8-31-2012

Analysis of factors affecting Indian deck officer retention

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ANALYSIS OF FACTORS AFFECTING INDIAN DECK OFFICER RETENTION

By

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A research paper submitted to the World Maritime University in partial fulfillments of the requirements for the award the degree of

MASTER OF SCIENCE

ITL

2012

Declaration

I hereby declare that all the data and contents in this research paper that is not my own work has been identified, and that no contents are included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal opinion, and are not necessarily endorsed by the University.

10th June 2012

Ramar Senthil Kumar

Supervised by

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Acknowledgement

I want to express my deepest appreciation to Ms. HU FangFang, who is in charge of this program on behalf of Shanghai Maritime University for her strong support throughout my master study.

I sincerely thank my Supervisor Professor Liu Wei for his prompt suggestion and support in continuously helping to improve my research work.

I would like to thank all Seafaring Deck officers and Cadets who participated in this survey to give opinions and feedback useful to complete my research paper.

I deeply appreciate “Synergy Marine Private Limited”, a ship management company for sharing data to complete my research paper.

Finally, I would like to show my indebtedness to my beloved wife and daughter for their patience and support during my master study.

Abstract

Title of Research paper: Analysis of Factors Affecting Indian Deck Officer Retention

Degree: M.Sc.

Shipping being the backbone of world trade is severely facing shortage of skilled officers. Particularly, profound shortage is noticed for senior rank officers. This study uses **AHP model** to analyze the identified factors important to Indian Deck Officers. A cross analysis is carried out to verify the effectiveness of **AHP model** by using **DEA model**.

The identified factors were grouped under General factors, Company specific factors and factors due to personal reasons. The most important factors under "General factors" were **money**, **leave** and **safety & Security**. Under company specific retention factors, **quality management system**, **fleet quality** and **onboard work culture** were important to deck officers. The factor **financial commitment** was the most important personal factor which kept deck officers onboard.

It is noted that, the importance of factors varied among ranks of deck officers. This helped in benchmarking 4 shipping companies based on ranks of deck officers. A test subject called "Test Company" was having shortage of chief officers and correspondingly the company ranked least by chief officers.

An introduction of linear programming helped the Test Company to optimize its resources to address important retention factors namely money and leave .Thus improve its position among chief officers and reduce manpower shortage.

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To conclude the paper pinpoints the core issue, which is retention problem and gives a tool with scope of improvement for shipping companies to leverage its position in seafarer manpower market.

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List of Abbreviations

AHP- Analytic Hierarchy Process

BIMCO-Baltic and International Maritime Council

DEA- Data Envelopment Analysis

DG Shipping- Directorate General of Shipping

ISPS-The International Ship and Port Facility Security (*ISPS*) Code

ILO- International Labor Organization

IMO- International Maritime Organization

Intertanko-International Association of Independent Tanker Owners

ISF-International Shipping Federation

KPI- Key Performance Indicator

MBA-Masters in Business Administration

NRI- Non-Resident Indian

STCW-International Convention on Standards of Training, Certification and Watch keeping for Seafarers

Chapter 1: Introduction

1.1 Background

Breaking news "***despite the current downturn in every sector of the shipping market, one thing remains constant: the shortage of skilled deck officer continues. Latest estimates still project a shortfall of nearly 84,000 officers by 2012***" (ITF Inspector, 2009).

With present financial crisis which is slowing down the global economic engine has a huge negative impact on Maritime sector. This sector being a derived demand, shipping companies have very few options to survive; these options are by cutting costs, slow steaming, laying up vessels or ultimately sell off vessels.

With innumerous constraints, the shipping companies are pushed to cut costs and look for cheaper means of labor source. With unlimited reports of Deck Officers being ill treated, it's a collective responsibility of the stakeholders to ensure that these skilled labor force should not be effected because the very own existence of the shipping companies and global trade purely depends upon the existence of deck officer. As quoted by ITF "***everyone knows what improvements need to be made in order to recruit and retain more deck officer. It's just that it will cost a bit of money and it will mean those dinosaurs that still exist in some shipping circles must back down from their age-old hatred of decent conditions for seamen***" (ITF Inspector, 2009). This mindset of shipping company considering crew as an expense has to change.

In many cases deck officers are treated like criminals, not allowed shore leaves and held as scapegoats by pirates for ransom. Onboard jobs are getting more difficult, ship sizes are going up but manning levels are still the same, and seafarer spending years of training is not being used onboard as ships are getting technically advanced. Additionally deck officers are burdened with more training courses and are unable to be in peace during their vacation. In these conditions, it becomes a difficult choice to pursue sailing as a career.

Many research studies have been made and there are ongoing studies on seafarer attraction and retention issues by various organizations and they have managed to identify key factors which affect the underlying problems. Many of these factors

cannot be influenced by strategic decision of shipping community as they are much broader and beyond the control of any organization to handle. The only way is to focus on the factors which shipping community can influence and maximize the utilization of deck officer till they sail. If retention improves, automatically attraction will also improve, thus this study narrows down and will focus on how to rank these factors and address the issues to minimize shortage of deck officers.

1.2 Objectives of the Study

The objective of the study is to analyze the identified factors affecting the retention of Indian Deck Officers. During the analysis, the influence of shipping companies on retention factors will be highlighted and further extended to show, how the retention factors vary across the ranks of Indian deck officers. The identified factors will be compared with related key performance indicator used by shipping companies. Finally, a methodology will be developed for shipping company to tackle manpower shortage. It is utmost important to address this issue of manpower shortage, the reasons is discussed in next section.

1.3 Importance of study

With 90% international trade is transported by cheapest mode which is by sea, shipping has no substitute .This sector plays a pivotal role and is the core link in supply chain management. Disruption of this maritime link would have a catastrophic damage to global economy and in some cases life depends on shipping. Ships transport raw materials, food, manufactured products, finished goods, oil and other necessities important for infrastructural development of many countries. These ships are manned by skilled and competent deck officers; a manning crisis in this sector is of serious concern and has to be addressed. As quoted by Efthimios Mitropoulos **"**Without their contribution, half the world would freeze and the other half starve" (Efthimios Mitropoulos, IMO 2005).

The above statement highlights the gravity of the problem and emphasizes the need to conduct a study to help retain deck officers. It is important to set criteria for the research work, which is discussed in next session.

1.4 Criteria for the study

As the research is based on opinion and feedback from participants, it is critical that participants are closely involved in shipping.

Following are the criteria for the study

- Target participants will be of Indian Origin.
- Attraction Factors will be identified and analyzed using deck cadets as participants who are undergoing training in maritime institution.
- Retention factors will be identified and analyzed using deck officers as participants .Many officers are from Synergy Maritime Ltd, India, which is a Ship Management Company and has 35 ships under her fleet with 20 ships manned by Indian officers. In addition me being a deck officer, have additional contacts with other deck officers from whom feedback will be collected.
- Shipping Company's data will be collected but confidentiality will be maintained, hence the research paper will not identify the true names of the four companies but will call the subjects as "Test Company", "Company A", "Company B" and "Company C".

Based on the above criteria the study will be conducted and the research paper will be structured as shown in next section.

1.5 Structure of the Research Paper

So far we have seen that Chapter 1 **"Introduction"** has given the backdrop of the underlying problem, which is shortage of deck officers. In Chapter 2 **"Literature Review and Conceptual Framework",** it will focus on supply and demand of deck officers, and an insight into Indian deck officers. It also highlights the key findings from similar studies on addressing seafarer attraction and retention issues. The conceptual framework will be built for the research to show how the factors will be analyzed. In Chapter 3 **"Research Methodology",** research methods will be explained in detail describing which model is suitable for the research. In Chapter 4 **"Attraction Factors"**, identified factors will be analyzed in detail by using **AHP** and

DEA model and results will be explained. In Chapter 5 **"Retention Factors",** which is the core of this paper, analyzes identified retention factors using AHP and DEA model. In ,Chapter 6 **" Futuristic Scope & Conclusion"** , the results from Chapter 5 in conjunction with ranks of shipping companies in providing best facilities will show the most suitable company to sail for. It also uses linear programming to help shipping company to leverage their ranks in employment market by improving the service provided to seafarers.

Chapter 2: Literature Review and Conceptual Framework

2.1 Introduction

This chapter discusses about related articles and studies on supply and demand of deck officers and also provides an insight into factors affecting seafarer attraction and retention. From the literature review key points will be summarized and will be used to conceptualize the framework for the study.

2.2 Supply and Demand

As per **BIMCO/ISF** manpower study 2010 the worldwide supplies of seafaring officers in **2010** was **624,000** and worldwide demand **637,000** officers**.** There is an increase in supply in some countries, notably in China, India and Philippines, as well as in several European nations.

In 2009, the data suggests that while the supply and demand for ratings are more or less balanced there are still some shortages for officers, particularly for certain grades and for ship types such as tankers and offshore support vessel (Bimco/ISF 2010)

The supply of officers are shown in below table 2.1

Table 2.1: Availability of Officers
Source: BIMCO/ISF Manpower 2010 Update

Area	Current Supply	
	Officers (1000's)	%
OECD Countries	184	29.4
Eastern Europe	127	20.3
Africa / Latin America	50	8
Far East	184	29.5
Indian Sub-Continent	80	12.8
All National Groups	624	100

We could see from above table that supply of officers from Indian Sub-Continent is 80,000 in year 2010.In order to know what attracts and retains seafarers, which were identified from other studies are discussed in section 2.3 and 2.4.

2.3 Seafarer Attraction

As cited in Life at sea Survey reports 2007/2008 by Capt Thomas Brown and Emma Brown (Shiptalk Publishing) the key motivators for attraction were identified as ***to see the world, for the money, family tradition, wanted a carrier at sea, better carrier prospects, assuming life at sea less stressful, well respected in society, working condition better than home, better wages and other reasons*** (Capt Thomas Brown, Emma Brown 2007/2008).

The above view point contained respondents from many countries, when this view point was challenged from only Indian subcontinent officers, who constituted 12.7% (Capt Thomas Brown, Emma Brown 2007/2008). of the participants, the results were surprising. Family tradition was not at all identified as a factor, which emphasizes the point that deck officer themselves don't support their children to choose this career.

In India there is no shortage of successful cadets passing out of institutions, but the biggest problem is getting them actual sea time. ***Quoting, the Indian director-general of shipping, GS Sahni, Giorgi points out every year 5,000 successful cadets come out of 132 maritime training institutes, "[but] of these only 15-20% get actual sea-time training and the rest don't get employment opportunities: it's a Catch-22 situation"*** (GS Sahni, Giorgi 2005). The underlying reason is that, the shipping company cannot afford to increase their operating cost by spending on cadets and there is no legal requirement which dictates that ship owners need to have cadets, to the contrary there are stringent rules and regulations if the companies have cadets onboard.

As the vessel sizes are increasing and the crew compliment decreasing, there is heavy workload on officers due to which they are unable to train cadets. Thus, young cadets have a negative outlook towards shipping and they look for alternative job prospects. Poorly trained cadets become incompetent junior officers and shipping companies will not promote them by compromising quality and safety. This leads to shortage of senior officers, and hence we need to know what factors were identified by other studies which are important for retaining deck officers will be discussed in section 2.4.

2.4 Seafarer Retention

As per life at sea survey 2007/2008 the most important factors for deck officers to

continue sailing were salary 31.5%, job satisfaction 20%, time on leave 19.3%, paid leave 12%, wanting to see the world 8%, promotion prospects 6.1% and peer respect ashore 3.2%.The study also highlights that increase in pay couple by short contracts can be move in right direction.

At present, Indian deck officers are raising similar demands for pay rise and shorter contracts, but the shipping companies will start looking as reported by Roberto Giorgi, president of Monaco-headquartered V.Ships. The acute awareness of a global crew shortage could also mean that shipping companies are less likely to look at shaving a few dollars off the crewing budget and more likely to be concerned with no compromise on safety and quality (GS Sahni, Giorgi 2005).

The Indian deck officers were benefitted by tax free status provided they sail more than 6 months within a fiscal year. In India Six months is usually the time frame for which deck officer go out. As per new proposed rule, they would have to stay out at least ten months to be considered as NRI and therefore, be not subject to tax in India. This would make it difficult to retain manpower at Indian shipping companies that are already facing a tough time, competing with several foreign countries that provide various tax concessions to their employees" (Abdulgani Y Serang 2010) .

There are two reasons for reducing the tax benefit, firstly deck officers are seen as a source of income by revenue department and secondly they want to follow the global norms. These constraints put on deck officers will be further escalate retention issue.

Average sea span of Indian deck officer has also reduced from 25 to 30 years at sea to 10-15 years (Rangnekar 2005). The family structure has changed in India from joint family to nuclear family structure which has forced the head of the family to be at home. Thus personal circumstances have a major influence on the retention, which is out of scope for shipping companies to handle. The older generation Indian Officers had to wait till they get Master Mariner Certificate to qualify for higher studies like MBA program or M.Sc Programs to get jobs ashore, whereas today candidates are graduates before joining the sea as officer, so it becomes easy for them to exit from sailing career.

We have to accept that sea is not a natural environment for human and in addition

with changes happening ashore every day a seafarer feels that he is totally isolated from the world.

All these above facts clearly state that retention is a problem which will be faced by shipping companies at present and in years to come.

In order to build a conceptual framework we have to assess related studies conducted, which is discussed in next section 2.4.

2.5 Key Points from Related Studies and Conceptual Framework

As per BIMCO/ISF manpower study 2010, (2%) shortage of officers is estimated in year 2012. It highlights with regard to certain nationalities there is a concern about the current and future availability of senior officers (BIMCO /ISF 2010).

Life at sea survey report 2007/2008 is census based indicator where the view points of the deck officer were taken into account and put forward as simple percentage of acceptance similar to DEA model. The study focuses on global perspective which cannot be applied for Indian Subcontinent deck officer (Capt Thomas Brown, Emma Brown 2007/2008).

Another study conducted by Ruanthi de Silva, Patricia Stanton & John Stanton for officers in Indian subcontinent with 200 valid completions were analyzed using correlation and regression highlighted four factors which were of concern namely long-term career prospects, a smooth and fair recruitment process, a better relationship with maritime authorities and an employee-friendly organizational culture passed the test (Ruanthi de Silva, Patricia Stanton & John Stanton, 2011).

A study conducted to make an effective seafarer empowerment model by Inderveer Solanki from World Maritime University Malmo, Sweden (2007), highlights factors being influential in retaining officers. The method establishes a model to empower seafarer with authors own experience (Inderveer Solanki 2007).

All the above models are generalized and will require long time for shipping companies to implement.

Hence a study is required to avoid these generalization and speculation and create a tool useful for company to retain officers.

This has lead me to make a model which uses Analytical Hierarchical Process

model (AHP) which is helpful in understanding complex human behavior by cross comparing the important factors and convert it into numerical weights which can be used by shipping companies to identify their own strength and weakness and improve their position using linear programming. To verify the effectiveness of AHP model DEA model is used with limitations. The conceptual frame work is shown in below figure 2.1.

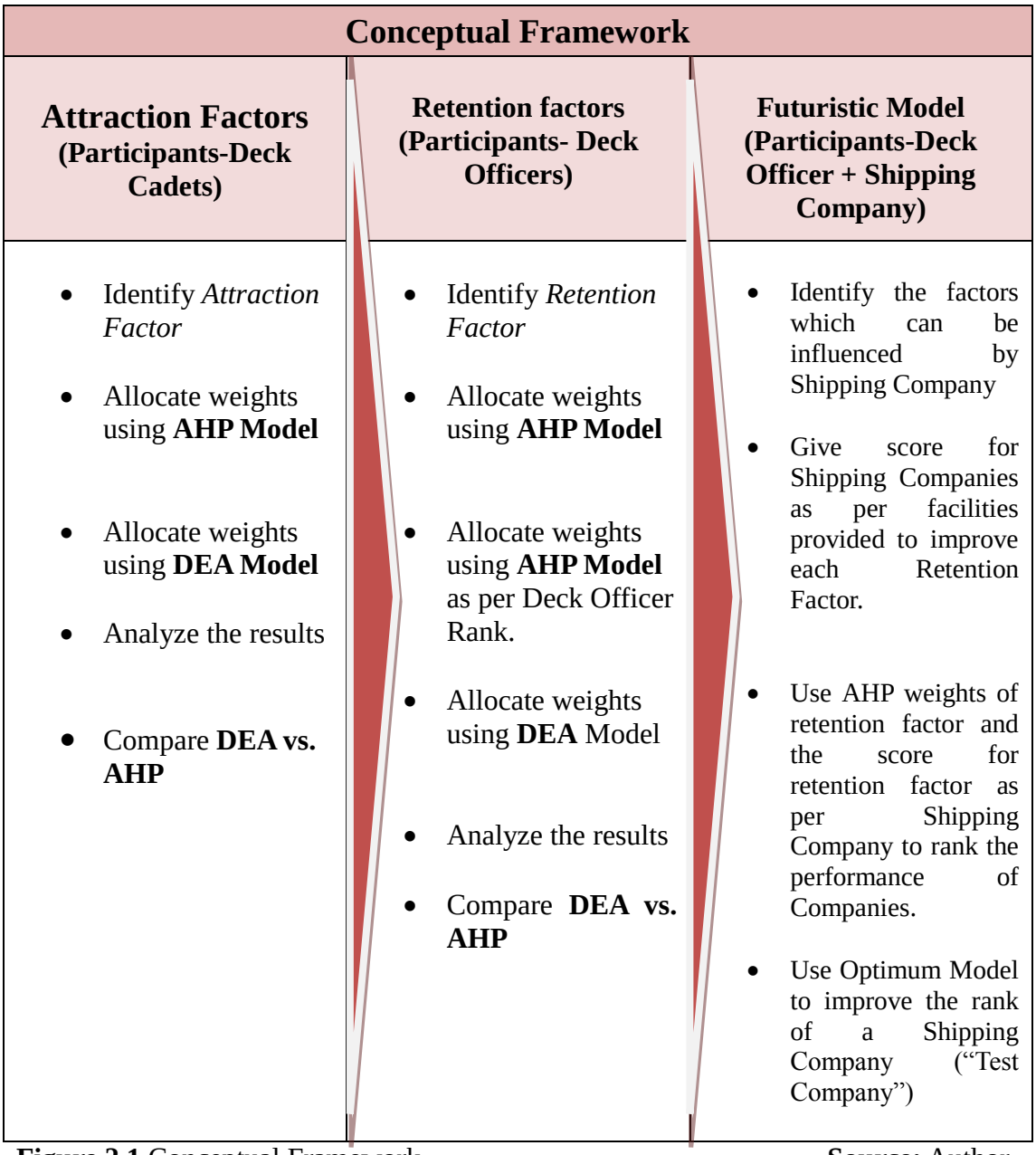


Figure 2.1 Conceptual Framework **Source:** Author

2.6 Key Objectives

Using conceptual framework, objectives will be achieved and can be used by seafarer as well as Shipping Company for mutual benefit. Following objectives will achieved during the research study:

- What are the factors affecting Indian Deck Officer Retention?
- What are the factors which can be influenced by the Shipping Company in retaining Indian Deck Officers?
- Does retention problem vary in Indian Deck officer ranks?
- What are the ranking of factors?
- What factors should the shipping company focus to avert manpower shortage?
- Is Analytical Hierarchy Process a good Model for this problem?
- What is the future scope of using AHP model?

Chapter 3: Research Methodology

3.1 Selection of Research Method

Qualitative research method will be used for this study, which ensures high level of interaction and primary focus on human element .This method ensures there is no preconceived or prefigured research questions rather the questions may change or be refined during ongoing study. The purpose of using this method is to have a holistic view and narrow it down to key elements which need to be focused.

The study involves group of humans with different psychology which has to be refined, structured and put into mathematical result for decision making. Thus **AHP model** would be used to analyze the data.

DEA model would be used to verify the effectiveness of AHP Model. For futuristic scope to use AHP result, linear programming will be used. The research study extensively uses MS Excel programming for analyzing the data using above models.

3.2 AHP Model

The AHP model is developed by T.Satty (1977, 1980, 1988, and 1985); this method allows the user to evaluate qualitative, quantitative and intuitive criteria. The results can be confidently used by carrying out consistency testing.

The AHP takes complete aggregation among criteria and develops a linear additive model. The weights and scores are achieved basically by pair wise comparisons between all options with each other (ODPM, 2004).

AHP can be used in situations where it comes to make choice, allocate ranking, prioritize options, resource allocation, benchmarking, quality management and conflict resolution.

The seafarer will compare the retention factors and the results can be converted into numerical values which are called **weights** or priority for each factor. This weights when coupled with alternative choices of shipping companies can highlight the best shipping company as per seafarer needs shown in figure 3.1.

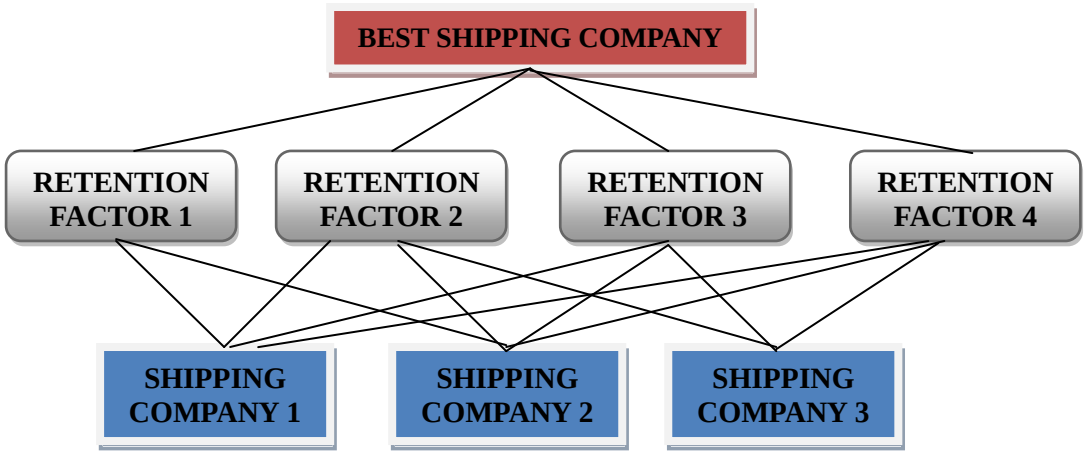


Figure 3.1: Analytic Hierarchical Process Model

3.2.1 AHP Process:

Step 1 -Defining a decision problem and selecting the criteria.

In this step the problem is divided into smaller parts into simplest form. The main components are goal at the topmost level, criteria (and sub criteria) at the intermediate levels, while the lowest level contains the options. In this method an overall view of the complex relationship can assessed and compared. *An element in a given level does not have to function as a criterion for all the elements in the level below. Each level may represent a different cut at the problem so the hierarchy does not need to be complete (Saaty, 1990).*

Step 2 - Pair wise Comparison (weighing) for priority setting-

The participant and the decision makers have to respond to a question "How important criterion A relative to criterion B?" Rating the relative "priority" of the criteria is done by assigning a weight between 1 (equal importance) and 9 (extreme importance) the reciprocal of this value is assigned to the other criterion in the pair. The weightings' are then normalized and averaged in order to obtain an average weight for each criterion.

Step 3- Pair wise comparison of options on each criterion (scoring)

Pair-wise comparison, homogeneity, independence relation, and expectation are basic assumptions of AHP technique (Vargas, 1990). For each pairing within each criterion the better option is awarded a score, on a scale between 1(equally good) and 9 (absolutely better), whilst the other option in the pairing is assigned a reciprocal

rating of this value. Each score records how well option “X” meets criterion “Y”. Afterwards, the ratings are normalized and averaged. Comparisons of elements in pairs require that they are homogeneous or close with respect to the common attribute; otherwise significant errors may be introduced into the process of measurement (Saaty, 1990).

Step 4- Obtaining an overall relative score for each option

In a final step the option scores are combined with the criterion weights to produce an overall score for each option. The extent to which the options satisfy the criteria is weighed according to the relative importance of the criteria. This is done by simple weighted summation.

3.2.2 Strengths and weaknesses of AHP

Strengths:

- This method is straight forward and simple for the users. AHP is flexible, intuitive appeal to the decision makers and its ability to check inconsistencies (Ramanathan 2001).
- AHP method has the distinct advantage that it divides a decision problem into its constituent simpler parts and builds hierarchies of criteria. Here, the importance of each element (criterion) becomes clear (Macharis et al. 2004).
- AHP helps to capture both subjective and objective evaluation measures and consistency checks can be made to build confidence and avoid bias in the system.
- The AHP method supports group decision−making through consensus by calculating the geometric mean of the individual pair wise comparisons (Zahir 1999).
- AHP is uniquely positioned to help model situations of uncertainty and risk since it is capable of deriving scales where measures ordinarily do not exist (Millet & Wedley 2002).
- AHP method gives numerical result which can be used in conjunction with other models.

Weaknesses:

- Many researchers have long observed some cases in which ranking irregularities can occur. This rank reversal is likely to occur e.g. when a copy or a near copy of an existing option is added to the set of alternatives that are being evaluated. ·
- Pair wise comparisons to be made, may become very large, and thus become a lengthy task (Macharis et al. 2004).
- It has an artificial limitation of the use of the 9−point scale. Sometimes, the decision maker might find difficult to distinguish among them and tell for example whether one alternative is 4 or 5 times more important than another. Also, the AHP method cannot cope with the fact that alternative A is 20 times more important than alternative B.

3.3 DEA Model

DEA methodology was formally developed by Charnes, Cooper and Rhodes (1978). It helps in finding the efficiency, which is defined as a ratio of weighted sum of outputs to a weighted sum of inputs,

Example of DEA model

X= Input= Number of participants to whom opinion was asked=120

Y= Output=Number of participants who agreed to the question=100

Z= Score = (Y / Z) x 100 %=83.33%

Strengths

- No requirement of a mathematical form.
- Useful in uncovering relationships that remain hidden in other methodologies
- Capable of handling multiple inputs and outputs
- Capable of being used with any input-output measurement
- The sources of inefficiency can be analyzed and quantified for every evaluated unit

Weakness

- Results are sensitive based on the selection of inputs and outputs (Berg 2010).
- Require maximum related inputs and outputs to have good results.

3.4 Linear Programming Model

Linear programming (**LP** or **linear optimization**) is a mathematical method for determining a way to achieve the best outcome (such as maximum profit or lowest cost or desired value) in a given mathematical model for some list of requirements represented as linear relationships.

Key to a linear program is the decision variables, objective, and constraints. The decision variables represent (unknown) decisions to be made. Every linear program has an objective whose result has to be either minimum or maximum or desired value whereas the linear program may also have constraints limiting feasible decisions.

All the above models require data and the means and sources are discussed in next section.

3.5 Data Requirement and Collection

Since the research topic is based on Indian deck officers, two Indian organizations namely maritime educational institution and shipping company will be involved. The attraction factors will be obtained from deck cadets, whereas Retention Factors will be obtained from deck officers. Direct interview and questionnaires will be used and the feedback will be analyzed.

The deck cadet participants will become future deck officers, provided they successfully complete Bachelors' program. The students are of Indian origin with age group of 19-21 years. Since they choose this study they are the best targets to ask about what attracted them to join merchant navy.

Crucial data is required from the shipping company which is affected by retention problem. Synergy Maritime Private Ltd which is Ship Management Company has 35 ships and mans Indian Crew in 20 ships has given full support for this study. The participant includes the Company Management Team and the deck officers.

The above company started in year 2006 and has many senior officers from other companies. This has a positive impact on the survey, as the deck officers can compare benefits provided by other company.

Chapter 4: Attraction Factors

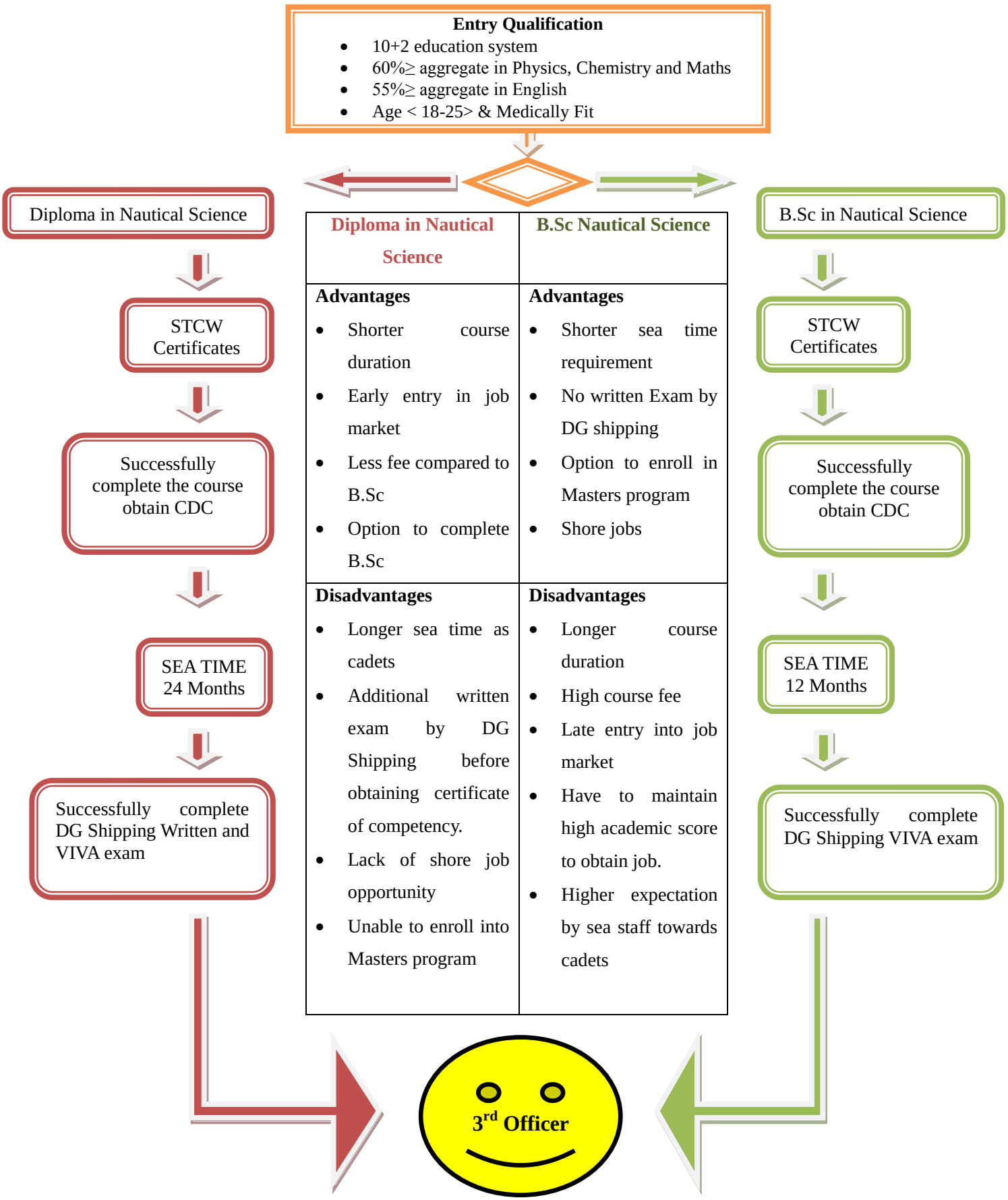
4.1 Introduction

In this chapter “Attraction factors” mean those factors which attract and influence potential candidates to take up sailing as a career for first time. The survey data is collected from students who are undergoing training to pursue merchant navy as a career for life. This chapter also highlights the number of years they are expected to sail, thus that could help in understanding the future supply of deck officers. To pursue this career, the students have to choose between two streams of education which is discussed in next section.

4.2 Training and Education System

There are two streams of education system which can be taken by students to become a seafarer on deck side. The first choice is to enroll into a diploma program in which the candidate completes one year at nautical institute and in addition acquires basic STCW certificate required for sailing. The second choice is to take up three year undergraduate program in Nautical Studies and additionally acquire basic STCW certificate. Both courses expect candidates to perform academically well and nurture discipline .The students have to stay in campus throughout the tenure of course to have a feel of isolation which supposedly helps them in adapting once they are onboard ship.

So why there are two streams of education?? There are definite advantages and disadvantages of these two streams which are shown in below career path figure 4.1.



Diploma in Nautical Science	B.Sc Nautical Science
Advantages • Shorter course duration • Early entry in job market • Less fee compared to B.Sc • Option to complete B.Sc	**Advantages** • Shorter sea time requirement • No written Exam by DG shipping • Option to enroll in Masters program • Shore jobs
Disadvantages • Longer sea time as cadets • Additional written exam by DG Shipping before obtaining certificate of competency. • Lack of shore job opportunity • Unable to enroll into Masters program	**Disadvantages** • Longer course duration • High course fee • Late entry into job market • Have to maintain high academic score to obtain job. • Higher expectation by sea staff towards cadets

Figure 4.1: Career Chart **Source:** Author

4.3 Onboard Performance

Since there are two streams of education there would be quality issues which would affect the retention of deck officers. Following survey data from Second officers, Chief Officers and Captains will help us in identifying these issues.

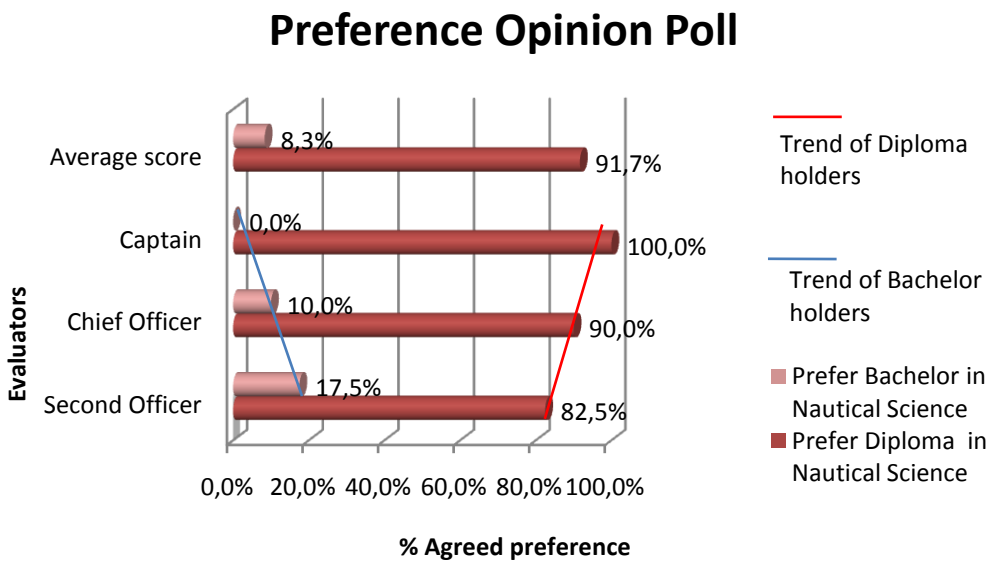


Figure 4.2: Score Card: Performance of Junior Officers onboard coming from different educational background

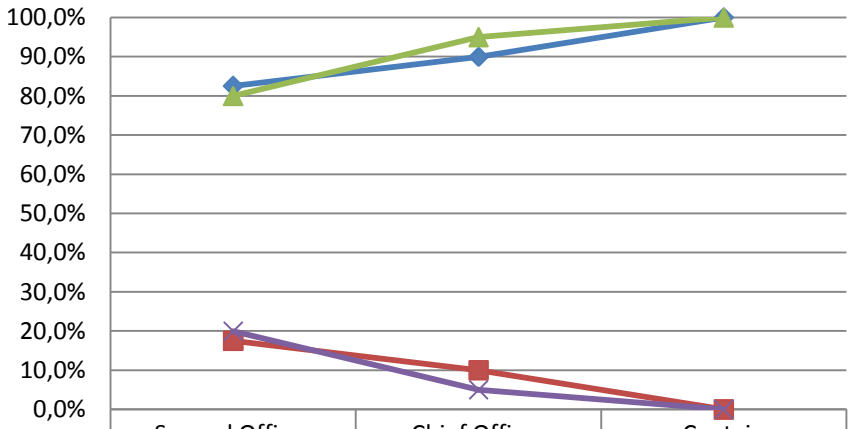
Source: Author (Participants 120)

From the above chart we can clearly see that in average 91.7% senior officers prefer diploma students compared to Bachelors students. This is mainly due to fact that the amount of sea time during training for Bachelors program is not sufficient to make them a competent deck officer. As from figure 4.1 we can see that diploma students train for 24 months compared to bachelor's program students who require only 12 months at sea. Hence, emphasizes the point that classroom training cannot substitute onboard training.

We can notice in the trend line that as higher the rank likeliness towards diploma holders is high. There could be two reasons for this; firstly the senior officers evaluate junior officers hence they have clear idea of who performs well. Secondly, there is possible that they are biased because they are not graduates and hence dislike graduate cadets.

This opinion poll when brought into the attention of few cadets under bachelors

program responded by saying that the officers onboard are biased towards diploma holders because majority of senior officers themselves are diploma holders. Secondly, performance expectation during the training period onboard is high from these students compared to diploma holders. We can verify if officers are biased towards different education stream candidates as shown in Figure 4.3.



	Second Officer	Chief Officer	Captain
Prefer Diploma in Nautical Science	82,5%	90,0%	100,0%
Prefer Bachelor in Nautical Science	17,5%	10,0%	0,0%
Diploma Holders Evaluators	80,0%	95,0%	100,0%
Bachelor Holders Evaluators	20,0%	5,0%	0,0%

Figure 4.3: Bias Graph
Source: Author (participants 120)

From the above graph it can be noted that those who preferred Diploma holders, themselves hold similar education vise versa those who hold Bachelors program have prefered candidates from similar background. This indiactes that there are factors of bias which could effect onboard workculture when two different educational stream candidates meet. But, this will not undermine the quality issue closely related to insufficient sea time onboard for training.

4.4 Effects of Education System on Manpower Retention

Since there are quality issues because of stream of education, this would affect retention. The survey result below in figure 4.4 shows the opinion of Deck Officers on which stream of students stay longer at sea.

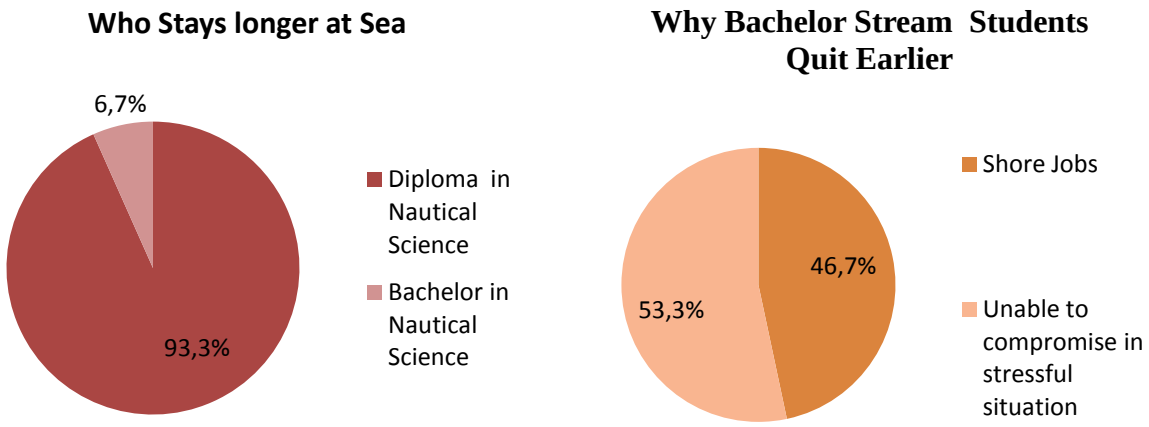


Figure 4.4 Longevity and Retention based on Education system
Source: Author (Participants 120)

The above opinion poll shows that 93.3% accept that diploma holders stay longer at sea .The reasons are primarily due to the fact that they do not have option to switch ashore, as shore job require only graduates. Secondly, diploma holders are well adapted to work onboard due to 24 months training period during their internship. The bachelor stream students' expectancy to pursue seafaring as a long term career is less because they can find shore jobs and are unable to compromise onboard in event of stressful work environment.

4.5 Future Commitment towards Sailing

With reduced manning onboard and increased ship size, the productivity per person has gone up and this would also indicate that the number of years deck officer would commit to sea will be reduced due to the workload.

In order to understand till what age future potential deck officer would commit towards sailing, following were the response from 120 participants with average age of 19 years as shown in table 4.1.

Table 4.1 Future Commitment to Sailing
Source: Author (Participants 120)

Expected duration of Sailing -Age group	Age Group					
	< 25	**25-30**	**30-35**	**35-40**	**40-50**	**50-60**
Respondents	*4.2%*	*5.0%*	*70.8%*	*9.2%*	*0.8%*	*10.0%*

Considering that the respondents would proceed to sea at the age of 20 we could see from above data that 70.8% of the candidates would commit to sailing between 30-35 years of age that is 10-15 years of commitment is expected from future deck officers**.** Only 10% would take up sailing as lifelong career hence it is important that shipping companies make strategic organizational decisions to utilize the manpower resource effectively.

When a question was put to same participants on how long will they sail, following were the response as shown in the figure below.

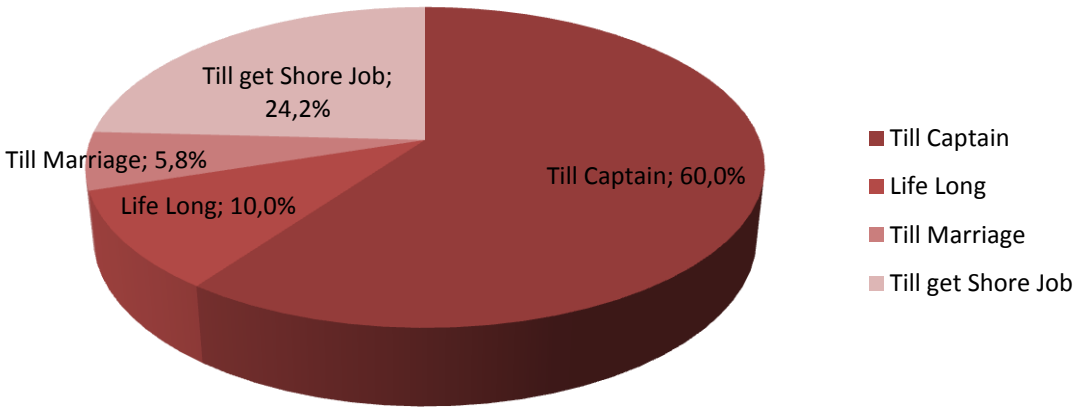


Figure 4.5: How long will they sail?
Source: Author (Participants 120)

The survey result indicated that 60.0% of the participants will sail till they become Captain. In order to know why the cadets choose this career, a survey was conducted and the results are discussed in next section.

4.6 Attraction factors

The training course is residential, which means the cadets have to be in isolation and in addition the course fee is high, In spite of these drawbacks, still sailing manages to attract young students.

Students are aware of both positives and negatives of sailing and have put lot of thought into it before deciding to enroll into maritime training program. AHP and DEA methods were used to identify the relative efficiency of attraction factors. AHP matrix and the related findings are shown in below table 4.2.

Table 4.2: AHP Matrix for Attraction Factors
Source : Author (Out of 120 participants only 87 results passed the Consistancy ratio check)

Matrix A-Pair wise Comparison

PAIRWISE COMPARISON MATRIX "A"	Money	Adventure	Sight Seeing	Vacation	Peer Respect
Money	*1*	*7*	*8*	*6*	*5*
Adventure	*1/7*	*1*	*1/2*	*1/4*	*1/5*
Sight Seeing	*1/8*	*2*	*1*	*1/2*	*1/2*
Vacation	*1/6*	*4*	*2*	*1*	*3*
Peer Respect	*1/5*	*5*	*2*	*1/3*	*1*

Value of a_{ij}	Interpretation for Pair wise Matrix
1	Objective "i" and "j" are equally important
3	Objective "i" is slightly more important than "j"
5	Objective "i" is strongly more important than "j"
7	Objective "i" is very strongly more important than "j"
9	Objective "i" is absolutely more important than "j"
Note: i = row and j = column	

Matrix B-Normalized Pair wise Comparison Matrix

PAIRWISE COMPARISON MATRIX "A"	Money	Adventure	Sight Seeing	Vacation	Peer Respect	Weight (W)	A x W	λmax
Money	*0.6118*	*0.3684*	*0.5926*	*0.7423*	*0.5155*	*56.6%*	*3.23*	*1.14*
Adventure	*0.0874*	*0.0526*	*0.0370*	*0.0309*	*0.0206*	*4.6%*	*0.24*	*1.03*
Sight Seeing	*0.0765*	*0.1053*	*0.0741*	*0.0619*	*0.0515*	*7.4%*	*0.39*	*1.06*
Vacation	*0.1020*	*0.2105*	*0.1481*	*0.1237*	*0.3093*	*17.9%*	*1.01*	*1.13*
Peer Respect	*0.1224*	*0.2632*	*0.1481*	*0.0391*	*0.1031*	*13.5%*	*0.68*	*1.01*
Constancy Ratio (CR) = 0.084 (should be < 0.1)							**λmax**	*5.375*

As per AHP matrix key identified factors relative ranking is shown in below figure 4.6.

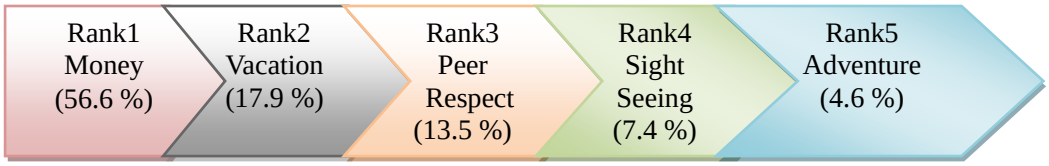


Figure 4.6 : AHP Ranking for Attraction Factors
Source: Author (Participants 120**)**

To cross evaluate the AHP model, DEA method was used and following were the results as shown in table 4.3.

Table 4.3 DEA data table for relative efficiency
Source: Author (Participants 120)

Attraction Factors	Input	Output	Relative Efficiency
Money	*120*	*120*	*100.0%*
Vacation	*120*	*40*	*33.3%*
Peer respect	*120*	*38*	*31.7%*
Sight Seeing	*120*	*30*	*25.0%*
Adventure	*120*	*15*	*12.5%*

The above DEA table represents input variable from 120 participants and respective response. As per DEA key identified "Attraction factors" relative ranking is shown in below figure 4.7.

Figure 4.7: DEA Ranking for Attraction Factors
Source: Author (Participants 120)

In order to observe the trend of AHP and DEA results, both the values were put in single graph as shown in below figure 4.8.

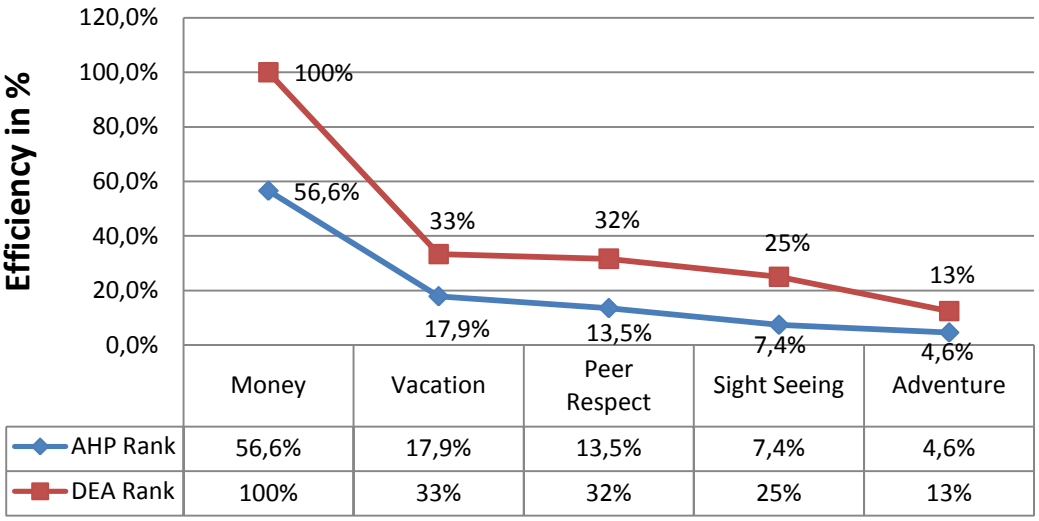


Figure 4.8: AHP vs. DEA for Attraction Factors
Source; Author (DEA Model 120 participants, AHP Model 87 participants)

The relative ranking in both AHP and DEA methods follow the same trend in the order of highest to lowest with Money ranking the top followed by vacation, peer respect, sightseeing and adventure. Following figure 4.8 helps in analysis of attraction factors.

The factors which attracted the students to choose sailing as a career are money, vacation, peer respect, sightseeing and adventure because of following reasons-

- **Money** (56.6%) - Being a merchant navy officer entitles seafarer to have tax free income. The company provides all expenses for the seafarers related to ship joining, food, accommodation, signing off expenses, medical expenses and uniform expenses. However, seafarers do spend money on board on satellite calls to home and during shore leave. Thus with high income and less spending, money is a key motivator for sailing and ranks the highest.
- **Vacation** (17.9%) - Onboard isolation requires to be compensated by long vacation thus ranks second. The relative ranking between money and vacation is quite steep because the cadets are ready to compromise vacation for getting a job on ship .Secondly they would earn and pay back the educational loan as soon as possible. (Note: 83.7% students are under educational loan)
- **Peer Respect** (13.5%) closely follows Vacation as the students consider

this career is for mentally strong people and should be respected for the choice and sacrifice they have made.

- Surprisingly **sightseeing** (7.4%) ranked only 4th compared to other factors. It is a common notion that sailors travel around the world free of cost and have opportunity to visit many places, but today's generation do understand that the time vessel spends in port is matter of hours .Many ports are moving away from cities and deck officer with lack of time and considering the travel time are unable to go ashore. The participants are aware of these facts thus many have accepted that this is not the key motivator.
- **Adventure (4.6 %)-** It is very hard to define adventure; the participants have opinion that perils at sea like rough weather, piracy attacks, changing weather conditions and locations contribute to adventure. This opinion would change once they go onboard but still is a key motivator for attraction.

4.7 Summary

- Training and Education system has a definite impact on future manpower. Diploma holders will stay longer at sea compared to bachelor program holders.
- Onboard performance of Diploma stream students is better than Bachelor program students.
- Shortage of training time for Bachelor program students affects their performance onboard.
- Senior officers onboard are biased towards diploma holders as many of the senior officers are diploma holders.
- In future 70.8% of students would sail from 10-15 years and only 10% will take this career for life.
- Among key identified attraction factors, money ranks the top followed by vacation, peer respect, sightseeing and adventure.

Chapter 5: Retention Factors

5.1 Introduction

This Chapter is the core of this research paper, which highlights the factors which are important for deck officer to continue sailing. The results are purely based on Indian deck officer Perspective and it also highlights the difference of opinion based on the rank of deck officers. AHP model is the primary means to determine the relative importance whereas DEA model acts as a support and helps in verifying the suitability of AHP model.

5.2 Retention Factors

In this section the focus is on the factors which affect deck officers' retention. To collect influential factors, initial survey was conducted which resulted in identifying following factors shown in below table 5.1.

Table 5.1: DEA result for Retention Factors
Source: Author (Participants 160 deck Officers)

Retention Factors	Number of participants who have agreed in %				
	Ranks				Average for All Officers
	Captain	Chief Officer	Second Officer	Third Officer	
Money	*100.0%*	*92.5%*	*87.5%*	*97.5%*	*94.4%*
Additional Benefits	*37.5%*	*87.5%*	*92.5%*	*97.5%*	*78.8%*
Optimum Crew	*95.0%*	*100.0%*	*60.0%*	*62.5%*	*79.4%*
Single Nationality	*95.0%*	*100.0%*	*35.0%*	*45.0%*	*68.8%*
Onboard Facilities	*92.5%*	*60.0%*	*92.5%*	*95.0%*	*85.0%*
Study Grant for Training Course	*30.0%*	*62.5%*	*100.0%*	*100.0%*	*73.1%*
Safety & Security	*80.0%*	*100.0%*	*87.5%*	*77.5%*	*86.3%*
Leave	*100.0%*	*92.5%*	*85.0%*	*72.5%*	*87.5%*
Shore Leave	*57.5%*	*42.5%*	*87.5%*	*35.0%*	*55.6%*
Promotion Prospects	*0.0%*	*87.5%*	*37.5%*	*100.0%*	*75.0%*
Fleet Quality	*100.0%*	*100.0%*	*27.5%*	*100.0%*	*81.9%*
Company Brand	*35.0%*	*50.0%*	*45.0%*	*100.0%*	*57.5%*
Quality Management System	*100.0%*	*100.0%*	*100.0%*	*30.0%*	*82.5%*
Onboard Work Culture	*52.5%*	*100.0%*	*55.0%*	*95.0%*	*75.6%*
Ship Shore Staff Relation	*92.5%*	*77.5%*	*30.0%*	*95.0%*	*73.8%*
Family dependent on Salary	*100.0%*	*100.0%*	*35.0%*	*22.5%*	*64.4%*
Financial Commitment	*100.0%*	*100.0%*	*45.0%*	*85.0%*	*82.5%*
Lifestyle	*100.0%*	*50.0%*	*100.0%*	*60.0%*	*77.5%*

The survey was conducted among 120 participants comprising of Captains, Chief Officers, Second Officers and Third Officers. The opinion for each factor varied among deck officers ranks as seen in table 5.1.

. This emphasizes the fact that deck officer's opinion tends to change when they move up the career path. The most important factors for Deck Officers using DEA model were money (94.4%), leave (87.5%) and Safety & Security (86.3%).These factors were again tested using AHP model which is discussed in next section.

5.3 AHP analysis of Retention Factors

The identified retention factors were divided into three broader groups namely General Factors, Company Specific Factors and Personal Factors as shown in below Figure.

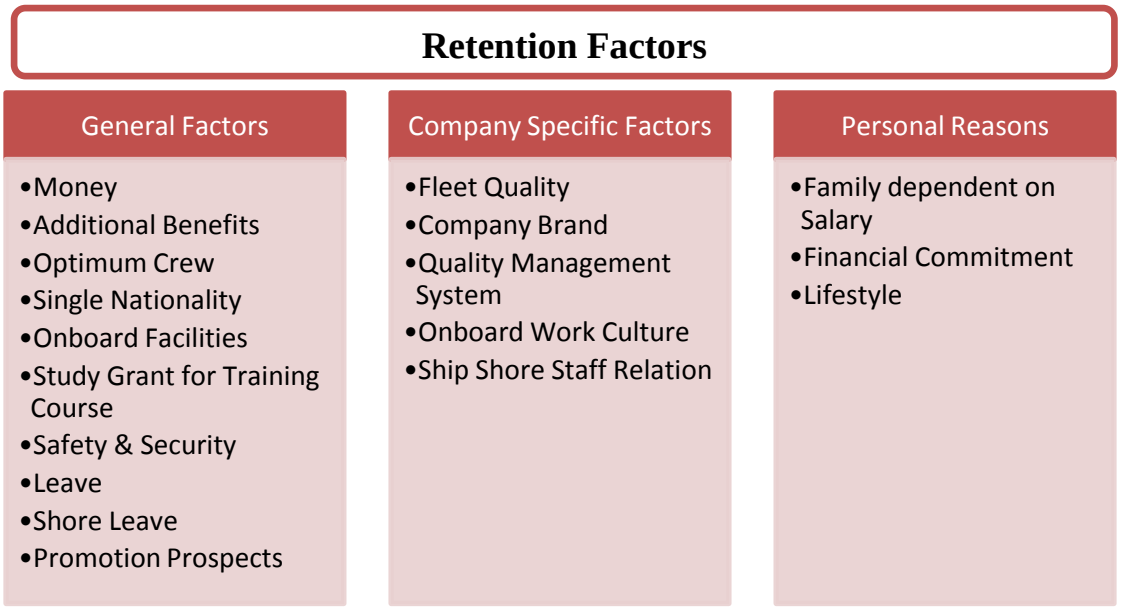


Figure 5.1: Grouping of Retention Factors
Source: Author (Participants 160 deck Officers)

The subdivision was needed for an effective analysis of the data from AHP method, because too many factors in one AHP matrix will reduce the relative importance of factors and induce rank reversal.

The subgroup is formed based on the opinion poll from the participants.

- The subgroup **General factors** are those factors which concerns deck officer in pursuing sailing as a career for life and is given a weight of 0.5(source:

Author, 160 participants) for the whole group.

- The sub group **Company Specific Factors** means those factors which concerns deck officer in committing to one specific shipping company and is given a weight of 0.2 (Source: Author 160 participants).
- The last subgroup, **Personal reasons** are those factors due personal commitment for which the deck officers continue sailing and is given a weight of 0.3 (Source: Author, participants 160).

Consolidated AHP matrices were built as per deck officer ranks which are attached in Appendix.

The result of AHP model for subgroup "a General factor" is discussed in next section.

5.3.1 General Factors

The average of weight for each factors in subgroup "General factors" are shown in below figure 5.2.

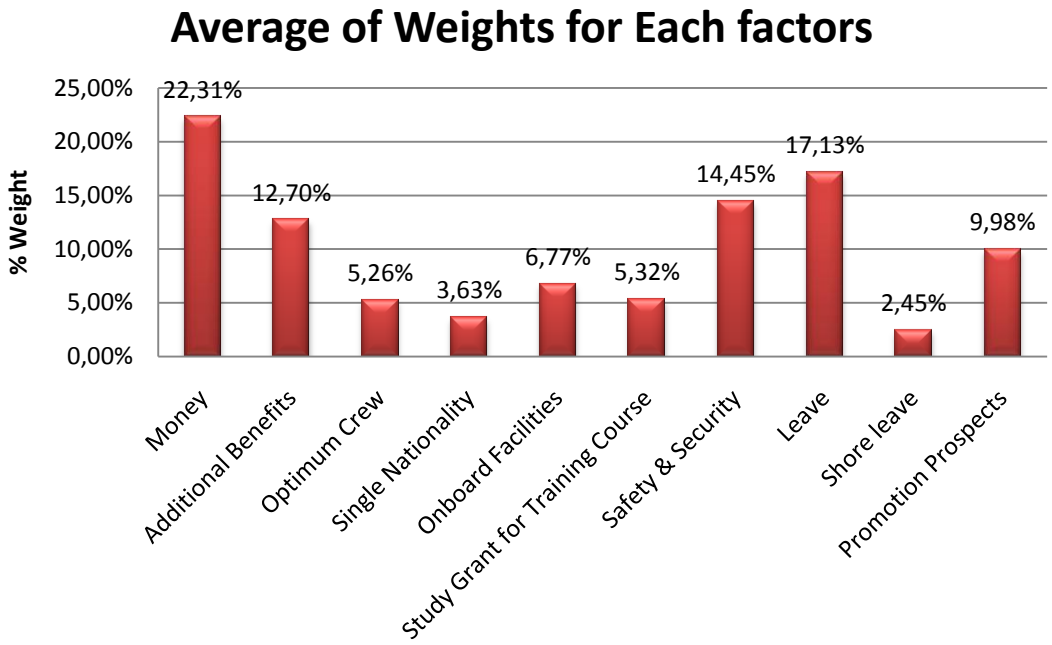


Figure 5.2: AHP weights for General Retention Factors
Source: Author (Participants 160 deck Officers)

In relative importance among the factors, money matters the most for deck

officer (22.31%) followed by leave (17.13%) and Safety & Security (14.45%).

•**Money** (22.31%) is the most influential factor for any career including seafaring. In general, common public have the opinion that deck officers are highly paid, and for this, seafaring participants believe that they should be compensated for the high risks and personal sacrifice involved in this career. The survey identified following results as shown in figure 5.3.

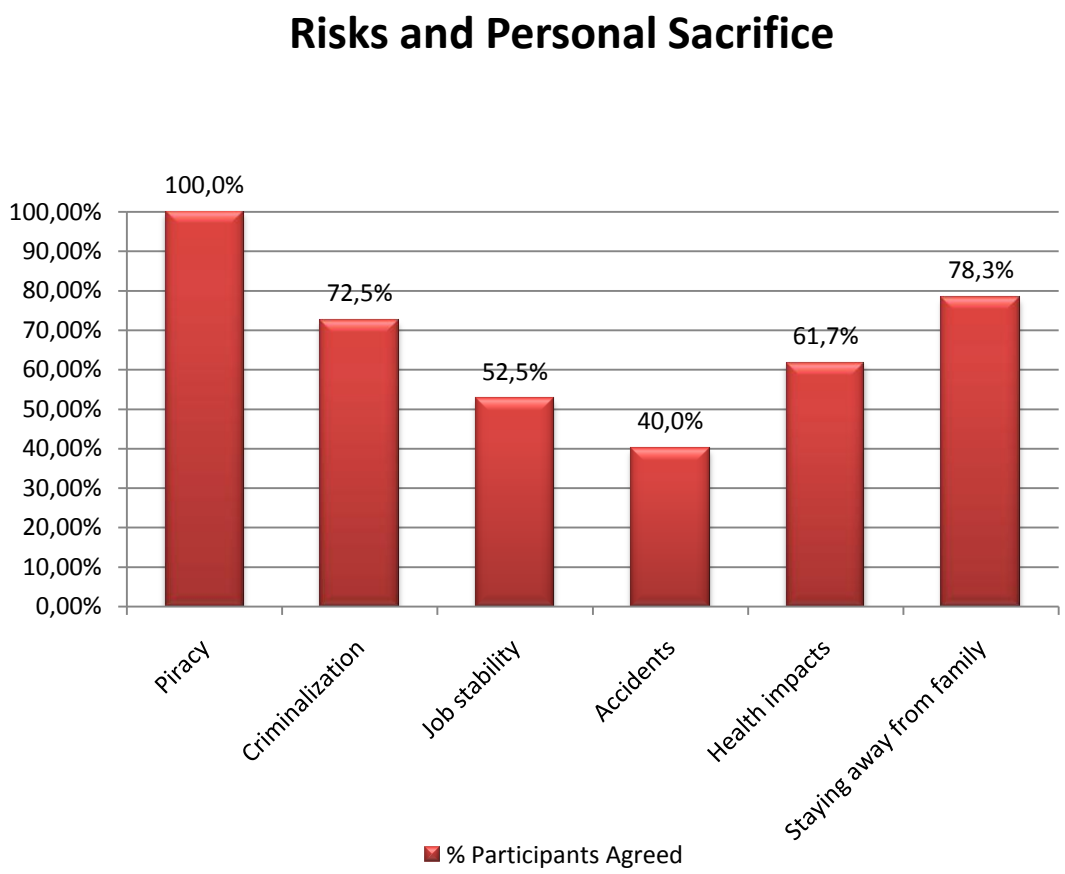


Figure 5.3: Factors for which Deck Officers Demand High Pay
Source: Author (Participants 120 deck Officers)

Piracy ranks the highest with 24.7% followed by staying away from family 19.3% and Criminalization (18.2%).

- Piracy over the years has become a major problem for shipping community. From the Deck Officer's perspective, it is a matter of life and death for them. In addition, this problem increases workload onboard as vessel has to be secured when transiting through piracy prone areas.

- Staying away from home is a concern as the Deck Officer is unavailable at home during household emergencies, besides, deck officers have to safeguard their personal investments which require personal presence. To safe guard their investments, substantial amount of money are spent on security needs at home.
- Criminalization on deck officer is a serious concern. In many marine accidents and incidents, the shipping communities including IMO are unable to provide immunity to deck officers even if they are not found guilty.
- Deck officers are aware that shipping is derived demand and the market is highly volatile. During weak markets, first thing shipping company does is cutting its operating cost. Seafarer's salary contributes to 50% of the OPEX for shipping company and thus, the market affects the deck officers' salary. Attrition is high during weak market and deck officers don't have alternative jobs other than to rely on their income from accumulated investments.

- In most cases accidents onboard are fatal and injuries can make deck officers medically unfit for sailing. Thus, a serious injury can result in the ending the career.

Thus, considering all these above facts we could see that money takes precedence over all other factors.

- **Leave (**17.13%)

In present market situation the deck officers are in a position to bargain their pay and leave. Senior Officers normally get 4 months contract onboard and 3 months leave, whereas Junior Officers get 6 months onboard with 2 months' leave. Isolation from family needs to be compensated with leave, thus this factor ranks second. Human being is a social animal, the need to be involved with community is essential. Unfortunately, Sea is not a natural environment for living, and onboard work atmosphere is very different as the Officers work, eat, sleep and mingle with same crew till the time they remain onboard.

India, earlier, had joint family system, where married couple would live with their parents even after marriage. This helped the deck officers to stay onboard as elders at home supported the family. The last generation deck officer's even had an additional advantage of having more than one sibling, i.e., a brother or sister, who would be available for supporting the family. This has changed over the years and nuclear family system is on the rise, which needs the family head to stay at home.

From the above reasons, the need for optimum leave is required for deck officers. Thus, an improvement in duration of leave would keep Indian deck officers on board.

- **Safety & Security** (14.45%) ranks third because of increase in cases related to piracy attacks. This is a serious concern for shipping companies, because deck officer do not want to sail on those company vessels which transits pirate infested waters. An increase in safety and security measures and reduction in piracy cases would definitely improve retention**.**

- **Additional benefits** (12.70%)

The most desirable benefits required by Deck Officer are shown in below figure 5.4.

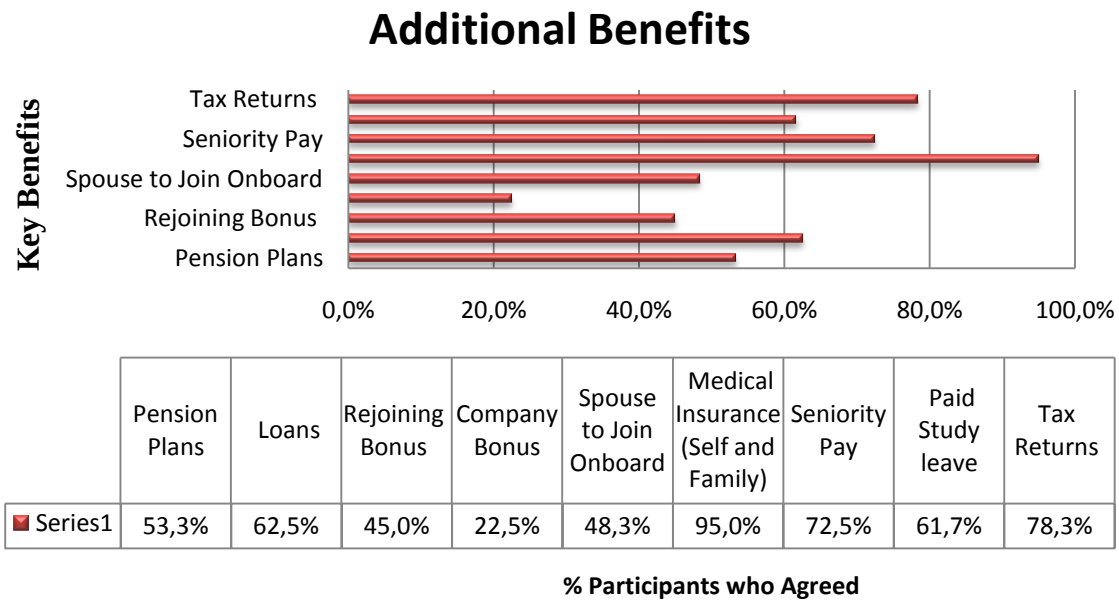


Figure 5.4: Additional benefits for Deck Officers
Source: Author (Participants 120 deck Officers)

The most important additional benefit required by deck officers are Medical Insurance for self and family (95%), followed by Tax Returns (78.3%) and Seniority Pay (72.5%).

It is noted that Captains and Second officers have a strong demand for spouse to sail onboard. This reflects the fact that Chief Officer though being in senior rank is unable to spend onboard time with his spouse because of work load. This factor does not apply to Third Officers as most of them are single. This finding led to identify which rank has maximum workload onboard. A survey showed work load of various ranks as shown in below figure 5.5.

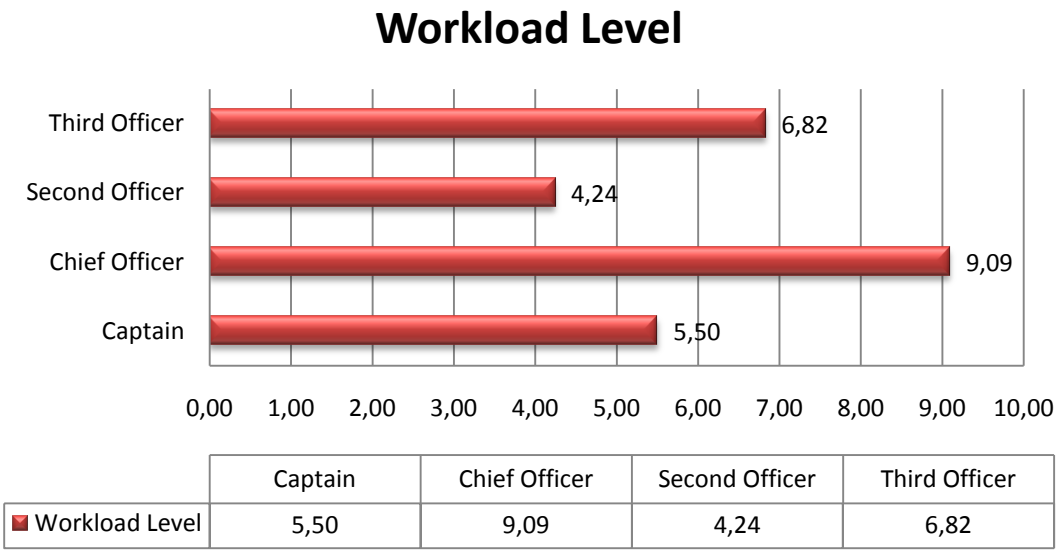


Figure 5.5: Workload Level for each Rank (1 least -10 best)
Source: Author (Participants 120 deck Officers)

From the above figure we can see that Chief Officer's job is considered to have maximum workload, followed by Third officer. The job role with least workload onboard is Second Officer followed by Captain.

- **Promotion Prospects** (9.98%)

This factor is crucial for all ranks except Captain Rank which is the highest position on board. The weight given by Chief Officers and Third Officers are high, as it reflects that deck officers at this rank want to run through this position as soon as possible due to work load.

Third officers being the weakest link are forced with additional workload and

are subjected to fatigue. Also being the lowest rank, they have natural tendency to be ambitious resulting in strong need for a promotion. Another reason is promotion will financially benefit them in repaying educational loans which most of them would have acquired for joining maritime courses.

From chief officers perspective the workload pushes them for early promotion for which they would compromise their salary and leave. Thus, in many cases we see shipping companies having shortage of senior officers as chief officer switch companies for promotion. The increment in salary when promoted from Chief Officer to Captain is not so significant compared to reduction in workload.

These above reasons contribute for high weight given for promotion by Third and Chief Officers. Second officer being the most comfortable position onboard, the need for promotion is given less weight. He keeps the watch onboard at night hours from Midnight to 4 Am. During this time all people onboard are at sleep and their lives rest on proper watch keeping duties kept by him.

Since this work timing is unnatural for human, thus Second Officers are not stressed with petty works to assure he is not affected by fatigue. Thus, Third officer being the weakest link takes up all petty work increasing his workload. Second officer also has least interaction with other officers onboard because of his unusual work hours, thus reducing his workload.

If there is a delay in promotion first the Officers would opt to switch companies. When this does not work, they would consider looking for alternative jobs ashore. Thus, shipping community as a whole has to unify the promotion and evaluation system for Officers to avoid switching companies and thus improve retention.

- **Onboard facilities** (6.77%)

ILO has been targeting rouge ship owners who are not providing bare minimum facilities on board. With present weak market and low supply of manpower, Officers do have strong say in choosing companies that provide good onboard facilities. The basic facilities needed for Officers are shown in figure 5.6

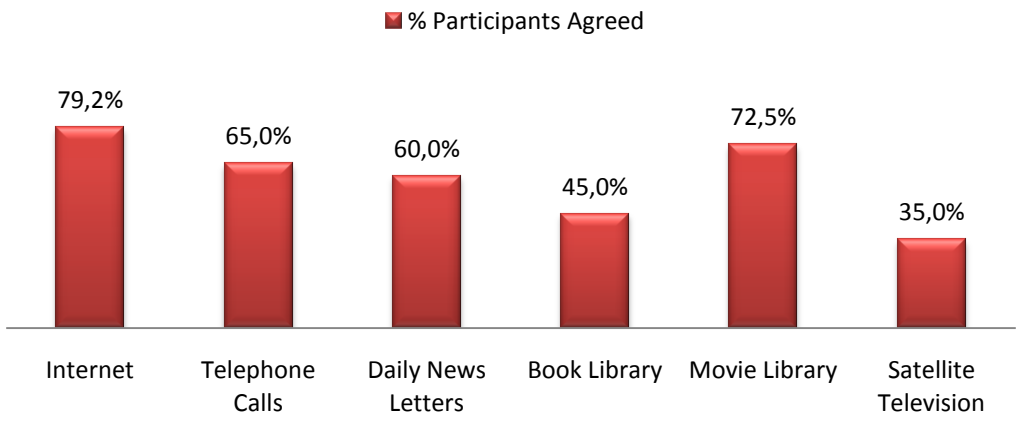


Figure 5.6: Onboard Facilities
Source: Author (Participants 120 deck Officers)

Internet facilities is the most desired facility agreed by 79.2% of participants, followed by Movie library 72.5% and telephone calls 65%.

Ship being a mobile unit, it needs to communicate via satellite thus leading to high cost. Onboard ship, at any point of time only one person can make an external call. Internet facility onboard could avoid this problem where multiuser can communicate simultaneously using chat functions like SKYPE and Yahoo Messenger. In addition, internet gives access to daily newsletters, e-books and online movies.

- **Study Grant for Training Courses** (5.32%)

Over the years IMO has made strong commitment in reducing maritime accidents by formulating safety courses to train Deck Officers. To become a Deck Officer, the basic requirement is to acquire certificate of competency, but that alone is not sufficient, there are additional STCW certificates and other certificates specific to type of ships to be obtained and renewed.

Usually maritime courses are expensive and the frequency offered by maritime institution is based on demand by Officers .The deck officers have to spend money and his vacation for updating certificates to be eligible for sailing. Thus Deck Officers demand for study grant from Shipping Companies.

Among the participants, 67% obtained their certificate of Competency from foreign country because duration to clear the exam takes very long time in India.

- **Optimum Crew** (5.26%)

The Participants were asked why they would require optimum crew onboard .In

response, 94% of participants opted for optimum crew to reduce workload and 65% (Source: Author) for safe operations.

Particular focus is on **port operations** as Deck Officers feel that they are occupied with **heavy workload** during port stay which is unsafe. As quoted by a participant "a 5700 TEU vessel loading and discharging containers at port of Kaohsiung at a rate of 168 containers per hour per ship has one Officer on watch with two seamen on deck. Among the two seamen, one is doing ISPS security watch and other monitoring the mooring lines and Cargo Operation, so where is safety?" .This clearly shows that the operation is not in control. Unfortunately, the **safe manning certificate** considers the number of crew based on sailing and does not consider port operation into account.

- **Single Nationality** (3.63%)

With stressful work atmosphere onboard the last thing any Deck Officer would like to have is a communication failure. In most cases, this would lead to operational hazard resulting in serious accident. With fast paced work operations onboard, it is required that the people have similar demographic origin in understanding the communicating well with the co-workers.

It is preferable to have single national crew for effective operation on board.
As one officer states "there is no time for diplomacy onboard, people have to clearly understand instruction and not to be offended because of the slang or language".
This is a key concern for Indian Officers as they also consider that same nationality means onboard will have Indian Cuisine.

- **Shore leave** (2.45%)

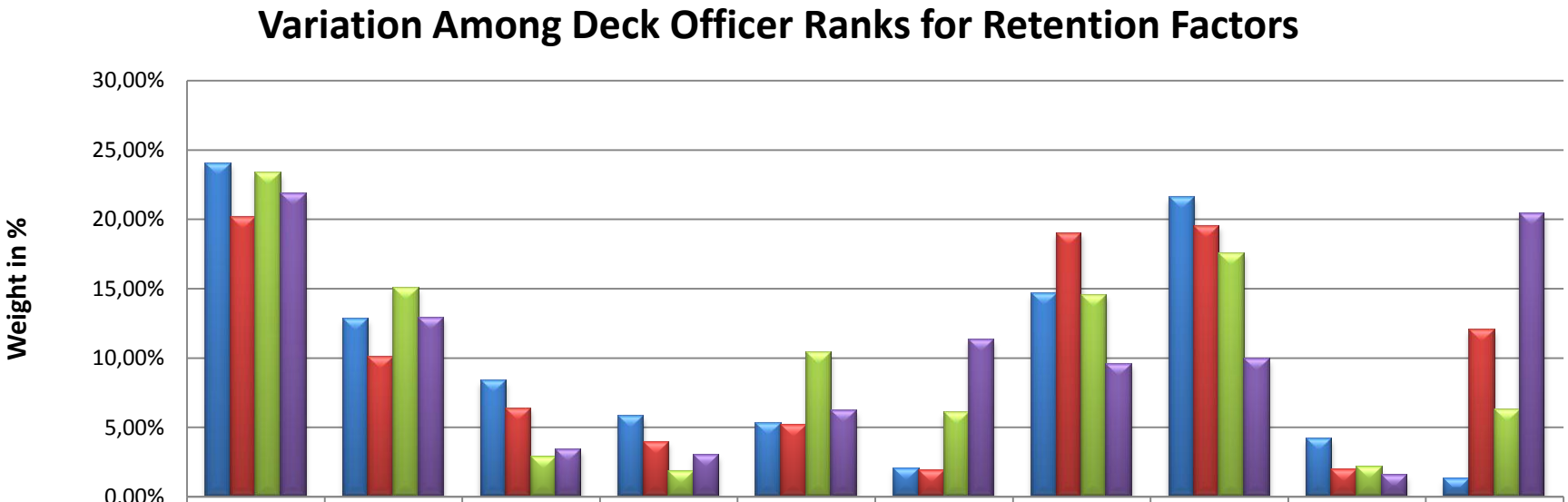
This is the least ranked factor with a given weight of 2.45%, but still important to Officers. The deck officers are aware of the tight port schedules and security issues involved, but they feel it is depressing for them to pass by without seeing good tourist locations in the world.

The major problem is lack of unified immigration procedures for seamen and unavailability of internationally recognized Identity Document. One participant quoted that "vessel stays at port for 8 hours and out of which immigration check take 4 hours".

So an effort to improve the above discussed general factors would defiantly improve retention. The variations of weights for factors are discussed in next section.

5.3.1.1 Variations in General Retention Factors among Deck Officers ranks

Significant variations of weights were noted among deck officer ranks as showed in below figure.



	Money	Additional Benefits	Optimum Crew	Single Nationality	Onboard Facilities	Study Grant for Training Course	Safety & Security	Leave	Shore Leave	Promotion Prospects
Captain	24,02%	12,83%	8,37%	5,77%	5,31%	2,06%	14,65%	21,54%	4,16%	1,30%
Chief Officer	20,10%	10,05%	6,40%	3,93%	5,16%	1,89%	19,00%	19,51%	1,95%	12,01%
Second Officer	23,30%	15,03%	2,86%	1,84%	10,39%	6,04%	14,56%	17,55%	2,16%	6,27%
Third Officer	21,82%	12,90%	3,39%	2,99%	6,21%	11,31%	9,57%	9,93%	1,55%	20,35%

Figure 5.7: Variation of weight for each General Retention Factor among Deck Officer Ranks
Source: Author (Participants 160 deck Officers-results from AHP model)

- **Money**

  Money is the most important factor for all the ranks, but for chief officers it is relatively less compared to other ranks as the work load leads them to compromise money for other factors.

- **Additional benefits**

  Significant need for additional benefits is noted for second officer as 48% are newly married and would like to have spouse onboard.

- **Optimum crew**

  For Master and Chief Officer the need for optimum crew is comparatively high as they are directly accountable and responsible for allocation of manpower resource onboard. Whereas, second officer and third officer the weights are less because their interaction and need for crew to support them is minimum.

- **Single Nationality i**s preferred high by Captains and Chief Officers compared to Second and Third Officers, which basically highlights the level of interaction with crew.

  The second officer has given least weight as his unusual work hours leads to less interaction with crew, so for him, it does not really matter which nationality is onboard. Similarly Third Officer has independent work responsibility hence communication is less with other crew.

  Onboard all issues with respect to work and social welfare is handled by Captain and Chief Officer, hence the need for having single nationality is high for senior ranks.

- **Onboard Facilities**

  The weight given by junior officers is higher compared to senior officers as Second and Third Officers stay for 6 months onboard compared to Captain and Chief Officer who stay only for 4 months.

  Second officer has given maximum weight as he has ample time for himself onboard because of reduced workload as previously shown in figure 5.5.

- **Study Grant for Training course**

  The need for study grant is deemed more important by Second and Third Officers compared to Chief Officers and Captains. This is because the senior officers possess all required certificates, whereas the junior officers have to

complete additional certificates to get promoted. Third Officer has strong demand as he being the lowest in rank has to acquire maximum number of certificates compared to other ranks.

- **Safety & Security**

  This factor is strongly needed by chief officer, as in most companies he is responsible for security and safety of the vessel and hence, we would expect that he has a strong affinity towards this factor. Onboard Chief Officer is designated as Ship Security Officer (SSO), which is a requirement by ISPS code.

- **Leave**

  In average all Deck Officers prefer good leave structure. It is noted that the need for leave increases as we go from lower rank (Third officer) to highest rank (Captain).

  Third officer have given least weight compared to other ranks as it is noted that 97% of the third officers are still single whereas 100% of Captains are married, hence the need for Captains to stay at home is high.

  Another reason is 86% of the Third Officers are under educational loan hence staying onboard means more money and would be able to repay loan as early as possible.

- **Shore Leave**

  Preferred strongly by master as in most cases they sail with their family onboard.

- **Promotion Prospects**

  For Chief Officer, to become Captain is the last stepping stone in his career path and will substantially reduce workload. Whereas for Third officers promotion gives additional financial benefit, reduces workload and gets him out of being a weakest link.

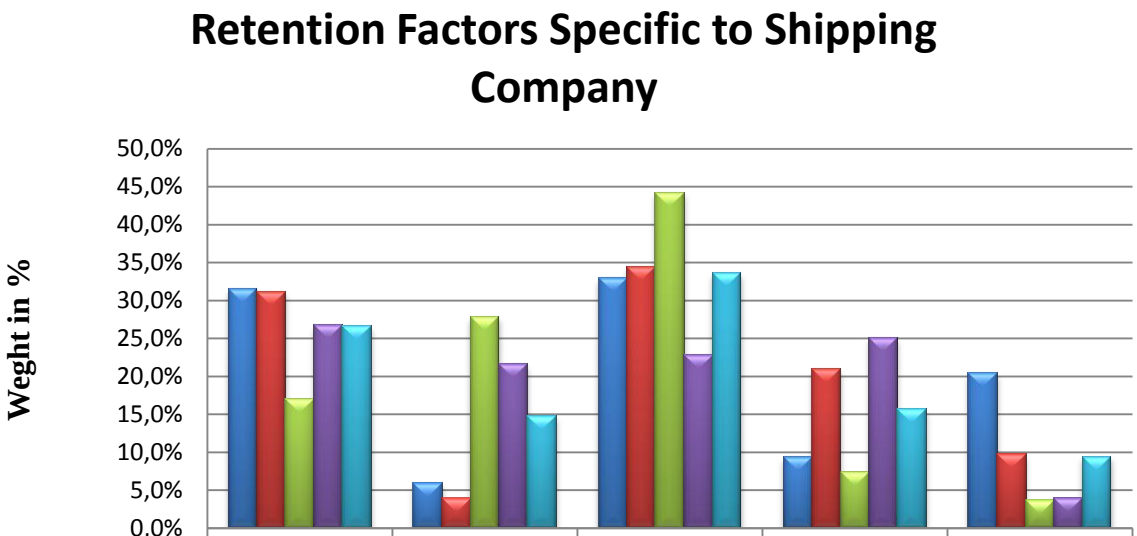
  Thus Chief Officer and Third Officer have given higher weights compared to other ranks.

  In next section the AHP results are discussed for additional factors specific to shipping company.

5.3.2 Analysis of Additional Factors Specific to Shipping Company

In this section, the results of AHP model are shown for retention factors

specific to a shipping company. The main factors are Fleet Quality, Company Brand, Quality Management System, Onboard Work Culture and Ship Shore Staff relation as shown in below figure 5.8.



	Fleet Quality	Ownership Company	Quality Management System	Onboard Work Culture	Ship Shore Staff Relation
Captain	31,5%	5,9%	32,9%	9,3%	20,4%
Chief Officer	31,1%	3,9%	34,4%	20,9%	9,7%
Second Officer	17,0%	27,8%	44,2%	7,4%	3,7%
Third Officer	26,6%	21,6%	22,8%	25,1%	4,0%
Average	26,6%	14,8%	33,6%	15,7%	9,4%

Figure 5.8: Additional Retention Factors Specific to Shipping Company
Source: Author (Participants 160 deck Officers-Weights from AHP calculation)

- **Quality Management system** is the most desired factor with average weight of 33.6%. A shipping company with good quality management system should contain following aspects-
  - Streamlined paperwork with negligible duplication
  - Clear accountability ,responsibility , reporting and communication
  - Continuous improvement of management system using reviews involving seafarer's opinion and feedback.
- **Fleet Quality:** If the vessels are less than 6 years old in the fleet, then it is considered young fleet and ideal choice for Officers to sail. Other than Second Officer, all other ranks have given higher weight as their job responsibility dictates them to be accountable and responsible for physical condition of vessel. The cost and workload

will be higher in poor quality vessel and hence stress on Captain and Chief Officer will be higher.

The Third Officer being responsible for fire fighting and life saving appliances would prefer good fleet as his workload will be less in maintaining the equipments.

Second Officer has least weight as he is centered on Navigational Equipment. Since navigational equipments being critical for the safety of the vessel, it is always maintained in good condition whether the vessel is old or new.

Thus condition of vessel is an important issue for deck officer; hence company has to assure that they allocate sufficient budget to upkeep the quality of vessel.

- **Onboard work culture** The weight given by Chief Officer and Third Officer is high. From Third Officer's perspective, it is important for him because he being the weakest link would expect good cordial relation with seniors onboard. Whereas from Chief Officer's perspective, he has to have good relationship with crew since he is in charge of deck department which needs strong backing of Captain.

- **Ownership Company** is a strong choice for Junior Officers compared to Captain and Chief Officer.

From Third Officer perspective, the need to be in an ownership company is to have a stable job as the market is flooded with Third officers.

From Second Officer's perspective, he considers an Ownership company a strong choice because apart from, giving stable job, the company usually has fleet of vessels with similar designs particularly navigational equipments .This helps in adapting to any vessel within the company, so that he can put his efforts on learning Chief Officer's role to get promoted.

Captain and Chief Officer have given less weight as they consider that ownership company have old vessels and contribute to high workload. With the ship management companies in rise, the senior roles have better say in the company compared to a well established ownership company.

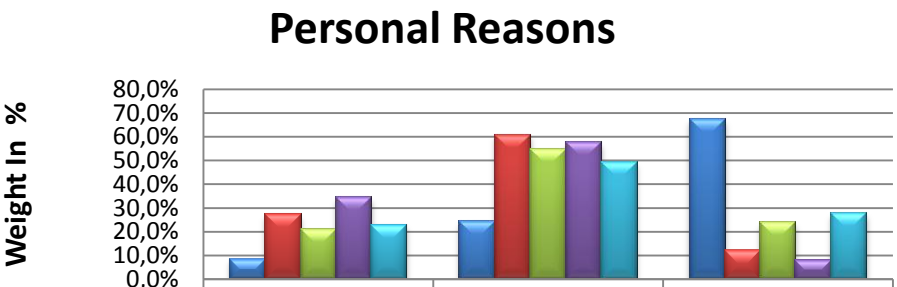
- **Ship-Shore staff relation** is preferred strongly by senior officers compared to juniors, because people management onboard cannot be done without strong support from shore. Onboard mostly the communication between shore and ship happens only with senior officers hence it is more important for them than junior officers.

An improvement of these above factors specific to shipping company will definitely attract and retain officers. In next section the AHP results of personal

factors are explained in detail

5.3.3 Retention Factors due to Personal Reasons

In this section, the personal reasons responsible for Deck Officers to stay onboard are discussed; the results are shown in below figure 5.9.



	Family dependent on Salary	Financial Commitment	Lifestyle
Captain	8,5%	24,4%	67,1%
Chief Officer	27,2%	60,8%	12,0%
Second Officer	21,1%	54,8%	24,1%
Third Officer	34,3%	57,5%	8,2%
Average	22,8%	49,4%	27,8%

Figure 5.9: Retention Factors due to Personal Reasons
Source: Author (Participants 160 deck Officers-result from AHP)

Financial commitment is the main reason for Deck Officers to be onboard which is given a weight of 49.4%, followed by Lifestyle 27.85% and family dependence on salary 22.8%.

Financial Commitment is least for Captain which shows that at this position Captains are financially strong because of their past investments.

Captains have given lifestyle a weight of 67.1% the highest among other ranks which shows that their standard of living is better because of reduced financial commitment.

Family dependency on salary for Captains is least as past investments would be sufficient enough to help his family.

So far we have seen all the retention factors affecting deck officers using AHP method. A cross comparison to verify the effectiveness of AHP model is done using DEA model, which is discussed in next section.

5.4 DEA vs. AHP

To show the effectiveness of two methods DEA and AHP models, out of 18 factors 11 factors ranks matched as shown in table 5.2. In particular top 3 ranks of each subgroup matched showing the consistency of important factors for deck officers. The DEA model is less effective as the number of input and output variables in survey is only one. The number of participants (160) is input and number of participants who agreed as output. The consistency between DEA and AHP is shown in below table 5.2.

Table 5.2: DEA vs. AHP Rank
Source: Author (Participants 160 Deck Officers – result from AHP and DEA model)

DEA VS AHP Check					
General Retention Factors	DEA	AHP	DEA Rank	AHP Rank	Status
Money	*94.4%*	*22.3%*	*1*	*1*	*Pass*
Additional Benefits	*78.8%*	*12.7%*	*6*	*4*	*Fail*
Optimum Crew	*79.4%*	*5.3%*	*5*	*8*	*Fail*
Single Nationality	*68.8%*	*3.6%*	*9*	*9*	*Pass*
Onboard Facilities	*85.0%*	*6.8%*	*4*	*6*	*Fail*
Study Grant for Training Course	*73.1%*	*5.3%*	*8*	*7*	*Fail*
Safety & Security	*86.3%*	*14.4%*	*3*	*3*	*Pass*
Leave	*87.5%*	*17.1%*	*2*	*2*	*Pass*
Shore Leave	*55.6%*	*2.5%*	*10*	*10*	*Pass*
Promotion Prospects	*75.0%*	*10.0%*	*7*	*5*	*Fail*
Additional Company Specific Retention Factors					
Fleet Quality	*81.9%*	*26.6%*	*2*	*2*	*Pass*
Company Brand	*57.5%*	*14.8%*	*5*	*4*	*Fail*
Quality Management System	*82.5%*	*33.6%*	*1*	*1*	*Pass*
Onboard Work Culture	*75.6%*	*15.7%*	*3*	*3*	*Pass*
Ship Shore Staff Relation	*73.8%*	*9.4%*	*4*	*5*	*Fail*
Personal Factors					
Family dependent on Salary	*64.4%*	*22.8%*	*3*	*3*	*Pass*
Financial Commitment	*82.5%*	*49.4%*	*1*	*1*	*Pass*
Lifestyle	*77.5%*	*27.8%*	*2*	*2*	*Pass*
				Score	61%

We could see from above table that 11 out of 16 factors the ranks match and in particular top three ranks for each sub group are matching. Thus we could confirm that AHP is a suitable model for evaluating retention issues in shipping industry

5.5 Summary

In this chapter retention factors are analyzed using AHP model and the key summary points are given below,

- Important General Retention factors as per AHP model for Indian Deck Officers are Money (22.3%), Leave (17.1%) and Safety & Security (14.4%).
- Important retention factors Specific to shipping company as per AHP model for Indian Deck Officers are Quality Management System (33.6 %,) Fleet Quality (26.6%) and onboard work Culture (15.7%).
- Important personal reasons for Indian Deck Officers to continue sailing as per AHP model is financial commitment (49.4%).
- Strong variations of weights are noted among Deck Officer Ranks.
- AHP is an effective tool for the analysis as 11 factors ranks match with DEA model.

Chapter 6: Futuristic Scope and Conclusion

6.1 Introduction

This Chapter uses results from chapter 5 "Retention Factors" to help in identifying strength and weakness of a Shipping company, herewith called as "Test Company" by comparing with other 3 competitive shipping companies namely Company A, Company B and Company C. In this Chapter we also incorporate linear programming in conjunction with AHP to help shipping company to leverage their position in employment market.

6.2 Shipping Company's Influence on Retention factors

In Chapter 5 among the identified retention factors not all can be improved by shipping company. A survey to know which factors can be influenced by companies was taken and the results are shown below in table 6.1.

Table 6.1: Influence of Shipping Company on Retention Factors.
Source: Author (Participants 160)

Retention Factors	**Number of participants who have agreed in %**				**Average**
General Retention Factors	**Captain**	**Chief Officer**	**Second Officer**	**Third Officer**	
Money	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Additional Benefits	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Optimum Crew	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Single Nationality	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Onboard Facilities	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Study Grant for Training Course	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Safety & Security	*57.5%*	*70.0%*	*75.0%*	*70.0%*	*68.1%*
Leave	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Shore Leave	*10.0%*	*12.5%*	*20.0%*	*10.0%*	*13.1%*
Promotion Prospects	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Additional factors Specific to Shipping Company					
Fleet Quality	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100%*
Company Brand	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100%*
Quality Management System	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100%*
Onboard Work Culture	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100%*
Ship Shore Staff Relation	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100%*
Personal Reasons					
Family dependent on Salary	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Financial Commitment	*5.0%*	*10.0%*	*0.0%*	*2.5%*	*4.4%*
Lifestyle	*5.0%*	*2.5%*	*2.5%*	*5.0%*	*3.8%*

It can be noted that in Subgroup 1 General Retention Factors, other than Safety & security and Shore Leave all other factors can be completely influenced by shipping Company.

Safety & Security cannot be completely influenced by shipping companies as the seafarers believe that unless pirates have alternate source of income the piracy cannot be eradicated. Improving security measures onboard cannot be long term solution, rather it will increase operational cost to shipping companies.

Similarly, shore leave cannot be completely influenced by the company, as it depends on port security, immigration process which depends on government policies of those countries.

In Subgroup 2 "Additional factors specific to shipping company", all factors are influenced by shipping Company.

In Subgroup 3 "Personal reasons" the influence is less than 5%.

Using the above data we eliminate Retention Factors which have less than 15% approval from participants. The factors which are eliminated are Shore Leave, Family dependent on Salary, Financial Commitment and Lifestyle.

6.3 Shipping Company's Score for Retention Factor

In this section the "Test Company" is compared with 3 competitive shipping companies namely A, B and C. The identities of the companies are not put forward to keep the confidentiality .Each company is scored individually for all retention factors from score 1 to 10 in perspective of Captain, Chief Officer, Second officer and Third Officer.

It is important to mention here that companies do not provide equal benefits for all rank officers. Thus some companies are good for junior ranks and some are good for senior ranks.

The survey results for the score is given below in table 6.2, the number of participants used were only 49 as they have worked in all four companies.

Table 6.2: Score for Retention Factors for Shipping Companies **Source:** Author (participants 49)

	Score by Captains				Score by Chief Officer				Score by Second Officer				Score by Third Officer			
1) General Retention Factors	Score 1-10 (10 is best)				Score 1-10 (10 is best)				Score 1-10 (10 is best)				Score 1-10 (10 is best)			
	Test Company (T)	A	B	C	Test Company (T)	A	B	C	Test Company (T)	A	B	C	Test Company (T)	A	B	C
Money	7	9	6	6	7	9	6	6	8	6	6	6	7	5	6	6
Additional Benefits	4	5	7	3	4	5	7	3	4	5	7	3	4	5	7	3
Optimum Crew	9	7	6	10	9	7	6	10	9	7	6	10	9	7	6	10
Single Nationality	9	5	5	5	9	5	5	5	9	5	5	5	9	5	5	5
Onboard Facilities	7	5	5	5	7	5	5	5	7	5	5	5	7	5	5	5
Study Grant for Training Course	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
Safety & Security	7	9	9	5	7	9	9	5	7	9	9	5	7	9	9	5
Leave	6	5	8	7	6	5	8	7	7	4	8	7	7	4	8	7
Shore Leave	Not applicable as this factor cannot be influenced by Shipping Company															
Promotion Prospects	5	7	8	7	5	7	8	7	5	7	8	7	5	7	8	7
2) Additional Factors Specific to Shipping Company																
Fleet Quality	9	5	5	5	9	5	5	5	9	5	5	5	9	5	5	5
Company Brand	4	9	8	6	4	9	8	6	4	9	8	6	4	9	8	6
Quality Management System	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Onboard Work Culture	4	7	9	4	4	7	9	4	4	7	9	4	4	7	9	4
Ship Shore Staff Relation	8	8	7	10	8	8	7	10	8	8	7	10	8	8	7	10
3)Personal Reasons	Not applicable as this factor cannot be influenced by Shipping Company															

)

6.4 Methodology to find suitable Company for Deck Officers

Using the AHP weights of the retention factors from chapter 5 and score from previous section 6.3, we could calculate the grand total score for shipping company and rank them to find the best Company to sail for.

Formula to be used-

AHPW= AHP weight for Retention factor
T=Score for Test Company
A=Score for shipping company A
B=Score for shipping company B
C=Score for shipping company C
GW= Group Weight

Since the retention factors were grouped under three sections namely General Retention Factors, Additional Factors Specific to Shipping Company and Personal reasons. In order to find the best shipping company for different officer ranks weight has to be given to each above section.

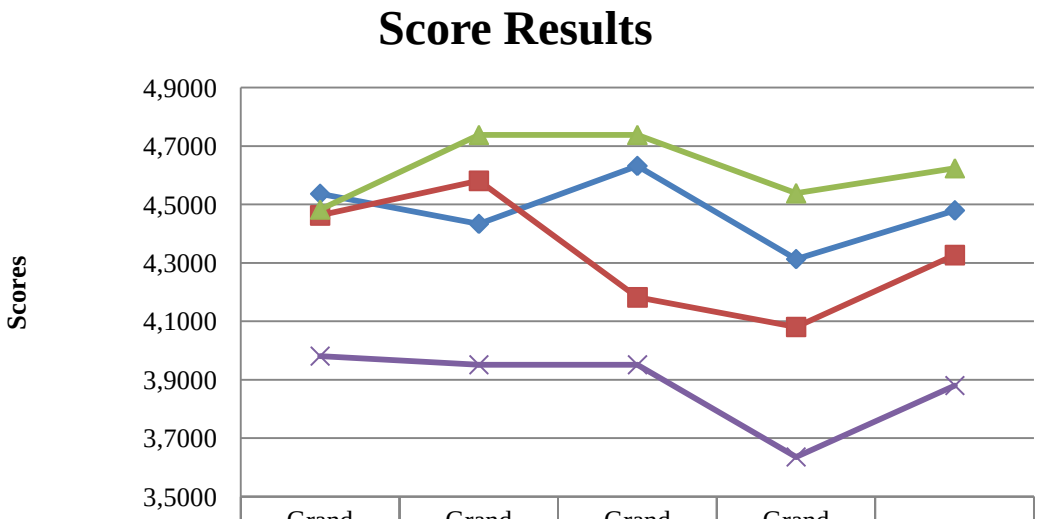
General retention Factor "Group Weight" GW =0.5 (Source: Author Participants 120)
Additional factors Specific to Shipping Companies Group Weight =0.2 (Source: Author Participants 120)
Personal Reasons "Group Weight" = 0.3 (Source: Author Participants 120)
Total=0.5+0.2+0.3=1
Grand Total Score for Test Company (T) = X+Y+Z
Where **X**=∑ (AHPW x GW (General retention factors) x T)
Y= ∑ (AHPW x GW (Additional factors specific to Shipping Companies x T) +
Z= ∑ (AHPW x GW (Personal Reasons x T)
Note: Personal retention factors cannot be influenced by shipping Companies hence
Z= ∑ (AHPW x GW (Personal Reasons x T) = 0
Thus, **Grand Total Score for Test Company (T) = X+Y**

Same method will be applied to company A, B and C to find the relative ranking of the companies. A sample of calculation sheet is shown in below table 6.3 for Captain Rank.

Table 6.3: Ranks by Captain for each Company
Source: Author (Own calculation based on AHP Results and Scores for Retention Factors)

1) General Retention Factors	AHP Weights by Captain (AHPW)	Score 1-10 (10 is best)				Group Weight (GW)	Test Company	A	B	C
		Test Company (T)	A	B	C		Adjusted Score = AHPW x T x GW	Adjusted Score = AHPW x A x GW	Adjusted Score = AHPW x B x GW	Adjusted Score = AHPW x C x GW
Money	0.2402	7	9	6	6	0.5	0.8407	1.0809	0.7206	0.7206
Additional Benefits	0.1283	4	5	7	3	0.5	0.2565	0.3206	0.4489	0.1924
Optimum Crew	0.0837	9	7	6	10	0.5	0.3767	0.2930	0.2511	0.4186
Single Nationality	0.0577	9	5	5	5	0.5	0.2598	0.1443	0.1443	0.1443
Onboard Facilities	0.0531	7	5	5	5	0.5	0.1857	0.1327	0.1327	0.1327
Study Grant for Training Course	0.0206	8	4	2	1	0.5	0.0824	0.0412	0.0206	0.0103
Safety & Security	0.1465	7	9	9	5	0.5	0.5127	0.6591	0.6591	0.3662
Leave	0.2154	6	5	8	7	0.5	0.6463	0.5386	0.8618	0.7540
Shore Leave	0.0416	0	0	0	0	0.5	0.0000	"Cannot be Influenced by Shipping Companies "		
Promotion Prospects	0.0130	5	7	8	7	0.5	0.0324	0.0453	0.0518	0.0453
	X= ∑ (AHPW x GW(General retention factors) x T,A.B,C) =						3.1931	3.2557	3.2909	2.7844
2) Additional Factors Specific to Shipping Company										
Fleet Quality	0.3148	9	5	5	5	0.2	0.5666	0.3148	0.3148	0.3148
Company Brand	0.0592	4	9	8	6	0.2	0.0473	0.1065	0.0947	0.0710
Quality Management System	0.3289	5	5	5	5	0.2	0.3289	0.3289	0.3289	0.3289
Onboard Work Culture	0.0934	4	7	9	4	0.2	0.0748	0.1308	0.1682	0.0748
Ship Shore Staff Relation	0.2037	8	8	7	10	0.2	0.3259	0.3259	0.2852	0.4074
	Y=∑ (AHPW x GW(Additional Factors) x T,A.B,C) =						1.3435	1.2069	1.1917	1.1968
						Grand Total Score(T) =X+Y	4.5367	4.4627	4.4826	3.9812
						Ranks by Captain	1	3	2	4

From the above table we could see that Captains have ranked “Test Company” as number 1 compared to others, showing that “Test Company” is preferred more than other companies by Captains. Similarly scores and ranks were calculated for other Deck Officer ranks as shown in below figure 6.1.



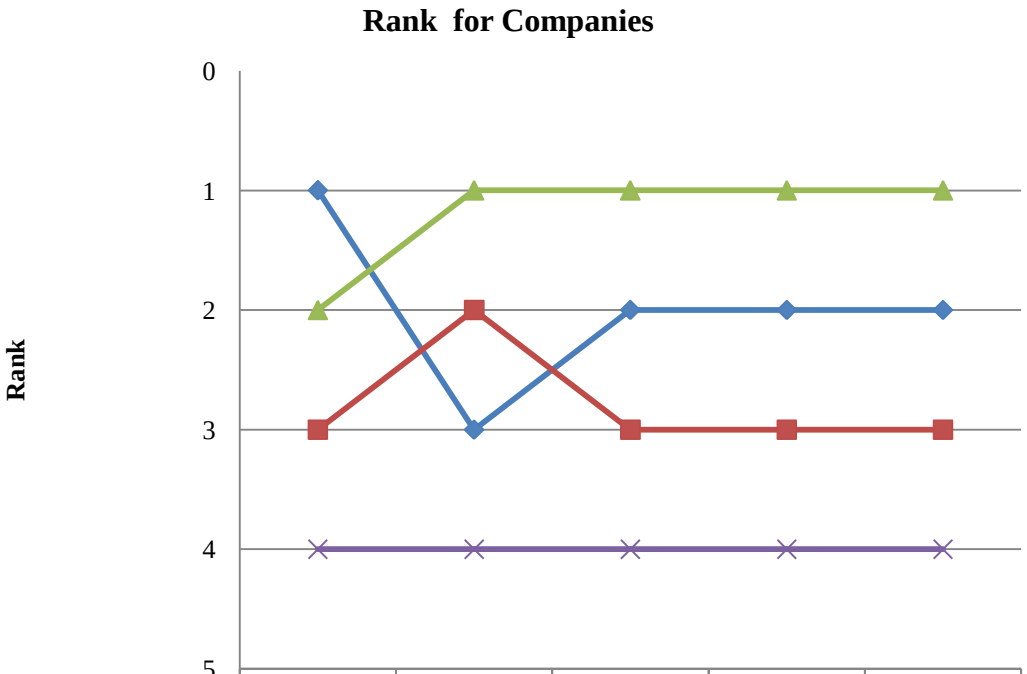
	Grand Total=X+Y Captain	Grand Total=X+Y Chief Officer	Grand Total=X+Y Second Officer	Grand Total=X+Y Third Officer	Average (X+Y)
Test Company	4,5367	4,4338	4,6319	4,3129	4,4788
A	4,4627	4,5809	4,1818	4,0807	4,3265
B	4,4826	4,7380	4,7380	4,5381	4,6242
C	3,9812	3,9515	3,9515	3,6355	3,8800

Figure 6.1: Grand Total Score (for detailed calculation look in Annex-Table XXXX
Source: Author (Own Calculation)

In the above table we could see that for the test company Second Officers calculated score is highest 4.6319 followed by Captain 4.5367 , Chief Officer 4.4338 and Third Officer 4.3129 .This indicates that onboard Second Officers are the most happiest ,compared to other ranks. This only indicates the relative score among the Deck Officers ranks within the “Test Company”, further more if we compare the score with respect to other companies the ranking for companies can be constructed as shown in figure 6.2 which indicates the rank order using maximum to minimum score.

Example from above figure 6.1 we could see that captain has given Test Company 4.5367, which is highest, compared to other scores for company A, B and with C being the lowest 3.9812.Thus for captain the “Test Company” will be given

Number 1 rank whereas Company C will be given rank 4. Similarly, rank can be allocated for other Deck Officers as shown in below figure 6.2.



	Captain	Chief Officer	Second Officer	Third Officer	Overall Rank
	Ranks				
Test Company	1	3	2	2	2
A	3	2	3	3	3
B	2	1	1	1	1
C	4	4	4	4	4

Figure 6.2: Shipping Company Ranks (1 means best)
Source: Author (Own Calculation)

In this table it is noted that Captains have ranked “Test Company” as number 1 whereas Chief Officer has ranked this Company as Number 3 .Thus indicating the position of Test Company across Officers rank and also with respect to other companies.

Among all the companies with respect to deck officers “Test Company” ranks Number 2 which is calculated by taking average of grand total scores given to each company by different rank officers.

Using the above ranking system we can assume that retaining Chief Officer would be difficult for Test Company compared to other ranks.

To confirm if this is true we can cross analysis using Retention KPI by (Intertanko- 2008)

Formula for Retention Rate KPI-

$$\textbf{\% Retention Rate (RR)} = 100 - \left[\frac{\{S - (UT + BT)\} \times 100}{AE} \right]$$

Where:

RR = Officer Retention Rate

S = Total Number of terminations from whatever cause (In effect this means the total number employees that have left the company for whatever reason)

UT = Unavoidable Terminations (i.e. retirements or long term illness)

BT = Beneficial Terminations (i.e. sometimes those staff that do leave provide benefit to the company by virtue of leaving, for example under performers

AE = the average number of employees working for the company during the same period as calculated, this should be any period of 12 months.

Calculated retention KPI using data from "Test Company"

Captain= 98%

Chief Officer = **52%**

Second Officer=96%

Third Officer= 96%

From the above results we could see that retention rate is lowest for Chief Officer confirming the shortage.

6.5 Strategic Solution for Retaining Deck Officers

In order to improve retention of deck officers, AHP method can be further used to help shipping companies in allocating resources for improving retention.

For Immediate solution Shipping Company can leverage the pay (Money) and Leave to improve retention as these two factors ranked number 1 and 2 both in AHP and DEA.

In previous section we noted that for the "Test Company" retaining Chief Officer is a problem. As per chief officers the Test Company ranks 3rd, hence to improve its position to number 2 we have to identify how much score for pay and how much score for leave has to be changed. This can be done Using Linear Programming, hence our aim is to make Test Company Rank for Chief Officer as 2 by Changing the variable Money and or Leave. AHP results can be used into Linear Programming and constraints will be defined to have clear objectives.

- The objective for the problem is that the Grant Total Score should be equal to 4.5900 little higher than Company A (4.5809).

The AHP results which are weights for each factor are the inputs to this model and should not be changed.

The score given for the company are the variables, hence if the company can provide better facility the rank will improve and vice versa.

There are different cases by which "Test Company" can become No2 for Chief Officers-

Case 1

Objective – Grand Total Score=4.5900

Constraint -Increase only Score for Money and keep the score for Leave as 6.

Variables-

Score for Money = 8.5540

Score for Leave = 6.

Case 2

Objective – Grand Total Score=4.5900

Constraint –Increase Score for Leave and Keep money score at 7

Variables-

Score for Money = 7

Score for Leave = 7.6008

Case 3

Objective – Grand Total Score=4.5900

Constraint- Maximum Score for money and Change score for leave

Variables-

Score for Money = 10

Score for Leave = 4.501

Case 4

Objective – Grand Total Score=4.5900

Constraint- Maximum Score for leave and Change score for Money

Variables-

Score for Money = 4.6708

Score for Leave = 10

Case 5

Objective – Grand Total Score=4.5900

Constraint - Equal score for Money and Leave

Variables-

Score for Money = Score for Leave = 7.2959

Note: Detailed calculation is done in MS Excel using Solver function

Thus using Linear Programming Company can manipulate the leave and pay structure for improving retention.

6.6 Exploitation of Deck Officers

It is important to inform all Seafarers that this method of using AHP with Linear programming can also be used against them by reducing the existing facilities given to them. So it is important for the deck officers to be aware in disclosing crucial data by filling personality trait tests or similar tests given by shipping companies. The moment the weights for retention factors are identified, it is possible for company to start bargaining with pay and leave. An illustration is not required for this section as I myself being a seafarer would not help those Shipping Companies which consider us as an expense.

6.7 Conclusion

There is no shortage of students joining merchant navy, but the problem for them is to get a job onboard and to continue in the job for long term. There are serious quality issues due to education system in India. The performance of diploma holders is far higher than Bachelor degree graduates, as it is found that **91.7%** of the senior officers onboard prefer diploma holder candidates. The root problem for this is the ***shortage of sea time for training*** and hence emphasizes the fact that ***classroom training cannot substitute onboard training***. So it is important for the maritime institutions to look into the education system and improve quality of candidates joining merchant navy.

The senior officers are biased towards diploma holders because most of the seniors themselves are diploma holders. It is noted that 100% of the Captains, **90%** of the Chief Officers and **80%** of second officers were diploma holders. This shows that the ***penetration of bachelor degree holders to higher rank is very low***. The primary reason for this is that these candidates can get a shore job, whereas diploma holders do not qualify for a decent shore job. Thus, the education system has a definite impact on retention of officers.

The students who have participated in this study have a clear objective on how long they will serve onboard. This gives an insight on the manpower supply in the future and as per the results, it is noted that **70.8%** of the participants would sail for **10-15** years, and only 10% would continue this career till retirement. It is also noted that **60.8%** of the candidates want to sail till they become captain. There is strong relation between the two as we can say that these candidates would expect to become Captains within **10-15** years. Thus the **promotion factor** would be a serious problem for retaining officers in future.

Since it is noted that majority would serve only for 10-15 years, it is important for the shipping company to utilize the manpower supply effectively. They have to ***streamline the process with respect to joining issues, certifications, visa procedures and similar process*** to put the officer onboard who is willing to sail.

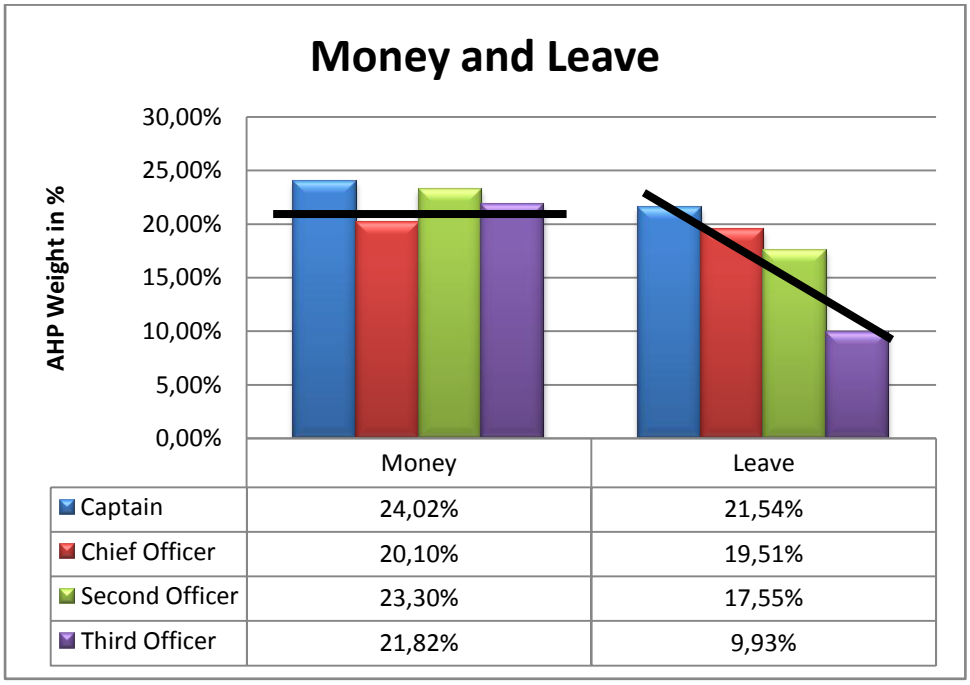
Though the career is deemed to have ***high risk***, still it manages to attract young students. The most influential factors which attract them are money, vacation, peer respect, sightseeing and adventure. Using AHP model the factor "**Money" ranked** highest with a given weight of **56.6%** followed by **"Leave" 17.9%, Peer respect**

13.5%, Sightseeing 7.4% and **adventure 4.6%.**

The shipping companies never had a shortage of cadets, so there strategic focus will be more on retaining officers than attracting new cadets. In addition, there is no compulsion on shipping companies to have cadets; on the contrary they have to follow strict rules if they have them onboard.

The core issue for the shipping company is to retain officers. The factors in the study were grouped into three sections namely **general factors**, **company specific factors** and **personal factors**. Under general factors, the most important retention factors for deck officers are **Money (22.3%)**, **Leave (17.1%)** and **Safety & Security (14.4%).**

In this study it is noted that there are strong variations in weights given by different officer ranks. Thus it is important for the shipping companies to review there strategy as per rank of deck officers. From junior ranks to senior ranks the leave catches up with money as shown in figure 6.3. Thus it emphasizes that though money has been always the most important factor, but leave has steep upward trend. So in near future we would expect to see that leave would take precedence over money.



	Money	Leave
Captain	24,02%	21,54%
Chief Officer	20,10%	19,51%
Second Officer	23,30%	17,55%
Third Officer	21,82%	9,93%

Figure 6.3: Money and Leave
Source: Author (Results from AHP)

Concern for **safety and security** ranks third with a given AHP weight of **14.45% .**The safety & security conscious within the maritime community is improving, but still piracy threat is a major issue and seafarers' believe that improving security onboard is not a feasible solution as it would only increase the workload and

operating expenses of the company.

The other factors in the group" **general retention factors**" is more based on rank of the officer. The factor "**promotion prospect**" is very important for third and chief officer due to workload faced at this position. For chief officer promotion will reduce substantial workload and for third officer, in addition to reduced workload there is substantial financial benefit and he is no more the weakest link in the system.

"Additional benefits" (12.70%) are strongly desired by second officer. In particular, the need for his spouse to sail onboard is deemed important.

Internet facility is the most preferred onboard facility; the weight given to **"onboard facility"** was **6.77 %**. It is noted that only second officer had given strong importance to this factor compared to other ranks because his workload level is least onboard, thus we can conclude that he has quality time onboard to enjoy these facilities.

The factor **"study grant" (5.32%)** is important for junior ranks because they have to obtain certificates to get promoted. The training courses are expensive and they have to spend crucial time, thus a company support is beneficial for them.

The factors **"Optimum crew" (5.26%)** and **"single nationality" (3.63%)** are more important to senior officers than juniors because of the job description and interaction.

"Shore leave" (2.45%) is the least desired general retention factor as the deck officers have over the years adapted to short port stays. This factor is more important for Captain than other ranks because, most of the Captains serving presently are from previous generation who had longer stays at port.

Under the group, company specific retention factors **"Quality management system"** ranked the highest. The deck officers expect marine sector to be in par with airline industry. This factor is more important for second officers as it is observed that paperwork is mostly handled by them and a company with good quality management system avoids unnecessary paperwork.

"Fleet quality" (26.6%) is more important to Captain, Chief Officer and Third officer, because the job description for these officers holds them responsible for physical condition of the vessel, whereas for second officers their responsibility is centered on navigational bridge equipments and in most cases equipments are in good condition, irrelevant of the vessel's age.

"Onboard work culture" (15.7%) is important for Chief and Third officers. Since, third officer being the weakest link are still in a learning curve hence they expect cordial relationship with the seniors onboard, whereas for chief officer the interaction with crew onboard should be cordial to have smooth working atmosphere and it needs strong backing of Captain onboard.

"Ownership Company" (14.8%) is more important for junior officers this is because the market is flooded with junior officers and hence the job will be stable in these companies.

"Ship Shore Staff Relation" (9.4%) is important for senior officers because the seniors are responsible for communication with shore team for managing the ship. Hence it is important to have good relationship between ship and shore.

There are three factors because of personal reasons and it is noted that the factor **"financial commitment" (49.4%)** is the most important, which makes seafarer to stay at sea. Since it is personal to seafarers, the company has no leverage on this factor. Some seafarers believe that company can leverage this factor by providing few investment opportunities in the form of loans and real estate investments to keep seafarers committed.

It is noted that weight given to factor **"financial commitment"** is least and factor **"Lifestyle"** is high for captain because of his past financial investments due to which he is financially in strong position and is able to maintain an expensive lifestyle.

In this study careful structuring and decomposing the problem into simpler form using AHP model has helped in deep understanding of the retention issue.

In a cross evaluation it is noted that **AHP model** ranking was consistent with **DEA model** and **11** out of **18** factors had same ranks.

Since the **AHP model** converted the factors into numerical weights, this result used in conjunction with **linear programming** helped **"Test Company"** which was facing severe shortage of chief officers to optimize its resources to leverage its position in manpower market.

Thus to conclude, this paper highlighted the use of AHP model with linear programming and is open for is further scope of improvement, where shipping companies can use this method for recruitment of officers and identify their commitment towards sailing. This can also help shipping companies in building independent contract agreements or create a bidding method to appoint seafarers.

6.8 Limitations of the study

The increase in number of participants would definitely increase the strength of the paper. In this study only 160 participants were used for retention factors and 120 for attraction factors, this is due to the rigorous interview process and high number of factors used in AHP model and hence it is difficult to cover large group within available time frame. This paper analyzes retention factors with Indian perspective but does not compares the results with global manpower.

So far from conclusion and the limitation of the research we have seen the effective use of AHP model. The confidence of the results can be improved by taking due diligence in selecting large strength of appropriate participants.

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Appendix

Table A.1: AHP Matrix for General Retention Factor (Captain)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Money	Additional Benefits	Optimum Crew	Single Nationality	Onboard Facilities	Study Grant for Training Course	Safety & Security	Leave	Job Satisfaction	Promotion Prospects
Money	1	4	5	6	7	8	2	1	4	9
Additional Benefits	1/4	1	4	3	5	6	1	1/2	3	8
Optimum Crew	1/5	1/4	1	3	4	6	1/3	1/4	3	8
Single Nationality	1/6	1/3	1/3	1	2	3	1/4	1/5	3	9
Onboard Facilities	1/7	1/5	1/4	1/2	1	6	1/5	1/6	3	8
Study Grant for Training Course	1/8	1/6	1/6	1/3	1/6	1	1/6	1/8	1/4	3
Safety & Security	1/2	1	3	4	5	6	1	1/2	7	8
Leave	1	2	4	5	6	8	2	1	7	9
Shore Leave	1/4	1/3	1/3	1/3	1/3	4	1/7	1/7	1	7
Promotion Prospects	1/9	1/8	1/8	1/9	1/8	1/3	1/8	1/9	1/7	1

Table A.2: Normalized PAIRWISE COMPARISON MATRIX "A" (Captain)

Normalized PAIRWISE COMPARISON MATRIX "A"	Money	Additional Benefits	Optimum Crew	Single Nationality	Onboard Facilities	Study Grant for Training Course	Safety & Security	Leave	Shore Leave	Promotion Prospects	**Weight**	**AW**	**λmax**
Money	0.2670	0.4252	0.2746	0.2578	0.2286	0.1655	0.2771	0.2503	0.1274	0.1286	*24%*	*2.85*	*1.18*
Additional Benefits	0.0667	0.1063	0.2197	0.1289	0.1633	0.1241	0.1385	0.1251	0.0956	0.1143	*13%*	*1.57*	*1.22*
Optimum Crew	0.0534	0.0266	0.0549	0.1289	0.1306	0.1241	0.0462	0.0626	0.0956	0.1143	*8%*	*1.00*	*1.20*
Single Nationality	0.0445	0.0354	0.0183	0.0430	0.0653	0.0621	0.0346	0.0501	0.0956	0.1286	*6%*	*0.66*	*1.14*
Onboard Facilities	0.0381	0.0213	0.0137	0.0215	0.0327	0.1241	0.0277	0.0417	0.0956	0.1143	*5%*	*0.58*	*1.09*
Study Grant for Training Course	0.0334	0.0177	0.0092	0.0143	0.0054	0.0207	0.0231	0.0313	0.0080	0.0429	*2%*	*0.21*	*1.04*
Safety & Security	0.1335	0.1063	0.1648	0.1718	0.1633	0.1241	0.1385	0.1251	0.2230	0.1143	*15%*	*1.77*	*1.21*
Leave	0.2670	0.2126	0.2197	0.2148	0.1959	0.1655	0.2771	0.2503	0.2230	0.1286	*22%*	*2.52*	*1.17*
Shore Leave	0.0667	0.0354	0.0183	0.0143	0.0109	0.0828	0.0198	0.0358	0.0319	0.1000	*4%*	*0.43*	*1.04*
Promotion Prospects	0.0297	0.0133	0.0069	0.0048	0.0041	0.0069	0.0173	0.0278	0.0046	0.0143	*1%*	*0.13*	*1.04*
												λmax	11.34

Table A.3: AHP Matrix for General Retention Factors (Chief Officer)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Money	Additional Benefits	Optimum Crew	Single Nationality	Onboard Facilities	Study Grant for Training Course	Safety & Security	Leave	Shore Leave	Promotion Prospects
Money	1	4	3	3	6	8	2	1	5	3
Additional Benefits	1/4	1	2	3	7	7	1/4	1/3	6	1
Optimum Crew	1/3	1/2	1	2	1	5	1/5	1/2	5	1/3
Single Nationality	1/3	1/3	1/2	1	1/4	4	1/6	1/5	3	1/7
Onboard Facilities	1/6	1/7	1	4	1	6	1/7	1/6	3	1/5
Study Grant for Training Course	1/8	1/7	1/5	1/4	1/6	1	1/8	1/7	2	1/8
Safety & Security	1/2	4	5	6	7	8	1	1/2	7	3
Leave	1	3	2	5	6	7	2	1	6	3
Shore leave	1/5	1/6	1/5	1/3	1/3	1/2	1/7	1/6	1	1/7
Promotion Prospects	1/3	1	3	7	5	8	1/3	1/3	7	1

Table A.4: Normalized PAIRWISE COMPARISON MATRIX "A" (Chief Officer)

PAIRWISE COMPARISON MATRIX "A"	Money	Additional Benefits	Optimum Crew	Single Nationality	Onboard Facilities	Study Grant for Training Course	Safety & Security	Leave	Shore Leave	Promotion Prospects	Weight	AW	λmax
Money	0.2358	0.2800	0.1676	0.0950	0.1778	0.1468	0.3144	0.2303	0.1111	0.2512	*20.1%*	*2.41*	*1.20*
Additional Benefits	0.0589	0.0700	0.1117	0.0950	0.2074	0.1284	0.0393	0.0768	0.1333	0.0837	*10.0%*	*1.24*	*1.23*
Optimum Crew	0.0786	0.0350	0.0559	0.0633	0.0296	0.0917	0.0314	0.1151	0.1111	0.0279	*6.4%*	*0.68*	*1.06*
Single Nationality	0.0786	0.0233	0.0279	0.0317	0.0074	0.0734	0.0262	0.0461	0.0667	0.0120	*3.9%*	*0.41*	*1.03*
Onboard Facilities	0.0393	0.0100	0.0559	0.1266	0.0296	0.1101	0.0225	0.0384	0.0667	0.0167	*5.2%*	*0.58*	*1.12*
Study Grant for Training Course	0.0295	0.0100	0.0112	0.0079	0.0049	0.0183	0.0197	0.0329	0.0444	0.0105	*1.9%*	*0.20*	*1.03*
Safety & Security	0.1179	0.2800	0.2793	0.1900	0.2074	0.1468	0.1572	0.1151	0.1556	0.2512	*19.0%*	*2.35*	*1.24*
Leave	0.2358	0.2100	0.1117	0.1583	0.1778	0.1284	0.3144	0.2303	0.1333	0.2512	*19.5%*	*2.32*	*1.19*
Shore Leave	0.0472	0.0117	0.0112	0.0106	0.0099	0.0092	0.0225	0.0384	0.0222	0.0120	*1.9%*	*0.21*	*1.06*
Promotion Prospects	0.0786	0.0700	0.1676	0.2216	0.1481	0.1468	0.0524	0.0768	0.1556	0.0837	*12.0%*	*1.43*	*1.19*
												λmax	11.3509

Table A.5: AHP Matrix for General Retention Factors (Second Officer)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Money	Additional Benefits	Optimum Crew	Single Nationality	Onboard Facilities	Study Grant for Training Course	Safety & Security	Leave	Shore Leave	Promotion Prospects
Money	1	3	7	8	4	5	2	1	7	7
Additional Benefits	1/3	1	5	6	3	4	2	1/3	5	6
Optimum Crew	1/7	1/5	1	3	1/5	1/4	1/7	1/5	2	1/5
Single Nationality	1/8	1/6	1/3	1	1/6	1/5	1/8	1/6	1	1/4
Onboard Facilities	1/4	1/3	5	6	1	4	1	1/3	6	3
Study Grant for Training Course	1/5	1/4	4	5	1/4	1	1/6	1/2	5	1/2
Safety & Security	1/2	1/2	7	8	1	6	1	1	4	5
Leave	1	3	5	6	3	2	1	1	5	4
Shore Leave	1/7	1/5	1/2	1	1/6	1/5	1/4	1/5	1	1/6
Promotion Prospects	1/7	1/6	5	4	1/3	2	1/5	1/4	6	1

Table A.6 Normalized PAIRWISE COMPARISON MATRIX "A" (Second Officer)

PAIRWISE COMPARISON MATRIX "A"	Money	Additional Benefits	Optimum Crew	Single Nationality	Onboard Facilities	Study Grant for Training Course	Safety & Security	Leave	Shore Leave	Promotion Prospects	Weight	AW	λmax
Money	0.26063	0.34026	0.17573	0.16667	0.30496	0.20284	0.25366	0.20067	0.16667	0.25814	*23.3%*	*2.81*	*1.20*
Additional Benefits	0.08688	0.11342	0.12552	0.12500	0.22872	0.16227	0.25366	0.06689	0.11905	0.22127	*15.0%*	*1.87*	*1.24*
Optimum Crew	0.03723	0.02268	0.02510	0.06250	0.01525	0.01014	0.01812	0.04013	0.04762	0.00738	*2.9%*	*0.29*	*1.03*
Single Nationality	0.03258	0.01890	0.00837	0.02083	0.01271	0.00811	0.01585	0.03344	0.02381	0.00922	*1.8%*	*0.20*	*1.07*
Onboard Facilities	0.06516	0.03781	0.12552	0.12500	0.07624	0.16227	0.12683	0.06689	0.14286	0.11063	*10.4%*	*1.23*	*1.18*
Study Grant for Training Course	0.05213	0.02836	0.10042	0.10417	0.01906	0.04057	0.02114	0.10033	0.11905	0.01844	*6.0%*	*0.63*	*1.04*
Safety & Security	0.13031	0.05671	0.17573	0.16667	0.07624	0.24341	0.12683	0.20067	0.09524	0.18439	*14.6%*	*1.73*	*1.19*
Leave	0.26063	0.34026	0.12552	0.12500	0.22872	0.08114	0.12683	0.20067	0.11905	0.14751	*17.6%*	*2.05*	*1.17*
Shore Leave	0.03723	0.02268	0.01255	0.02083	0.01271	0.00811	0.03171	0.04013	0.02381	0.00615	*2.2%*	*0.23*	*1.06*
Promotion Prospects	0.03723	0.01890	0.12552	0.08333	0.02541	0.08114	0.02537	0.05017	0.14286	0.03688	*6.3%*	*0.70*	*1.11*
												λmax	11.29039

Table A.7: AHP Matrix for General Retention Factors (Third Officer)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Money	Additional Benefits	Optimum Crew	Single Nationality	Onboard Facilities	Study Grant for Training Course	Safety & Security	Leave	Shore Leave	Promotion Prospects
Money	1	3	7	8	4	2	2	2	7	2
Additional Benefits	1/3	1	6	7	3	1	2	2	8	1/3
Optimum Crew	1/7	1/6	1	2	1/4	1/3	1/5	1/5	6	1/6
Single Nationality	1/8	1/7	1/2	1	1/5	1/3	1/6	1/8	7	1/7
Onboard Facilities	1/4	1/3	4	5	1	1/2	1/2	1/3	5	1/4
Study Grant for Training Course	1/2	1	3	3	2	1	2	2	7	1/2
Safety & Security	1/2	1/2	5	6	2	1/2	1	1	6	1/2
Leave	1/2	1/2	5	8	3	1/2	1	1	6	1/5
Shore Leave	1/7	1/8	1/6	1/7	1/5	1/7	1/6	1/6	1	1/7
Promotion Prospects	1/2	3	6	7	4	2	2	5	7	1

Table A.8: Normalized PAIRWISE COMPARISON MATRIX "A" (Third Officer)

PAIRWISE COMPARISON MATRIX "A"	Money	Additional Benefits	Optimum Crew	Single Nationality	Onboard Facilities	Study Grant for Training Course	Safety & Security	Shore Leave	Job Satisfaction	Promotion Prospects	**Weight**	**AW**	**λmax**
Money	0.2504	0.3071	0.1858	0.1697	0.2036	0.2407	0.1813	0.1447	0.1167	0.3820	*21.8%*	*2.46*	*1.13*
Additional Benefits	0.0835	0.1024	0.1593	0.1485	0.1527	0.1203	0.1813	0.1447	0.1333	0.0637	*12.9%*	*1.49*	*1.16*
Optimum Crew	0.0358	0.0171	0.0265	0.0424	0.0127	0.0401	0.0181	0.0145	0.1000	0.0318	*3.4%*	*0.37*	*1.08*
Single Nationality	0.0313	0.0146	0.0133	0.0212	0.0102	0.0401	0.0151	0.0090	0.1167	0.0273	*3.0%*	*0.31*	*1.03*
Onboard Facilities	0.0626	0.0341	0.1062	0.1061	0.0509	0.0602	0.0453	0.0241	0.0833	0.0477	*6.2%*	*0.71*	*1.14*
Study Grant for Training Course	0.1252	0.1024	0.0796	0.0636	0.1018	0.1203	0.1813	0.1447	0.1167	0.0955	*11.3%*	*1.27*	*1.12*
Safety & Security	0.1252	0.0512	0.1327	0.1273	0.1018	0.0602	0.0906	0.0723	0.1000	0.0955	*9.6%*	*1.09*	*1.14*
Leave	0.1252	0.0512	0.1327	0.1697	0.1527	0.0602	0.0906	0.0723	0.1000	0.0382	*9.9%*	*1.15*	*1.16*
Shore leave	0.0358	0.0128	0.0044	0.0030	0.0102	0.0172	0.0151	0.0121	0.0167	0.0273	*1.5%*	*0.16*	*1.05*
Promotion Prospects	0.1252	0.3071	0.1593	0.1485	0.2036	0.2407	0.1813	0.3617	0.1167	0.1910	*20.3%*	*2.38*	*1.17*
												λmax	11.19

Table A.9: AHP matrix for Additional Retention Factors Specific to Shipping Company (Captain)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Fleet Quality	Company Brand	Quality Management System	Onboard Work Culture	Ship Shore Staff Relation
Fleet Quality	*1*	*5*	*1*	*5*	*1*
Company Brand	*1/5*	*1*	*1/6*	*1*	*1/6*
Quality Management System	*1*	*6*	*1*	*5*	*1*
Onboard Work Culture	*1/5*	*2*	*1/5*	*1*	*1/2*
Ship Shore Staff Relation	*1*	*1/6*	*1*	*2*	*1*

Normalized MATRIX "A" (Captain)

Normalized PAIRWISE COMPARISON MATRIX "A"	Fleet Quality	Company Brand	Quality Management System	Onboard Work Culture	Ship Shore Staff Relation	Weight	AW	λmax
Fleet Quality	*0.2941*	*0.3529*	*0.2970*	*0.3571*	*0.2727*	*31.5%*	*1.61*	*1.02*
Company Brand	*0.0588*	*0.0706*	*0.0495*	*0.0714*	*0.0455*	*5.9%*	*0.30*	*1.03*
Quality Management System	*0.2941*	*0.4235*	*0.2970*	*0.3571*	*0.2727*	*32.9%*	*1.67*	*1.02*
Onboard Work Culture	*0.0588*	*0.1412*	*0.0594*	*0.0714*	*0.1364*	*9.3%*	*0.44*	*0.95*
Ship Shore Staff Relation	*0.2941*	*0.0118*	*0.2970*	*0.1429*	*0.2727*	*20.4%*	*1.04*	*1.03*
							λmax	5.039

Table A.10: AHP matrix for Additional Retention Factors Specific to Shipping Company (Chief Officer)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Fleet Quality	Company Brand	Quality Management System	Onboard Work Culture	Ship Shore Staff Relation
Fleet Quality	*1*	*6*	*1*	*2*	*4*
Company Brand	*1/6*	*1*	*1/7*	*1/5*	*1/6*
Quality Management System	*1*	*7*	*1*	*2*	*6*
Onboard Work Culture	*1/2*	*5*	*1/2*	*1*	*5*
Ship Shore Staff Relation	*1/4*	*6*	*1/6*	*1/5*	*1*

Normalized MATRIX "A" (Chief Officer)

Normalized PAIRWISE COMPARISON MATRIX "A"	Fleet Quality	Company Brand	Quality Management System	Onboard Work Culture	Ship Shore Staff Relation	**Weight**	**AW**	**λmax**
Fleet Quality	*0.3429*	*0.2400*	*0.3559*	*0.3704*	*0.2474*	*31.1%*	*1.69*	*1.09*
Company Brand	*0.0571*	*0.0400*	*0.0508*	*0.0370*	*0.0103*	*3.9%*	*0.20*	*1.01*
Quality Management System	*0.3429*	*0.2800*	*0.3559*	*0.3704*	*0.3711*	*34.4%*	*1.93*	*1.12*
Onboard Work Culture	*0.1714*	*0.2000*	*0.1780*	*0.1852*	*0.3093*	*20.9%*	*1.22*	*1.16*
Ship Shore Staff Relation	*0.0857*	*0.2400*	*0.0593*	*0.0370*	*0.0619*	*9.7%*	*0.51*	*1.05*
							λmax	5.437

Table A.11: AHP matrix for Additional Retention Factors Specific to Shipping Company (Second Officer)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Fleet Quality	Company Brand	Quality Management System	Onboard Work Culture	Ship Shore Staff Relation
Fleet Quality	*1*	*1/2*	*1/3*	*4*	*5*
Company Brand	*2*	*1*	*1/3*	*7*	*8*
Quality Management System	*3*	*3*	*1*	*6*	*7*
Onboard Work Culture	*1/4*	*1/7*	*1/6*	*1*	*4*
Ship Shore Staff Relation	*1/5*	*1/8*	*1/7*	*1/4*	*1*

Normalized MATRIX "A" (Third Officer)

Normalized PAIRWISE COMPARISON MATRIX "A"	Fleet Quality	Company Brand	Quality Management System	Onboard Work Culture	Ship Shore Staff Relation	Weight	AW	λmax
Fleet Quality	*0.1550*	*0.1049*	*0.1687*	*0.2192*	*0.2000*	*17.0%*	*0.93*	*1.10*
Company Brand	*0.3101*	*0.2097*	*0.1687*	*0.3836*	*0.3200*	*27.8%*	*1.57*	*1.13*
Quality Management System	*0.4651*	*0.6292*	*0.5060*	*0.3288*	*0.2800*	*44.2%*	*2.48*	*1.12*
Onboard Work Culture	*0.0388*	*0.0300*	*0.0843*	*0.0548*	*0.1600*	*7.4%*	*0.38*	*1.02*
Ship Shore Staff Relation	*0.0310*	*0.0262*	*0.0723*	*0.0137*	*0.0400*	*3.7%*	*0.19*	*1.02*
							λmax	5.397

Table A.12: AHP matrix for Additional Retention Factors Specific to Shipping Company (Third Officer)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Fleet Quality	Company Brand	Quality Management System	Onboard Work Culture	Ship Shore Staff Relation
Fleet Quality	*1*	*2*	*1*	*1*	*5*
Company Brand	*1/2*	*1*	*1*	*1*	*7*
Quality Management System	*1*	*1*	*1*	*1*	*5*
Onboard Work Culture	*1*	*1*	*1*	*1*	*8*
Ship Shore Staff Relation	*1/5*	*1/7*	*1/5*	*1/8*	*1*

Normalized MATRIX "A" (Third Officer)

Normalized PAIRWISE COMPARISON MATRIX "A"	Fleet Quality	Company Brand	Quality Management System	Onboard Work Culture	Ship Shore Staff Relation	Weight	AW	λmax
Fleet Quality	*0.2703*	*0.3889*	*0.2381*	*0.2424*	*0.1923*	*26.6%*	*1.37*	*1.03*
Company Brand	*0.1351*	*0.1944*	*0.2381*	*0.2424*	*0.2692*	*21.6%*	*1.10*	*1.02*
Quality Management System	*0.2703*	*0.1944*	*0.2381*	*0.2424*	*0.1923*	*22.8%*	*1.16*	*1.02*
Onboard Work Culture	*0.2703*	*0.1944*	*0.2381*	*0.2424*	*0.3077*	*25.1%*	*1.28*	*1.02*
Ship Shore Staff Relation	*0.0541*	*0.0278*	*0.0476*	*0.0303*	*0.0385*	*4.0%*	*0.20*	*1.01*
							λmax	5.105

Table A.13: AHP matrix for Retention Factors due to "Personal Reasons" (Captain)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Family Dependent on Salary	Financial Commitment	Lifestyle
Family Dependent on Salary	*1*	*1/4*	*1/6*
Financial Commitment	*4*	*1*	*1/4*
Lifestyle	*6*	*4*	*1*

Normalized MATRIX "A" (Captain)

Normalized PAIRWISE COMPARISON MATRIX "A"	Family Dependent on Salary	Financial Commitment	Lifestyle	**Weight**	**AW**	**λmax**
Family Dependent on Salary	*0.0909*	*0.0476*	*0.1176*	*8.5%*	*0.26*	*1.01*
Financial Commitment	*0.3636*	*0.1905*	*0.1765*	*24.4%*	*0.75*	*1.03*
Lifestyle	*0.5455*	*0.7619*	*0.7059*	*67.1%*	*2.16*	*1.07*
					λmax	3.109767

Table A.14: AHP matrix for Retention Factors due to “Personal Reasons” (Chief Officer)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Family Dependent on Salary	Financial Commitment	Lifestyle
Family Dependent on Salary	*1*	*1/3*	*3*
Financial Commitment	*3*	*1*	*4*
Lifestyle	*1/3*	*1/4*	*1*

Normalized MATRIX "A" (Chief Officer)

Normalized PAIRWISE COMPARISON MATRIX "A"	Family Dependent on Salary	Financial Commitment	Lifestyle	Weight	AW	λmax
Family Dependent on Salary	*0.2308*	*0.2105*	*0.3750*	*27.2%*	*0.83*	*1.02*
Financial Commitment	*0.6923*	*0.6316*	*0.5000*	*60.8%*	*1.90*	*1.04*
Lifestyle	*0.0769*	*0.1579*	*0.1250*	*12.0%*	*0.36*	*1.01*
					λmax	3.074134

Table A.15: AHP matrix for Retention Factors due to "Personal Reasons" (Second Officer)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Family Dependent on Salary	Financial Commitment	Lifestyle
Family Dependent on Salary	*1*	*1/3*	*1*
Financial Commitment	*3*	*1*	*2*
Lifestyle	*1*	*1/2*	*1*

Normalized MATRIX "A" (Second Officer)

Normalized PAIRWISE COMPARISON MATRIX "A"	Family Dependent on Salary	Financial Commitment	Lifestyle	**Weight**	**AW**	**λmax**
Family Dependent on Salary	*0.2000*	*0.1818*	*0.2500*	*21.1%*	*0.63*	*1.00*
Financial Commitment	*0.6000*	*0.5455*	*0.5000*	*54.8%*	*1.66*	*1.01*
Lifestyle	*0.2000*	*0.2727*	*0.2500*	*24.1%*	*0.73*	*1.00*
					λmax	3.018319

Table A.16: AHP matrix for Retention Factors due to "Personal Reasons" (Third Officer)

Source: Author, (40 participants)

PAIRWISE COMPARISON MATRIX "A"	Family Dependent on Salary	Financial Commitment	Lifestyle
Family Dependent on Salary	*1*	*1/2*	*5*
Financial Commitment	*2*	*1*	*6*
Lifestyle	*1/5*	*1/6*	*1*

Normalized MATRIX "A" (Third Officer)

Normalized PAIRWISE COMPARISON MATRIX "A"	Family Dependent on Salary	Financial Commitment	Lifestyle	Weight	AW	λmax
Family Dependent on Salary	*0.3125*	*0.3000*	*0.4167*	*34.3%*	*1.04*	*1.01*
Financial Commitment	*0.6250*	*0.6000*	*0.5000*	*57.5%*	*1.75*	*1.02*
Lifestyle	*0.0625*	*0.1000*	*0.0833*	*8.2%*	*0.25*	*1.00*
					λmax	3.029159

Table A.17: Rank Calculation for Chief Officer

Source: Author (Own calculation)

1) General Retention Factors	AHP Weights by Chief Officer (AHPW)	Score 1-10 (10 is best) Test Company (T)	A	B	C	Group Weight (GW)	Test Company Adjusted Score = AHPW x T x GW	A Adjusted Score = AHPW x A x GW	B Adjusted Score = AHPW x B x GW	C Adjusted Score = AHPW x C x GW
Money	0.2010	7	9	6	6	0.5	0.7035	0.9044	0.6030	0.6030
Additional Benefits	0.1005	4	5	7	3	0.5	0.2009	0.2512	0.3516	0.1507
Optimum Crew	0.0640	9	7	6	10	0.5	0.2879	0.2239	0.1919	0.3199
Single Nationality	0.0393	9	5	5	5	0.5	0.1769	0.0983	0.0983	0.0983
Onboard Facilities	0.0516	7	5	5	5	0.5	0.1805	0.1289	0.1289	0.1289
Study Grant for Training Course	0.0189	8	4	2	1	0.5	0.0757	0.0379	0.0189	0.0095
Safety & Security	0.1900	7	9	9	5	0.5	0.6652	0.8552	0.8552	0.4751
Leave	0.1951	6	5	8	7	0.5	0.5854	0.4878	0.7805	0.6829
Shore Leave	0.0195	0	0	0	0	0.5	0.0000	0.0000	0.0000	0.0000
Promotion Prospects	0.1201	5	7	8	7	0.5	0.3003	0.4204	0.4805	0.4204
						Total (a)	3.1763	3.4080	3.5088	2.8887
2) Additional Factors Specific to Shipping Company										
Fleet Quality	0.3113	9	5	5	5	0.2	0.5604	0.3113	0.3113	0.3113
Company Brand	0.0391	4	9	8	6	0.2	0.0313	0.0703	0.0625	0.0469
Quality Management System	0.3441	5	5	5	5	0.2	0.3441	0.3441	0.3441	0.3441
Onboard Work Culture	0.2088	4	7	9	4	0.2	0.1670	0.2923	0.3758	0.1670
Ship Shore Staff Relation	0.0968	8	8	7	10	0.2	0.1549	0.1549	0.1355	0.1936
						Total (b)	1.2576	1.1728	1.2292	1.0628
						Grand Total=a + b	4.4338	4.5809	4.7380	3.9515
						Ranks by Chief Officer	3	2	1	4

Table A.18: Rank Calculation for Second Officer

Source: Author (Own calculation)

1) General Retention Factors	AHP Weights by Second Officer (AHPW)	Score 1-10 (10 is best) Test Company (T)	A	B	C	Group Weight (GW)	Test Company Adjusted Score = AHPW x T x GW	A Adjusted Score = AHPW x A x GW	B Adjusted Score = AHPW x B x GW	C Adjusted Score = AHPW x C x GW
Money	0.2010	8	6	6	6	0.5	0.8040	0.6030	0.6030	0.6030
Additional Benefits	0.1005	4	5	7	3	0.5	0.2009	0.2512	0.3516	0.1507
Optimum Crew	0.0640	9	7	6	10	0.5	0.2879	0.2239	0.1919	0.3199
Single Nationality	0.0393	9	5	5	5	0.5	0.1769	0.0983	0.0983	0.0983
Onboard Facilities	0.0516	7	5	5	5	0.5	0.1805	0.1289	0.1289	0.1289
Study Grant for Training Course	0.0189	8	4	2	1	0.5	0.0757	0.0379	0.0189	0.0095
Safety & Security	0.1900	7	9	9	5	0.5	0.6652	0.8552	0.8552	0.4751
Leave	0.1951	7	4	8	7	0.5	0.6829	0.3902	0.7805	0.6829
Shore Leave	0.0195	0	0	0	0	0.5	0.0000	0.0000	0.0000	0.0000
Promotion Prospects	0.1201	5	7	8	7	0.5	0.3003	0.4204	0.4805	0.4204
						Total (a)	3.3743	3.0090	3.5088	2.8887
2) Additional Factors Specific to Shipping Company										
Fleet Quality	0.3113	9	5	5	5	0.2	0.5604	0.3113	0.3113	0.3113
Company Brand	0.0391	4	9	8	6	0.2	0.0313	0.0703	0.0625	0.0469
Quality Management System	0.3441	5	5	5	5	0.2	0.3441	0.3441	0.3441	0.3441
Onboard Work Culture	0.2088	4	7	9	4	0.2	0.1670	0.2923	0.3758	0.1670
Ship Shore Staff Relation	0.0968	8	8	7	10	0.2	0.1549	0.1549	0.1355	0.1936
						Total (b)	1.2576	1.1728	1.2292	1.0628
						Grand Total=a+b	4.6319	4.1818	4.7380	3.9515
						Rank by Second Officer	2	3	1	4

Table A.19: Rank calculation for Third Officer

Source: Author (Own calculation)

1) General Retention Factors	AHP Weights by Third Officer (AHPW)	Score 1-10 (10 is best) Test Company (T)	A	B	C	Group Weight (GW)	Test Company Adjusted Score = AHPW x T x GW	A Adjusted Score = AHPW x A x GW	B Adjusted Score = AHPW x B x GW	C Adjusted Score = AHPW x C x GW
Money	0.2182	7	5	6	6	0.5	0.7637	0.5455	0.6546	0.6546
Additional Benefits	0.1290	4	5	7	3	0.5	0.2579	0.3224	0.4513	0.1934
Optimum Crew	0.0339	9	7	6	10	0.5	0.1526	0.1187	0.1017	0.1695
Single Nationality	0.0299	9	5	5	5	0.5	0.1345	0.0747	0.0747	0.0747
Onboard Facilities	0.0621	7	5	5	5	0.5	0.2172	0.1551	0.1551	0.1551
Study Grant for Training Course	0.1131	8	4	2	1	0.5	0.4524	0.2262	0.1131	0.0566
Safety & Security	0.0957	7	9	9	5	0.5	0.3349	0.4306	0.4306	0.2392
Leave	0.0993	7	4	8	7	0.5	0.3475	0.1986	0.3971	0.3475
Shore Leave	0.0155	0	0	0	0	0.5	0.0000	0.0000	0.0000	0.0000
Promotion Prospects	0.2035	5	7	8	7	0.5	0.5087	0.7122	0.8140	0.7122
						Total (a)	3.1693	2.7839	3.1922	2.6028
2) Additional Factors Specific to Shipping Company										
Fleet Quality	0.2664	9	5	5	5	0.2	0.4795	0.2664	0.2664	0.2664
Company Brand	0.2159	4	9	8	6	0.2	0.1727	0.3886	0.3454	0.2590
Quality Management System	0.2275	5	5	5	5	0.2	0.2275	0.2275	0.2275	0.2275
Onboard Work Culture	0.2506	4	7	9	4	0.2	0.2005	0.3508	0.4511	0.2005
Ship Shore Staff Relation	0.0396	8	8	7	10	0.2	0.0634	0.0634	0.0555	0.0793
						Total (b)	1.1436	1.2967	1.3458	1.0327
						Grand Total=a+b	4.3129	4.0807	4.5381	3.6355
						Rank by Third Officer	2	3	1	4

Table A.20: Sample of Linear programming in MS Excel Sheet

Source: Author (Own calculation)

1) General Retention Factors	AHP Weights by Chief Officer (AHPW)	Score 1-10 (10 is best)				Group Weight (GW)	Test Company	A	B	C
		Test Company (T)	A	B	C		Adjusted Score = AHPW x T x GW	Adjusted Score = AHPW x A x GW	Adjusted Score = AHPW x B x GW	Adjusted Score = AHPW x C x GW
Money	0.2010	4.6708	9	6	6	0.5	0.4694	0.9044	0.6030	0.6030
Additional Benefits	0.1005	4	5	7	3	0.5	0.2009	0.2512	0.3516	0.1507
Optimum Crew	0.0640	9	7	6	10	0.5	0.2879	0.2239	0.1919	0.3199
Single Nationality	0.0393	9	5	5	5	0.5	0.1769	0.0983	0.0983	0.0983
Onboard Facilities	0.0516	7	5	5	5	0.5	0.1805	0.1289	0.1289	0.1289
Study Grant for Training Course	0.0189	8	4	2	1	0.5	0.0757	0.0379	0.0189	0.0095
Safety & Security	0.1900	7	9	9	5	0.5	0.6652	0.8552	0.8552	0.4751
Leave	0.1951	10.0000	5	8	7	0.5	0.9756	0.4878	0.7805	0.6829
Shore Leave	0.0195	0	0	0	0	0.5	0.0000	0.0000	0.0000	0.0000
Promotion Prospects	0.1201	5	7	8	7	0.5	0.3003	0.4204	0.4805	0.4204
						Total (a)	3.3324	3.4080	3.5088	2.8887
2) Additional Factors Specific to Shipping Company										
Fleet Quality	0.3113	9	5	5	5	0.2	0.5604	0.3113	0.3113	0.3113
Company Brand	0.0391	4	9	8	6	0.2	0.0313	0.0703	0.0625	0.0469
Quality Management System	0.3441	5	5	5	5	0.2	0.3441	0.3441	0.3441	0.3441
Onboard Work Culture	0.2088	4	7	9	4	0.2	0.1670	0.2923	0.3758	0.1670
Ship Shore Staff Relation	0.0968	8	8	7	10	0.2	0.1549	0.1549	0.1355	0.1936
						Total (b)	1.2576	1.1728	1.2292	1.0628
						Grand Total= a + b	**4.5900**	4.5809	4.7380	3.9515
						Ranks by Chief Officer	2	3	1	4