

## CHAPTER 1 – INTRODUCTION

### 1.1 Introduction:

Shipping is the most cost effective method of transportation of goods. Seaborne trade is about 90% of the total world trade and seafarers contribute substantially by ensuring that this trade is continuously performed as per schedule with minimum delays or loss to cargo, life or environment. About three fourth of surface of earth is covered by water and there is long distance between countries with raw materials and industrialized countries. The economy of scale has resulted in development of large ships for carrying oil and other raw materials so as to keep the transportation costs low. Further modern container ships carry large number of containers with finished goods to places where they are in demand. Passenger shipping while diminished due to the slow speed of the ships, a new type of cruise shipping is fast developing in a big way where large ships with all modern amenities provide excellent holidays to interested people. Since not much is known about the shipping industry to outside world a brief perspective of maritime industry and education is presented in the following pages.

A ship is a complicated floating place with extensive equipment and has a competent crew on board. The crew is well trained and certified as necessary. Maritime education & training (MET) is an integral part of the maritime industry. With a large coastline, shipping is also very important for India. While the ship owning and operating activities have yet to be in a very large scale, the Indian MET activities have made a name in the global maritime industry. As of 2005 the Indian fleet was 411 ships totaling to 8.28 million gross tons with world figure being 37,644 ships totaling to 657.04 million gross tons [INSA (64)].

Quality of our seafarers is extremely important if we have to remain in this global market. Therefore the quality of maritime education and training in this sector also becomes an important issue. This project is an attempt to develop a model where in the principles of total quality management are adopted in this area.

## **1.2 Careers at sea:**

Professionally trained crew mans the ships. The ships are expensive and it is therefore imperative that technically sound people operate them so that optimized operations are achieved.

Ship operations include loading and discharging of the ship, navigating it from one port to other, running and operating different machineries which may be fitted on the ship, taking care of the ship, cargo, people and marine environment while the ship is in operations. The ship also has different machineries on board which may include main propulsion engine, electrical power generation and distribution system, steam generation, fresh water generation system, sewage treatment plant and many other associated systems and machineries. The cargo operations also are of different types. While oil cargoes are pumped in or out of the ship, cranes on the ship lift cargoes in containers. Bulk cargoes like iron ore/ coal etc. are loaded by a system of conveyor belt. It can therefore be appreciated that staff on board ships needs to be trained in all these varied areas.

Primarily the entire crew of a ship can be divided in following categories and a distribution of crew on a typical merchant ship is shown in figure 1.1.

**Nautical officers:** Officers responsible for the navigation of the vessel, communications and care and handling of cargo. This includes loading, discharging and correct storage of the cargo. The senior most nautical officer is also the master of the vessel i.e. captain of the ship.

**Engineering officers:** These are marine engineers and are responsible for operations and maintenance of complete machineries and systems of the ship.

**Ratings:** These are the non-officer grade employees who may be both in the nautical side (also referred as deck side) or engineering side. Besides these the ship also has ratings as cooks and stewards.

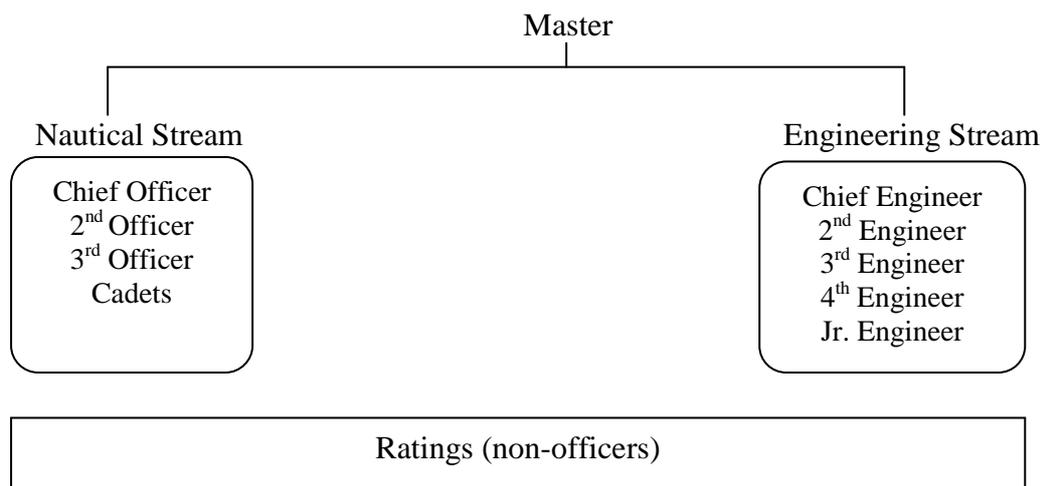


Figure 1.1 – An organization chart of a typical merchant ship

All these crewmembers are appropriately trained and some of them are certificated. These certificates are referred as certificate of competencies and are awarded by the government of the country where the seafarer is trained and passed the examinations.

### 1.3 Indian seafarers:

India's share of maritime manpower is 26,950 officers and 55,650 ratings totaling to about 6% of world share [GOI report (47)]. As per the report of Baltic International Council and International Shipping Federation (BIMCO/ISF) of 2005 on world manpower situation, considering a conservative annual growth rate of 0.5% in the world fleet, requirements for officers in next decade would be an additional 23,000 officers. Though with the increased activity in global seaborne trade the growth would be much higher and subsequently the demand for officers would be about 44,000 [BIMCO /ISF (14)]. Since 1998 till 2006 the number of ships globally has increased by more than 30% and is expected to increase by 40% in next five years. As per the prestigious shipping journal Lloyd's Ship Manager, Norway itself would require more than 10,000 employees to operate the new ships that are presently on order in different shipyards. Efforts are made to enroll more Europeans into shipping career and the applicants in the main MET institutions is doubled in UK, Denmark, Sweden, Russia etc. [LSM (87)].

A maritime country with developed economy and higher life standard has very few seafarers as the youngsters find other options more lucrative. Majority of the present day seafarers come from developing countries who are not there for the love of the sea but because they think they can earn more at sea than ashore. Of course as these economies

develop, more and better options ashore would be available and the career at sea would slowly become less attractive. India besides some other countries provides maximum numbers of the officers, both marine engineers and navigators to the global maritime industry.

Furthermore the motivation also comes from their expectation of free worldwide travel and opportunity to see distant places. Presently though with improvement in technology and increased productivity at the ports, the cargo loading unloading work is completed in much shorter time than before thereby reducing the time of port stay. With various maintenance works on equipment while in port and looking after receipt of supplies in port, the possibility of going ashore in an exciting new country is further reduced. Increased security measures after the incident of nine-eleven has also created yet another difficulty.

One of the difficulties being faced by the shipping industry is to attract good students in MET institutions and the other issue is more challenging and is about retention of the seafarers, including marine engineers in the maritime career. The seafarers are leaving the career fairly early and look forward to a quieter job ashore. Solanki (156), in his study found many respondents, who were seafarers, reflecting dissatisfaction, isolation, and lacking in academic qualifications. In fact many of them felt the need for further education, including higher education [Solanki (156)].

Effimios Mitropoulos, Secretary General of International Maritime Organization (IMO) said recently that the Indian seafarers are knowledgeable, dedicated, respected and trusted all over the world and the global demand for them is high [Mitropoulos (100)].

Shipping is usually not projected much in media except when there is an accident or incident of pollution. The bad publicity and at times extremely strict action from the local government has resulted in criminalization of seafarers. Increased piracy incidents and attempts of hijacking of ships have brought in an element of external danger to the life of seafarers.

The normal complement of a large merchant ship could be about 20 or 21 with four engineers. Few decades back these used to be about 45 seafarers on board a ship. Increased use of automation has resulted in this reduction. However, lack of

companionship on board for long and lonely sailings with increased workload results in mental agony and increased isolation. This eventually affects on the moral of the crew and their productivity.

All these above referred factors eventually force the seafarers, especially the Indian seafarers who culturally are mentally soft and more attached to their families, to leave sea life at the first available opportunity. This also works as a de-motivating factor for the fresh entrants.

The officers from Organization of Economic Cooperation & Development (OECD) countries continue sailing for many years. The BIMCO study has indicated that officers from the Indian subcontinent choose to give up sea life after few years and their attrition rate is comparatively higher [BIMCO /ISF (14)]. This would result in an increased shortage of officers at sea. As per Bajpae (9) the global average drop out rate of the cadets who enter the shipping is 10%. As against this the Indian drop out rate is only 1%. The only solution therefore is increased output for good maritime education and training institution.

With the acceleration of China and its economic transition, the foundation of old method of professionalism with blind commitment is changing. The new crop of Chinese seafarer possesses a new professionalism which is a combination of marine skills, knowledge, experience and techniques with professionalism i.e. attitude, values and standards [Wu (182)].

Number of Chinese Seafarers working in foreign ships is more than 40,000 and as per a survey regarding the performance of Chinese seafarers in the global shipping. 80% of the respondents were happy with the navigational skills though attitude and teamwork scored only 36.7% and 38.8% respectively [Wu (832)].

#### **1.4 International regulatory regime:**

Shipping is an international activity and ships, depending on the commercial considerations, move from one country to another. Every commercial ship is required to be registered and this registration provides a nationality to the ship and that country is referred as the flag state [UNCLOS (172)]. Sometimes the ship may be registered in a

country that is different than the country of the ship owner. Further the ship owner may be from one country and may give the vessel to a professional manager from another country to manage and operate the ship. Nationals of a fourth country who may have completed their training and certifications from yet another country may man the ship.

It is therefore imperative that a single acceptable international agency covers all regulatory regimes and all ships follow its requirements. The International Maritime Organization does this.

#### **1.4.1 International Maritime Organization (IMO):**

IMO is an agency of the United Nations and is based in London. It was established in 1958. Presently about 167 countries are its members. IMO develops various conventions, codes, recommendations and guidelines on different aspects of shipping. The individual countries thereafter ratify or accede to these conventions and incorporate the requirements of these conventions in their national laws. The responsibility of implementing the requirements of these conventions is of individual countries. The motto of IMO is “Safer ships and cleaner oceans” [IMO (65)].

#### **1.4.2 Standards of Training, Certification & Watch keeping Convention (STCW):**

This Convention was developed in 1978 and was the first initiative in establishing basic requirements on training, certification and watch keeping for seafarers on an international level. Previously individual governments established such standards, usually without reference to practices in other countries.

The Convention prescribes minimum standards relating to training, certification and watch keeping for seafarers which countries are obliged to meet or exceed. This Convention however, only came in force in 1984. Based on the experience gained for few years, in the early nineties a need was felt to amend this Convention. An international conference was organized in July 1995 where the 1978 Convention was revised quite substantially. This was considering the changes in technology, influx of seafarers from different nationalities and the development of ship manning as a management exercise.

The new amended convention referred as STCW'95 came in force in July 1997 and is today accepted by 151 countries having more than 98.77% of total world fleet [IMO (65)]. This convention was substantially reorganized and amended in 1995 and is now almost universally applied. This convention specified requirements for different levels of watch keeping personnel on board ships. These requirements are detailed in the form of competencies desired which are achieved in training and confirmed through subsequent examination and certification. The Convention also contains requirements for specialized ships e.g. oil tankers, passenger ships etc. Some other special requirements for training in fire fighting, first aid and other medical treatment, survival techniques etc. are also included. The convention is dynamic and can be amended if necessary. It is the duty of the flag state of a ship to ensure compliance with the convention on board its ships.

#### **1.4.3 Industry requirements:**

The mandatory requirements as indicated above specify training and certificates for different positions on a merchant ship. This is the minimum acceptable level. However, the shipping industry requirements are more than this and would include greater professionalism, dedication, commitment along with the sound technical knowledge and skills. Shipping is a competitive business and is subject to cyclic fluctuations. Manning costs are one of the main components of a ship's operating costs. The ship owner therefore per force engages seafarers from countries that demand lesser salaries as compare to the seafarers of the industrialized countries. Presently most of the ships employ foreign seafarers that are not from the country of the owner or where the ship is registered.

The performance of Indian officers on foreign ships in the last three decades has been excellent. However, new nationalities are now threatening to enter this market and share the pie. These include China, Philippines, Myanmar, East European countries etc. It has now become necessary that Indian officers not just maintain their quality but be better than before and offset the advantage that the officers from these other countries offer due to reduced salaries.

Willis (179) has written that business organizations complain that college graduates tend to have unrealistic expectations about organizational life, job responsibility etc. These

again are the sentiments of the shipping companies as they comment on the lack of ship specific awareness, in spite of having exceptional knowledge and skills.

Ding (33) in his study established that certain factors influenced the shipping companies in deciding the selection of its seafarers. These were cost in salaries and terms and condition of service; knowledge and skills; communication skills, especially English; physical and psychological attitude etc. These factors therefore demonstrate that the seafarers, including marine engineers should have multifaceted traits and should not be too expensive for the employer, i.e. shipping company.

### **1.5 Maritime Education & Training (MET):**

The aspect of education and training are both extremely important in the field of commercial shipping. Maritime education is primarily focused on long-term pre-sea programs. These are shore-based courses of three to four year duration after 12<sup>th</sup> class and after this a person can proceed to join a ship for job and move upwards afterwards. This is of course based on acquiring specified experience, completing prescribed courses and after successful completion of examinations that are conducted by the Government. It is of course pertinent to mention here that while it is essential to provide under pinning knowledge to students in a pre-sea course, it is equally important that practical training is also given so that the desired final product can be achieved.

The maritime training on the other hand covers various short-term courses. These are required by IMO and are mandatory for different ranks on a ship. Most of these are referred as post-sea courses i.e. they have to be undertaken after some initial experience at sea. There are of course four very basic pre-sea training courses of three days duration each. The pre-sea course for ratings is also a training program as it is more focused on vocational training.

All programs need to be approved by the office of the Directorate General of Shipping (DGS), Government of India and the institutions are subject to guidelines issued from time to time and annual inspections carried out by the DGS.

The pre-sea program for officers can be grouped as following:

Nautical stream:

Different schemes are in vogue with programs of one-year, three-year and four-year duration. These three schemes are presently available in different institutes in the country. The admission criteria for each of these programs is 12th class with Physics, Chemistry and Mathematics and these programs are supported by different universities in the country.

Marine engineering stream:

The main program is of four-year duration after 12<sup>th</sup> class with Physics, Chemistry and Mathematics and is supported by different universities in the country. The other scheme is of one-year duration after a Bachelor's degree in Mechanical Engineering. Similarly a person can also join a two-year program after completing a diploma in Mechanical engineering. Both these later programs are not supported by universities but are recognized by the Government of India.

Pre-sea MET program, especially the four-year marine engineering program, is selected for this study as that forms the main input to the industry.

**1.5.1 Importance of MET in India:**

Presently over 65% of world ships employ foreign seafarers and about 6% of that are Indians. The merchant fleet registered in India at the time of independence was a mere 0.5 million tons, which has now grown to over seven million tons. The increase in ship numbers is also quite substantial [Gupta (51)]. However, compare to global scene our shipping is extremely small and while we are at number 18 in terms of tonnage registered our shipping is only about two percent of the total world tonnage. [Gupta (51)].

While the Indian shipping has not made such a large name globally, Indian seafarers have really contributed and have played a significant role in world shipping. Many of the foreign ships are manned by Indian seafarers who are known for their knowledge, skills and dedication. At present a total of about 14,000 Indian seafarers are sailing on ships. It is estimated that a substantial amount of foreign exchange is remitted to the country by these seafarers. It is worth mentioning here that many youngsters from West Europe,

Japan and other industrialized nations do not prefer the sea going career due to disparity between wages at sea and ashore being very less.

### **1.5.2 MET in India:**

#### 1.5.2.1 Initial initiatives [DGS (34)]

The first Indian owned vessel S.S. "Loyalty" sailed out of Bombay harbour on 5th April 1919 for London. Scindia Steam Navigation Co owned this vessel. The Master and the other officers were British. Realizing the importance of maritime training an old troop ship Dufferin was acquired by the Government and converted into a training ship. On December 1927, the first batch of 50 nautical cadets joined DUFFERIN. In 1935, training of engineering cadets was also commenced on the Dufferin. The number of cadets admitted each year was 25 in nautical and 25 in engineering streams.

#### 1.5.2.2 Major changes in training post independence

##### *Officers training in India*

In 1949, training of Marine Engineers was transferred ashore to a new Engineering College at Calcutta, known as Directorate of Marine Engineering Training (DMET), with a branch in Bombay. The training period on the Dufferin was reduced from 3 years to 2 years and the annual intake increased to 80. In April 1972 a new Indian built ship called Training Ship Rajendra replaced Dufferin. The annual intake of cadets, for the two-year course, on T.S. Rajendra, was 125. In 1987, T.S. Rajendra became affiliated to the University of Bombay and the period of training was increased to three years. The first batch of these cadets passed out from the Rajendra in 1990 with BSc. (Nautical Science) degrees awarded by the University of Bombay. The syllabus was drawn with a view to give broad-based marine education, with special emphasis on fundamentals of marine subjects and practical aspects of the profession.

Considering the increased demand for nautical officers it was decided that a shore-based academy would be better. Therefore a new academy was developed in New Bombay called Training Ship Chanakya. This started operations in 1993.

Marine Engineering & Research Institute (MERI), earlier known as DMET, is situated at Kolkata and has a branch at Mumbai. Training in MERI consists of theoretical classes together with practical training in the institutes workshops followed by actual

maintenance, repair and overhaul of ship machinery in the marine workshops & repair yards. The students are also required to take part in sports and extra and co-curricular activities for their overall development.

#### 1.5.2.3 Present scene in India

Keeping with the policy of liberalization, Government of India decided in 1997 to allow private sector participation in maritime education and training. This led to development of many training institutes all over the country. While this provided increased job opportunities to the youngsters making easily available access to the maritime training, the quality of training left much to be desired. Today there are more than 130 maritime training institutes in the country. Out of these about 30 are engaged in pre-sea training in both nautical and marine engineering streams. About eight main institutions are providing the four-year marine engineering education and training in both government and private sectors.

While shipping is truly international the method of marine engineering education is different in many countries. In the study by Barnett 2006 (42) for various MET systems it was found that in many places it had the vocational approach whereas in some centres like Poland the approach was quite academic. In most countries it is felt that higher academic qualification may not be necessary for being a successful marine engineer and the emphasis is mostly on practical work. In UK too, the marine engineering education leads to award of Higher National Diploma and persons needing further qualification can do one more year to get Bachelors degree. In India, on the other hand, there is a balanced approach with emphasis both on academics and practical work during a four-year program leading to bachelor's degree in marine engineering.

#### 1.5.2.4 Tolani Maritime Institute:

Tolani Maritime Institute (TMI) is promoted and managed by a charitable trust supported by the Tolani Group of Companies, which also has a shipping company. The group also has many institutions in Adipur in Gujarat and also a collage in Mumbai. TMI started operations in 1998 and is located at Induri, near Talegaon in Pune in a 130-acre picturesque campus.

The main programs cover both disciplines of the careers in merchant marine. These are the four-year undergraduate program in Marine Engineering which started in 1998 and the other program is in Nautical Technology, which is also of four-year duration. Both these are conducted in collaboration with Birla Institute of Technology and Science (BITS), Pilani – a reputed technological university of India. In addition, the degree programs are approved by the Directorate General of Shipping, Government of India. TMI is also certified as per the standards of ISO 9001:2000.

For high level of hands on skills, TMI has developed a Workshop spread over 40,000 sqft area, having a 7 Ton boiler, 800 KW Steam Turbine besides state of art laboratories thus enabling students to do Watch Keeping on live power plant. A large welding bay trains students for 2G/4G/6G welding certification by Lloyd's Register. A full mission Ship Handling and Engine Room Simulator is also available to impart better training to students.

TMI acknowledges good performance and disburses scholarships worth more than seventy-one lacs rupees per year to deserving students to promote excellence. TMI also encourages the entry of women in this challenging career. So far about 40 girls have graduated from TMI and are presently working on ships and shore industries.

Grading agency CRISIL has awarded both these programs, GRADE 1 (Outstanding) – highest grading possible. TMI was declared the Winner of the 2006 Lloyds' List – Middle East & Indian Subcontinent Maritime Training & Development Award in Dubai on 08 Nov 2006.

### **1.6 Need for quality in MET in India:**

Different cultural and lingual backgrounds of the crew members may present a problem in its safe and efficient operation. In a survey carried out by National Maritime Polytechnic Philippines (129) – “Mixed Nationality Crews: The Filipino Seafarer's Experience, 31% respondents experienced difficulties on ships manned with crew of different nationalities. The problem identified were communication difficulties (75%), attitude related difficulties (67%). Some other issues were food related, habits and practices, personal hygiene etc. The possible solutions for these from the respondents

were to have better understanding and respect for others, more patience and develop ability to deal with others.

Bajpae, (9) President, InterManager announced that in India the future seafarers should be from areas of society where there is an incentive to choose shipping as a long-term career option e.g. from the villages or interior hinterland. He also said that the Indian seafarer is fast becoming a crucial asset on the world seafaring stage. The Indian seafarers have come to be recognized as a much wanted substitution for the fast reducing West European seafarers whose skills and competence have remained to be matched by the seafarers in Asia and Eastern Europe. Further global shipping industry is increasingly relying on India as a favoured source of its current and future seafarer demand.

The global shortage of well-trained seafarers is resulting in delayed relief from the ships and increased frustration among existing seafarers. The numbers of ships lost by accidents and other incidents have increased with insurance companies voicing their concern on this issue. The shipping journal, LSM (87) reported the present shortage has started contributing to the rising casualties and cost of claims. The numbers of all ship damage and liability claims have increased by 50% between 2005 and 2006 with claim amount increasing by over 60%. At the recent conference of International Union of Marine Insurance in September 2007, Poulson (133) commented that the present day seafarers are facing disturbing factors as fatigue; lack of social fabric onboard; isolation; poor morale; poor treatment by authorities; lack of freedom; and potential criminalization. It was commented that in this situation why would one want to go to sea?

Traditionally the officers at sea used to be from the OECD countries, primarily Europe, Japan etc. However, now the focus is changing with officers from Far East, Indian Subcontinent and Eastern Europe increasing. Philippines though, has the largest share in the ratings (non-officers) sector.

Seafarers from the OECD countries are aging with more than 25% being more than 50 years of age. Their replacement would definitely make more places for officers from other available nationalities. In India only 5% are over 50 years of age and about 28% are of less than 31 years of age [Bajpae (9)].

### **1.6.1 International requirements and Quality:**

Shipping, being the international industry also depends on various international requirements that emphasize the need of quality of seafarers as their performance reflects on the performance of ships.

#### **1.6.1.1 STCW Convention 1978, as amended in 1995:**

The STCW Convention, as referred earlier, specifies various requirements and standards for MET. These requirements have been collectively agreed and adopted by the international maritime community. The Convention therefore provides for the minimum acceptable standards for training and certification for different position on ships and also for certain specialized ships namely oil tanker, gas carriers etc. Regulation I/8 of the STCW Convention requires all institutes conducting maritime education and training to have a quality system in place [STCW (161)].

This was the first initiative when the international maritime community seriously recognized the importance of quality in training. Importantly the requirement of having a quality system emphasized the need of establishing a well-structured and documented system. This regulation of STCW Convention therefore made it mandatory for all MET institutions to have a quality management system. The institutions complied by adopting the existing models, which were available in the manufacturing industries for establishing quality management system. These standards desired that various documented procedures for activities in the organization be established; followed and documentary evidence is available that these procedures are being followed. Different certifying bodies awarded the certification after the initial verification and this was followed by periodical inspections to confirm compliance with the standard. Different influences on MET are indicated in Figure 1.2.

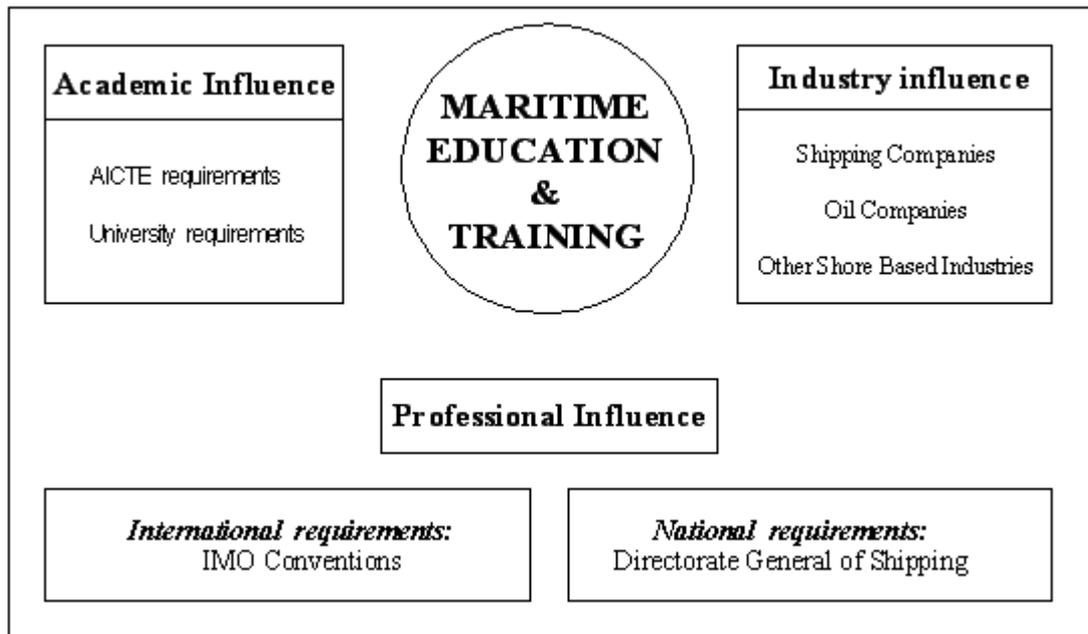


Figure 1.2 – Influences on maritime education and training

#### 1.6.1.2 Customer demands and satisfaction:

As mentioned earlier, shipping is truly an international activity. The seafarers educated and trained in one country work in ships owned and managed in some other countries. Some times there may be seafarers of more than one nationality on the same ship. Further ships are expensive and are required to be operated with clockwork efficiency. The total number of crew members on board a ship has reduced substantially and therefore the seafarer not only has to have a good knowledge but right skills and a positive attitude.

The shipping companies, which employ the seafarers, are the eventual customers of the maritime education and training activities. They are operating a commercial venture, which is cyclic in nature, and therefore the returns are not steady. Manning costs are about 32 percent of the total fixed costs of operating a ship [Stopford (164)]. The company therefore prefers to practice efficient cost control methods.

The cyclic peculiarity of shipping also affects the manpower market. At times the job scene is very good whereas things may change after some time and getting a job becomes difficult. Interestingly most of the assignments of working on ships is on contract nature and usually there are no permanent jobs. A seafarer joins a ship for a contract of six to nine months and after completing this period the seafarer goes on leave and thereafter makes another contract and so on. The contract is not renewed if the performance of the

seafarer is not satisfactory. This keeps the onus of continuously good performance on the seafarer and also signifies the importance of quality in MET.

A career in shipping is preferred in India though this is not the case in the western world. The Indian seafarer has made a place in the global shipping industry and is continued to be preferred against seafarers of other nationalities. It is however, imperative that the Indian seafarer continues to do the good work.

The maritime education and training institutes offering pre-sea programs have a major responsibility in imparting knowledge, developing skills, improving intellectual capabilities, inculcate values and develop positive attitude in its students. All this has to be at a quality acceptable at international levels. It is therefore necessary that the activities of the maritime institutes are quality focused.

### **1.6.2 Basic requirements of learning and educational process:**

Industry specific education and training starts after 10+2 in an undergraduate program. This program is aimed at giving underpinning knowledge on not only the maritime aspects but also on the relevant technical subjects. While the career at sea is application oriented however, it is imperative that the graduates have a sound basic knowledge. Most of the seafarers leave the sea job after few years and are absorbed in the shore based industry. A good educational base helps them to quickly understand the intricacies and adapt to the necessary work routine.

The curriculum is designed based on different mandatory and other guidelines. The teachers play an important role in facilitating transfer of knowledge. The environment has to be right for achieving this and should include not just the physical infrastructure but also the smooth and controlled process of teaching.

The physical development of the students is also an important issue and therefore time has to be allotted for sports and other physical activities. Further various extra and co curricular activities have also to be inbuilt in the program so that an overall development of the student is achieved.

Paine – Climes (125) suggests that the maritime higher education has a responsibility of developing methods to navigate through emotional crosscurrents like developing mature interpersonal relationships, establishing identity, developing purpose and integrity, managing emotions etc. The quality education should address these issues pertaining to the personal growth along with intellectual growth. Various factors like student-faculty relationships, student development programs and overall environment in the institution would have influence in developing this growth.

### **1.6.3 Future needs and requirements of the industry:**

The needs of the industry are constantly becoming more and more demanding. The ships are becoming more complicated with introduction of modern technology and automation. The ships are also getting more expensive and have to be operated efficiently without any delays that may have financial repercussions.

Similarly the manpower on board is regularly reducing so that the operating cost is further reduced. A recent step taken by some shipping companies is the removal of electrical officers from the ship. This of course means that the marine engineers have to be competent enough to tackle all electrical equipment besides the other machineries.

The quality management system in the MET institution, including in TMI is sufficient to comply with the requirements and provides an initial impetus for quality. However, in the existing competitive environment it is imperative that initiatives are taken to implement Total Quality Management (TQM) so that needs and expectations of all stakeholders are addressed.