tones)	% of all Vessels	% of total tonnage
1982-83	5	24716	0.12	0.08
1983-84	51	259387	1.23	0.87
1984-85	42	228237	1.02	0.76
1985-86	84	516602	2.03	1.73
1986-87	61	395139	1.48	1.32
1987-88	38	244776	0.91	0.82
1988-89	48	253991	1.16	0.85
1989-90	82	451243	1.98	1.51
1990-91	86	577124	2.08	1.93
1991-92	104	563568	2.52	1.89
1992-93	137	942601	3.31	3.16
1993-94	175	1256077	4.23	4.20
1994-95	301	2173249	7.28	7.27
1995-96	183	1252809	4.43	4.19
1996-97	348	2635830	8.42	8.82
1997-98	347	2452019	8.39	8.21
1998-99	361	3037882	8.73	10.17
1999-2000	296	2752414	7.16	9.21
2000-01	295	1934825	7.13	6.48
2001-02	333	2727223	8.05	9.13
2002-03	300	2424522	7.26	8.12
2003-04	294	1986121	7.11	6.65
2004-05 up to Jan-05	164	785304	3.97	2.63
Total	4,135	29,875,659	100.00	100.00

Source: Gujarat Maritime Board.

2.4 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 knows 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 varies 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 migratory in nature.

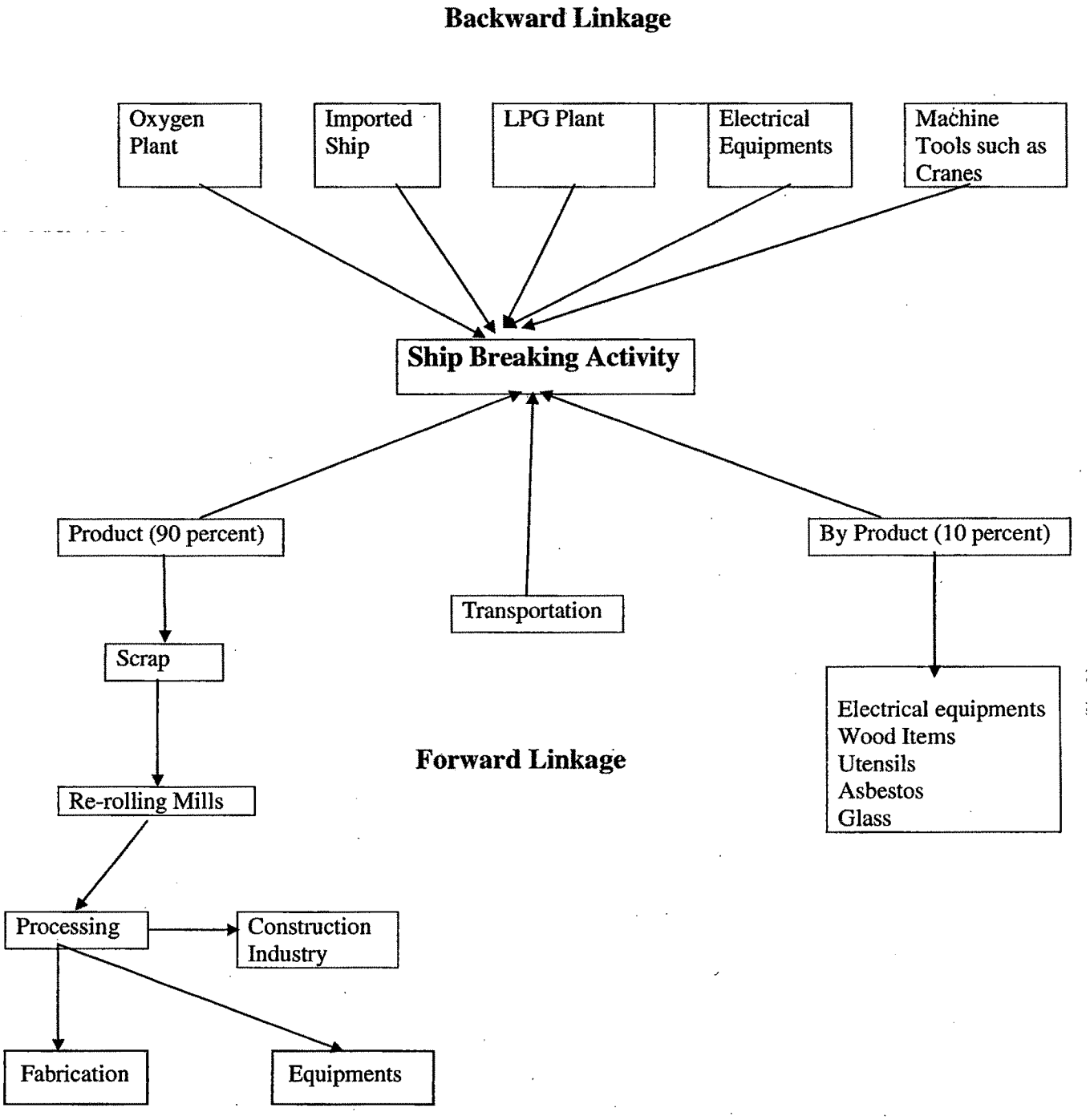
In developing countries, the informal sector is not an independent and exclusive sector. It is linked to formal sector and rest of the economy through various types of linkages. The formal sector is dependent on informal sector for cheap wage goods, service, cheap labour at lower price and sale of its 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 issues pertaining to labour are presented in chapter 4. 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 2.1: 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.

2.4.1 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.

2.4.2 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.

2.5 Alang Ship Breaking Yard: Formal or Informal?

The fast increase in the population growth is the main concern for the developed and developing countries of the world. The growing economic activity, when not in a position to absorb increasing labour force could lead to a number of problems in the society. The resultant effect could be in terms of disguised unemployment, open unemployment which is in acceptable to the individuals as well as to the society. In a poor country like India with around a third of the population living below poverty, few can actually afford to be unemployed. As labourers cannot afford to be unemployed he becomes a target of exploitation. The increase in investment and incomes in the modern sector of the developing countries large labour force migrate to this modern sector from agricultural sector. There are various other reasons for movement of labours from agriculture to non-agriculture sector and from rural to urban centers. The reasons most quoted are the disparities in the income in agricultural and non-agricultural activities, rural and urban income differences. In addition, location of industries, expansion of government activities and concentration of opportunities for acquiring skills and educations in urban areas. All these factors are attracting the rural migrants to the urban centers. Thus there are two divergent forces operating. The promises of better opportunities in modern sectors in urban areas act as pull factors for the movement of

labours. At the same time the dearth of opportunities in the rural areas and appalling conditions of work as the push factors.

In India a small fraction (only 7 percent) of labour force work in organized sector. The majority of the labour force is in the informal sector with little protection from trade unions and Government. Even though Government regulations exist, it is a matter of debate about their ground level implications. The Alang ship breaking yard is reported appears to be an organized industry but the ground reality appears to be different.

According to various researchers, the estimate of employment in the informal sector in urban centers varied between 45 to 70 percent of the employment. It was between 40-50 percent in Calcutta in 1971, 45 percent in Jakarta in 1976, 44.6 percent in Bombay in 1961 and 46.5 percent in Ahmedabad in 1971. Jan Breman in his empirical study on Valsad town of South Gujarat has thrown light on the size of informal sector. According to study around 75 percent of workforce is found in the informal sector (Breman, 1976: 1870-1876 and 1905-1908). This high proportion of the informal sector is due to low absorption capacity of the formal sector of the developing countries. Further many studies suggest that informal sector employment is concentrated mostly in manufacturing, trade, commerce and services etc. Various studies adopted different definitions and methodologies to measure informal sector, which makes comparison difficult. The following part attempts to discuss the various issues and debates relating to the informal sector by various researchers.

Keith Harth first used the concept of informal sector in his study of urban Ghana. During his fieldwork Harth identified a number of income and employment generating activities in the unenumerated sector of the urban area. The study identified that the workers engaged in the unorganized sector are self-employed rather than wage labours in the organized sector. The new entrants into the urban labour market particularly migrant are forced to work in the informal sector due to lack of experience and lack of skills required for formal sector employment. From this analysis Harth indicates various terms for informal sector viz, informal income generating activities, unorganized sector,

unenumerated sector, self-employed individuals, urban poor and earning less than minimum wage (Harth, 1971: 61-89).

The ILO/UNDP employment mission report on Kenya adopted informal sector to analyse the target group. According to this report, the informal sector has the following characteristics: entry by new enterprises is easy, rely on indigenous resources, family ownership, small-scale operation, unregulated and competitive markets and use of labour-intensive technique and outdated technology; their workers have low level of skill. The characteristic of formal sector is converse of the above, whereas entry of new enterprise is difficult, rely on overseas resources, and operate in large-scale, protected market,[1] using capital-intensive technology, imported technology, their workers are skilled and are experienced (Sethuraman, 1976: 71).

Mazumdar defines the informal sector as the unprotected sector. He describes that the employment is protected for some individuals in the labour force in terms that the wages, conditions of work and other facilities enjoyed by workers in the formal sector are not available to all job seekers in the labour market to overcome the barrier to entry. The protection arises from the trade union action, governments or both acting together. He distinguished that the entry into the informal sector is unrestricted by artificially raised standards, norms and procedures (Mazumdar, 1975).

T. S. Papola's study on Ahmedabad makes a distinction between the formal and informal sector labour market in the urban economies. In his view the distinction between formal and informal sector employment in manufacturing sector can be made on the basis of whether the employing enterprise is registered under the factory Act or not. If the enterprise is a registered factory then the condition of work gets regulated. The registration is obligatory as size of employment reaches 10 workers with use of power and 20 workers without the use of power (Papola, 1980).

[1] That is market protected by tariffs, quotas and trade licenses.

Jan Breman made the distinction between formal and informal sector, which he observed during his fieldwork in a district town of Valsad, and rural areas of South Gujarat. He found that there are two categories that oppose each other. On one hand those who earn their daily bread with poorly paid, unskilled, involved in lower occupation. On the other hand those in permanent employment for which formal education or trained skills are required, a job with a fairly high and regular wage, this ensures security and respectability to the workers (Breman, 1976: 1939-1944).

Abdul Aziz study on Bangalore recycling industry found two criteria to differentiate Formal and Informal sector. The two sets of criteria- one to be applied at the activity level and other to be applied at the enterprise level. He argued that a vast majority of urban poor depend on private sources of employment and the large industrial and commercial establishments hardly employ urban poor (Aziz, 1984: 6-9).

According to the Industrial Relations, the enterprise in the informal sector do not have definite form of organization and are generally not subject to labour laws protecting the interest of workers in matters of recruitment, working condition, hours of work, leave, payment of wages, dismissals and employment. More over workers engaged in this sector are mostly illiterate and migrants and fails to organize themselves into unions. The informal sector in fact includes a vast majority of "foot-loose" workers such as hawkers, vendors, shoeshine boys, transport operators-horse/bullock carts, pushcarts and other self-employed units (Ramanujam and Prasad, 1993: 18-19).

The urban labour market in developing countries is in the nature of economic dualism: the organized formal and unorganized informal sector from the urban economic system. The organised formal sector is characterized by capital intensive technology, higher wages, higher productivity, government organizations and operates on a medium and large scale. The unorganised informal sector is characterized by reverse characteristics which define in terms of easy entry, rely on indigenous resources, family ownership, small-scale operations, using labour intensive, low skills, traditional technology and unregulated markets.

S.V. Sethuraman's study on Jakarta define informal sector to include all economic units engaged in the production of goods and services rather than in registered commercial enterprise, formal non-commercial enterprises and the government sector. The bulk of the family-owned, small-holdings, the numerous non-motorized rickshaws, the countless hawkers, vendors and pretty retail traders and the vast majority of service workers constitute the typical informal sector units in agriculture, transport, trade and sector respectively. In Jakarta, transport and service sector together constitute third of population (Sethuraman, 1975: 196-197).

The informal sector referred to as very small units producing and distributing goods and services. These consist of largely self-employed produces in urban areas of developing countries. Some of them employ family labour and/or hired few workers, which operate with very little capital and none at all. They utilize indigenous technology and low skill, which therefore operate at low levels of productivity. They generally provide very low or irregular incomes and highly unstable unemployment to those who work in it. They are restrictions like formal sectors as well as no labour laws and have no access to formal credit institutions (Sharma and Kumar, 1998: 9-11).

In recent study by Paul, distinguishes the urban informal sector into two sub-sectors namely, counted and uncounted informal sector. The informal sector activities, which are found in the official records, are treated as the counted informal sector. For example, self-employed are excluded, the casual day labour used by formal sector activities and those which re not found in census data or official labour statistics because these activities are illegal. Uncounted informal sector activities are those, which are legal (for example a Street Vendor without a license). Paul describes this uncounted informal sector as a true under-ground economy (Paul, 1985: 2-3).

After discussing the informal sector defined by various scholars, now an attempt is made to analyse the character of Alang ship breaking yard. It is mentioned in the earlier section that Alang ship breaking yard is the world's largest ship breaking in terms of employment, tonnage of steel scrap, shares in world market. Breaking all type of ships

is done at Alang ship breaking yard. According to Gujarat Maritime Board, the ship breaking industry in India generates revenue of Rs. 25 billion per annum and most of it from Alang ship breaking yard i.e. 17 billion per year. This industry comes under the formal sector but has some informal characters. Informality of the sector can be defined in terms of access to technology. Studies conducted by various researchers found that in a vast majority of enterprises, workers acquire skill on the job as in informal sector. At Alang, each plot employs 250-300 workers thus adding up to total employment of 30,000-40,000 labours working inside the yard. Following the employment criteria all the plots at Alang ship breaking yard enjoy more than 200 workers and classified as factories registered under the Factories Act. Thus these firms are part of the organized sector. The firing in the organized sector is bound by the rules and regulation of the country. However these firms do not seem to be following these norms as reported by various studies.

There are few studies done by scholars and organizations that highlight the informal character of the Alang ship breaking industry. International Federation of Human Rights conducted study on Chittagong (Bangladesh) and Alang (India) ship breaking yards found that after functioning successfully for more than 20 years having high economic importance, the industry has some informal characters. The study defines informal character of the industry in terms of lack of labour laws and found that these laws permits unlimited exploitation of workers rights (FIDH 2002: 56-57).

A study conducted by International Metalworkers Federation on workers in ship breaking industry of Alang and Mumbai found that the industry has many a character which shows the informality of the industry. The study found that workers are getting wages below the Minimum Wages and other benefits such as health, safety and welfare are not provided by the employers or by Government authority (IMF, 2006: 15-20).

UNESCO conducted survey on Alang ship breaking yard and found that workers are working under serve conditions. The survey also found that the industry is a health hazard and risk prone. Safety equipments such as gloves, spectacles, boots and helmets

are required for protection during work. But these are not always supplied regularly and may need to purchase by the workers themselves. The majority of the workers are uneducated and untrained to handle the various toxic chemicals (UNESCO, 2004: 12-15). Many ILO studies defined the informality of the sector in terms of easy entry of enterprise. But in ship breaking activity comes under the preview of formal sector and is considered an industry. Therefore all the industrial and labour laws are applicable to the industry. In case of Alang ship breaking yard, ship breakers have to register under the Factories Act 1948 and also have to take prior permission from Gujarat Maritime Board which is an important facilitator in the ship breaking activity at Alang. According to GMB, in Alang the numbers of plots registered under the Factories Act 1948 are 183 at present (2004) as compared to 162 plots in 1998.

The labours in this industry are largely migrants from different backward regions of India. The ship breakers place their order for labours to labour contractor who recruit them with minimal wages Most of these labours are rural migrants, uneducated, unskilled and untrained. Majority of workers reported to have acquired some type of skill at the workplace through experienced workers or through labour contractors. There is no formal training for workers imported at Alang ship breaking yard. These methods of acquiring skill by workers show the informality of the industry. Overall it can be said that in the ship breaking industry of Alang the entry of ship breakers is difficult but the recruitment of labour is unregulated due to lack of rules and regulation which is one of the important characteristics of informality of this industry.

Paul divided informal sector into two sub-sector namely counted and uncounted or registered or unregistered informal sector. Further concluded that those activities which are found in official records are counted and those activities which are not found in official labour statistics are known as uncounted informal sector. The criteria provided by Paul are applicable to Alang ship breaking yard. According to International Federation of Human Rights (2000) Alang ship breaking yard provide employment opportunities to number of skilled and unskilled labours which varies between 30,000-40,000. There are many industries depends on Alang ship breaking yard and generate total employment of

1.5 to 1.6 lakhs. It includes various downstream and upstream industries. However, the records of these labours are not found in any statistics expect those employed in upstream industries.

Central and State Governments have formulated rules and regulations to protect the conditions of work of the labours. In the present study, the industry comes under organised sector and most of the industrial as well as labour laws are applicable. But these laws are not properly implemented by the ship breakers and authorities. Due to this workers are not covered by social security and face adversity in terms of hours of work, safety etc. Alang ship breaking yard is characterized by lack of registration of labours under Factories Act as well as Inter-State Migrant Workmen's Act. Labour intensive technique of production and untrained workers are some of characters of this industry which shows the informality of this industry. Overall it is found that the Alang ship breaking industry even after functioning for more than 25 years retain some informal characters.

2.6 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 in 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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