Female engineer officers: breaking the glass ceiling

Foong Mun Chan

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FEMALE ENGINEER OFFICERS – BREAKING THE GLASS CEILING

By

CHAN FOONG MUN
Singapore

A dissertation submitted to the World Maritime University in partial fulfilment of the requirement for the award of the degree of

MASTER OF SCIENCE
In
MARITIME AFFAIRS
(MARITIME ENERGY MANAGEMENT)

2019
Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

Name: Chan Foong Mun

Specialization: Maritime Energy Management

(Signature): ........................................

(Date): 24 September 2019

Supervised by: Professor Dr. Momoko Kitada

Supervisor’s affiliation World Maritime University
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I am sincerely grateful for my family and friends back home and here in Sweden who are my lighthouses in times of difficulty.

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Lastly, heartfelt thanks all who have volunteered the time to participate in this research, for without their participation this dissertation will not be possible.
Abstract

Title of Dissertation: Female Engineer Officers – Breaking the Glass Ceiling
Degree: Master of Science

Shipping industry is predominately a male dominated sector that is facing an increasing shortage of seafaring officers. In STEM field, engineering is also male dominated, indicating female engineer officers as one of the more marginalized population of women in work force today. According to reports estimation, women seafarers represent only 1 percent of the total seafaring population for the past 25 years of which female officer seafarers, both deck and engine departments, is at 0.12 percent. There have been studies on female officers on merchant ships; however, very few studies have focused on female engineer officers.

The main objective of this dissertation is to identify the challenges faced by female engineer officers pursuing a career on merchant ships and the perceptions of the work environment in the engine department by the officers from both deck and engine departments and male counterparts. In addition, the importance of the role of engineer officers in the shipping industry today and beyond.

The methodology of this study is qualitative method, consisting of an online questionnaire with 51 respondents with seafaring officer experience from 19 nationalities. From the results, it is identified that female engineer officers face gender-based discriminations and perceptions from their male counterparts. However, due to the nature of work engineer officer carry out involves machineries that are gender blind, allows their competency and proficiency at work speak for them.

**KEY WORDS:** Women seafarers, Marine Engineer, Engineer Officer, Seafarers, Gender issues, Discrimination, Occupational Culture, STEM.
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIMCO</td>
<td>The Baltic and International Maritime Council</td>
</tr>
<tr>
<td>HMI</td>
<td>Human-Machine Interface</td>
</tr>
<tr>
<td>ICS</td>
<td>International Chamber of Shipping</td>
</tr>
<tr>
<td>ICT</td>
<td>Information Communication and Technology</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labour Office</td>
</tr>
<tr>
<td>IMarEST</td>
<td>Institute of Marine Engineer, Science and Technology</td>
</tr>
<tr>
<td>IMHA</td>
<td>International Maritime Health Association</td>
</tr>
<tr>
<td>IMO</td>
<td>International Maritime Organization</td>
</tr>
<tr>
<td>IMPA</td>
<td>International Marine Purchasing Association</td>
</tr>
<tr>
<td>ISSA</td>
<td>International Shipsuppliers &amp; Services Association</td>
</tr>
<tr>
<td>IWMS</td>
<td>Women in the Maritime Sector</td>
</tr>
<tr>
<td>MASS</td>
<td>Maritime Autonomous Surface Ships</td>
</tr>
<tr>
<td>MET</td>
<td>Maritime Education and Training</td>
</tr>
<tr>
<td>MLC</td>
<td>Maritime Labour Convention</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>OSH</td>
<td>Occupation Safety and Health</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>SDG</td>
<td>Sustainable Development Goals</td>
</tr>
<tr>
<td>SMU</td>
<td>Shanghai Maritime University</td>
</tr>
<tr>
<td>STCW</td>
<td>International Convention on Standards of Training, Certification and Watchkeeping for Seafarers</td>
</tr>
<tr>
<td>STEM</td>
<td>Science, Technology, Engineering and Mathematics</td>
</tr>
<tr>
<td>SWE</td>
<td>Society of Women Engineers</td>
</tr>
<tr>
<td>UC Berkeley</td>
<td>University of California at Berkeley</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>WES</td>
<td>Women’s Engineering Society</td>
</tr>
<tr>
<td>WIMA</td>
<td>Women in Maritime</td>
</tr>
<tr>
<td>WMU</td>
<td>World Maritime University</td>
</tr>
<tr>
<td>WWII</td>
<td>World War II</td>
</tr>
</tbody>
</table>
Chapter 1: Introduction

1.1 Overview

Worldwide there is an increase in acknowledging that women are essential in contributing to the world and local communities. International organizations such as the United Nations (UN) are leading the way in bringing forth a positive change in empowering of individuals through eliminating biases towards one’s gender. Among the UN Sustainable Development Goals (SDGs) for 2030, Goal 5 (Gender Equality) and Goal 8 (Decent Work and Economic Growth), emphasize the importance of acknowledging the need for integration of women as part of the global workforce in order to achieve a dignified, peaceful and prosperous society for all (UN, 2015). The International Maritime Organization (IMO) has been consistently supporting the integration of females in the maritime industry since 1988 through its gender programme, the Integration of Women in the Maritime Sector (IWMS), which has facilitated the establishment of Women in Maritime (WIMA) associations around the world. One of the significant efforts made by IMO is highlighting the 2019 World Maritime Day theme "Empowering Women in the Maritime Community".

The Maritime industry, however, is slow to witness such a progress in gender equality in work climate. This is especially evident in the core operational sector of seafaring population. According to a report published by ILO (2003) women make up only 1 to 2 percent of the total population of seafaring community who mainly work in the hospitality or catering department of passenger and cruise vessels (Wu, 2005). Wu (2005) also argues that the women seafarers in cruise shipping mostly have higher probability of working alongside fellow female colleagues during their employment period. The job description and requirements are largely related to guest relations that require soft skills and in ensuring that guest needs are satisfied which is typically deemed on land based as a “female’s work” (Zhao, 2002). Whereas in the quintessential operational departments of a ship, the deck and engine departments, the population of female is 0.12% (Drewry, ILO & ITF, 2009).
Deck and engineer officers are high in demand and held in high regards with good career prospects. However, females are not commonly seen working in either departments, much rarer for the engine department where the job requirement is more demanding in physical ability, high temperature environment, large noise exposures and involving hands on mechanical skills that are deemed and stereotypically classified as masculine traits (Lundh, Lützhöft, Rydstedt & Dahlman, 2011). In relation to that matter, Chapter 3 of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) Code (IMO, 2017) is specifically set out the regulation for the Engine department where mandatory baselines of the qualifications for engineer officers which highlight the importance of having competent engineer officers on board ships.

With regard to technical requirements, Marine Engineering falls under the Science, Technology, Engineering and Mathematics (STEM) academic discipline. Various studies show that there is an unbalanced ratio of females to males in these disciplines. According to the Institute of Marine Engineer, Science and Technology (IMarEST), only 1.5% of its members registered as Chartered Engineer are females (Mackenzie, 2015). This data indicates that there are challenges faced by this little known population of females in the maritime workforce, much less for seafaring female engineer officers.

1.2 Problem Statement

According to The International Chamber of Shipping (ICS) defines shipping as “the life blood of the global economy.” (ICS, 2015). Currently, over 50,000 merchant vessels are responsible for the carriage of 90 percent of world trade, manned by over 1 million seafarers where an estimate of 774,000 are officers, of which an estimate 1 percent are females (BIMCO & ICS, 2016).
Shipping industry constantly needs to adapt to various factors like more stringent environmental regulations, trade patterns and demand fluctuations and fuel prices volatility that all affects the profitability of ship owners. The ship itself is a high value asset that cost millions of dollars to build with an average lifespan between 20 to 25 years (Chatzinikolaou & Ventikos, 2013). By maximising operational cost savings allows ship owners to increase their profit margin. Despite the fact that the development of automation and high technology reduces the labour operational cost, ship owners are still highly dependent on engineer officers’ proficiency for ship’s smooth operation. According to a joined report by BIMCO and ICS, Manpower report 2015, as shown on Figure 1, officer shortage is expected to increase from 2.1% to 18.3% by 2025 (BIMCO & ICS, 2016).

![Basic forecast for the future supply-demand balance for officers](image)


Figure 1. Basic Forecast for the Future Supply-Demand Balance for Officers
The current development in sustainable shipping sector requires the shortage of officer seafarers needs to be addressed promptly. Despite various stakeholders in the maritime sector promoting the integration of female seafarers on board, the low population remains at 1 percent for the past 25 years (Belcher, Sampson, Thomas, Zhao & Veiga, 2003, ICS, 2015). On the contrary, females have been integrating into male dominated profession such as police force, firefighting and navy. Therefore, the potential for females to make up for the shortage of work force in seafaring officers in particular engineer officer.

1.3 Objective of Research

The objective of this research is to identify the challenges faced by female engineer officers pursuing a career on board merchant vessels and the perception of both deck and engine officers on the work environment in the engine department.

Through the literature reviews, there is very little known facts about this specific population of female marine engineers and how they have been perceived by the male colleagues in both deck and engine departments. This research would bring much awareness and provide valuable new data for this area of research. In addition, this research would contribute in desensitizing the stereotypical biases towards female seafaring officers particularly female engineer officers, which in turn would help to reduce negative perceptions toward them.

In the long run, it is expected that this research would be found beneficial in encouraging more females to pursue an education in marine engineering and a career as a marine engineer officer by increasing the visibility of existing female engineer officers. With the information gathered, shipping companies will be encouraged to hire female seafarers and thus closing the gap in the lack of seafaring officers as well as ultimately creating a more gender balanced work environment for all on board ships particularly merchant vessels.
1.3 Research Questions

In order to achieve the objectives mentioned in chapter 1.2, the following needs to be addressed,

1. What are the challenges faced by female engineer officers pursuing a career on board merchant vessels?

2. What is the perception of both deck and engine officers on the work environment in the Engine Department?

3. What are the future probabilities for female engineer officers in evolving trends of shipping industry?

4. How the leaky pipeline in career progression in female seafarers in particular engineer officers be mitigated.

1.4 Methodology

Due to the small population of female marine engineer officers, a qualitative method of approach is found to be best suited for this research, “which focus more on the objective experiences and meaning of those being researched” (Maynard, 1994).

Data collection is primarily conducted through questionnaire, by means of purposive and snowball sampling methods that is critical in the inquiry of this small, less studied population (Woodley & Lockard, 2016). A key opportunity for sourcing avenues of dissipating the questionnaire was during Third WMU International Women’s conference in April 2019. In order to collect a wide pool of sample, the survey is not restricted by region to provide a broader perspective of challenges faced by these women. The survey is also being neutrally phrased and circulated to both male and female officers in order to identify any varied response on the particular topics be discussed in Chapter 4.
Prior to the questionnaire circulation, a pilot survey tested amongst selected group of students in World Maritime University (WMU) to clarify any issues and ambiguity of the questions. The feedback collected from the participants are taken into consideration and the required corrections are made to improve the quality of the survey. The WMU’s Research Ethics Committee has approved the questionnaire sent out and participants’ anonymity are protected. A selected few respondents were reached for clarification and further enquiry with relation to the comments in open-ended questions.

1.5 Key Assumptions and Restrictions of Research

Considering of the specific way of seafaring workforce work environment with varied nationalities and cultural backgrounds, the key assumption is that ethnicity and religion are not amongst contributing factors. Secondly, the focus of this research is on gender as a person and not involving one’s sexuality. Thirdly, the population is specifically aiming for seafaring officers in deck and engine departments while female seafarers in hospitality or catering departments are not included for the reason that their work requirements do not directly affect the function of a ship in terms of seaworthiness.

In conducting this research, there are a couple of potential limitations, which may affect the outcome of the research. Firstly, due to my background as seafarer, it is important to clarify that I do not have any bias or personal input during follow up process that may affect the respondents’ responses, which would give rise to inaccurate data collection. In addition, despite the intention of this research is to focus on particularly on female engineer officers, there is no collective data to show the exact numbers and sources for enough subjects that may pose a challenge to the research. Lastly, the demographics of seafarers is global and collection of data may not be immediate received where time that the author afforded to spend for a Masters in Science dissertation is a factor that can affect the percentage of data available to collect.
Chapter 2: Female Engineer Officer On Board

2.1 Women in Engineering Field

According to a report by Queen Elizabeth Prize for Engineering (2017), the current challenges globally is diverse in nature which widely regard engineering contributes significant role to the world than ever before. Particularly, on the faith that engineers provide solutions to the challenges around energy and the environment, such as energy efficiency and air pollution reduction.

According to the Merriam-Webster Dictionary (2019), engineering is defined as:

“(a) the application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people (b) the design and manufacture of complex products”.

In relation to the definition, during the First Industrial Revolution (1760 – 1870), where there was a shift from agrarian and handicraft economy to industrialization and machine manufacturing of goods, the global economy moved from hand production methods towards machines. In this time of technological innovations and advancement, the building and maintenance of equipment that embodies new technology relies on competent engineers (Meisenzahl & Mokyr, 2011).

In engineering trade, competency evolved from apprenticeship at entry level to a profession that requires a formal education to practice. While on the other hand, women had been restricted from enrolling into these academic fields (Layne, 2009). In 1876, Elizabeth Bragg earned her degree in civil engineering from the University of California at Berkeley (UC Berkeley) and became the first woman to graduate from engineering (Sheila, 1995). Only a handful of women graduated from engineering at UC Berkeley since then up until the onset of World War II (WWII) when 14 women graduated from engineering between 1940 and 1950 (Diversity Milestone, n.d.). The
emergence of professional societies in the USA during the nineteenth century set the membership criteria that includes a degree from an accredited university where most women were not accepted. The first professional society in the USA, the American Society of Civil Engineers, founded 1852, had its full grade woman member, Elsie Eaves, only in 1927.

During World War I, men drafted into the armed forces, leaving a huge vacancy in key industries, where owners were compelled to hire women to satisfy the demands of war (Carter, 2015). When the war ended, these women were pressured to release these jobs back to the men who returned from war. In 1919, women who resisted the pressure and to “promote engineering as a rewarding job for women as well as men” (History, n.d.), founded Women’s Engineering Society (WES) in England. Meanwhile in the USA, the Society of Women Engineers (SWE), the sister organization of WES, was founded in 1950 five years after WWII. An empirical data shows that the American engineering programs saw a growth from less than 1 percent in the 1950s of women students to 18.4% of bachelor's degrees, 22.6% of master's degrees, and 21.8% of doctorates in engineering, in 2010 and 2011 (Bix, 2014).

The other challenge is that women also faced with the early termination of professional career due to marriage, which is especially evident in the first half of the 20th century. It is notable that there were cases of having a supportive and influential spouse in the same field contributed to a woman's career continuation (Carter, 2015). For example, Lillian Gilbreth, known for founding the discipline of scientific management with her husband, married in 1904, continued their joint work decades after his death and was elected to the National Academy of Engineering in 1965 at the age of 89 (NAE, 1979).
The development of industrial revolution has evolved from the era of Industry 1.0 to present Industry 4.0 as shown on Figure 2.

It is seen from the figure above that on the Fourth Industrial Revolution phase, which is also known as the age of globalization, digitalization and knowledge economy prominence with increased complexity, STEM fields is widely valued in various sectors of the economy. This field is closely related to national’s innovation capacity and gaining increased attention from many countries (Hill, Corbett & St Rose, 2010). The shortage in STEM professionals flagged by multiple States, especially with the forecasted growth in demand for STEM skills (OECD, 2018). In recent years, women are strongly encouraged to pursue education and profession in STEM to increase innovation, creativity and competitiveness levels by diversifying the workforce. Professionals in STEM had brought various improvements to daily lives. However, the absence in women’s involvement, for example, in product design process can lead to oversight that involves lives, “for instance, a predominantly male group of engineers tailored the first generation of automotive airbags to adult male bodies, resulting in avoidable deaths for women and children” (Margolis & Fisher, 2002).

Figure 2. Industrial Revolution Stages
Studies have suggested that STEM education disciplines are a better measure of human capital because it considers the importance of education that stimulates innovation and produces workers that are able to drive and respond to technological advancement, which lies at the centre of economic prosperity (Croak, 2018). In USA, Only 13 percent of women constitutes to the engineer workforce in 2013 (Hill et al., 2010), despite having the least regression adjusted wage gap of 7 percent less per hour compared to male peers in the field of STEM (Beede, Julian, Langdon, McKittrick, Khan, & Doms, 2011). However, attrition rate is higher in women than their male peers which the UK parliament sought an inquiry to address the issue of ‘leaky pipeline’ of continuous loss of women at various stages of STEM profession (Mackenzie, 2015).

2.2 Role of a Marine Engineer

To point out the importance of Marine Engineers in the shipping industry, it is worth mentioning, “ships are a complex collection of self-sustaining machinery providing the facilities to support a small community for a considerable period of time” (Taylor, 1996). The effective management of these ships while in operation relies heavily on a particular population of work force, which is seafaring officers. The officers divided into two departments namely, deck and engine departments following a hierarchy organization structure shown on Figure 3.
The personnel in the engine department on board led by Chief Engineer, are responsible for the effective management of the machinery space on board, the Engine Room. Marine engineering on board encompasses a broad range of tasks, duties and responsibilities including operation, monitoring, maintenance and evaluation of shipboard equipment, systems and services; ranging from the main propulsion engine that drives the propeller to refrigeration system for provision rooms that stores perishable food for ship’s crew. Marine engineer competency includes a wide range of knowledge and skills from repair work using hands-on tools (Mukha, 2017) to operation of fault diagnosis systems on engines with modern Information Communication and Technology (ICT).
As specified in STCW, the minimum requirements and proficiency of engineer officers are split into two levels, that are operational and management; categorised into 4 major functions; (1) Marine Engineering (2) Electrical, Electronic and control engineering (3) Maintenance and repair (4) Controlling the operation of the ship and care of persons on board. The broad range of responsibility and competency are required in order to safeguard the crew, vessel, cargo and the marine environment (IMO, 2017). In 1999, IMO adopted Resolution A.1047(27) on principles of safe manning, which consist of guidelines that mentions the capability to maintain safe engineering watch as a determining observations in minimum safe manning of the ship (IMO, 2011). This guideline particularly reinforces the importance of the role of having qualified and competent engineer officers on board. However, the shortage of officers particularly in engineer officers at management level (BIMCO & ICS, 2016), is evident that the shipping industry is facing a loss in its human capital.

The increasing concerns of climate change has brought forth stringent environmental regulations for mitigation and adaptation measures coupled with volatile fuel prices and surplus capacity in freight market (UNCTAD, 2018). To address this issue, ship owners are adopting latest advanced technologies to optimize performance of operation, which in turn reduced labour cost and maximise cost savings despite higher initial capital investment (Saharuddin, Sulaiman, Kader, & Nick, 2011). This is in line with ship owners’ essential concern in optimising ship operation performance (Antão, Teixeira & Soares, 2013).

The increased presence of ICT in shipboard systems, increases human-machine interface (HMI) operation in the last few decades with the introduction of automation which reduces physical work but highly demands human information processing (Mišković, Bielić & Ćulin, 2018). Given the growing attention on Maritime
Autonomous Surface Ships\(^1\) (MASS), a recent study on the potential effects of autonomous ships on the role of seafarers indicates that there will be no shortage of jobs for seafarers, particularly officers, in the next two decades and there may be considerable addition of jobs ashore that require seafaring experience (Johns, 2018). Recent research found that highly skilled ship engineers have second least automation potential projected (WMU, 2019a) as shown of Figure 4 below.

![Automation Potential for Job Profiles in Transport](image)


**Figure 4 Automation Potential for Job Profiles in Transport**

In addition, engineer officers have wider choices when they seek employment ashore compared to deck officers. They are not restricted within the maritime industry but also in industries with large plants where their operational skills and experience are in demand (Barnett, Gatfield, Overgaard, Pekcan, & Graveson, 2006).

---

\(^1\) Maritime Autonomous Surface Ship (MASS) according to IMO is a ship which, of varying degree that can operate independently of human interaction. Source: IMO, 2018.
2.3 Steel Hull - A Male Dominated Environment

Seafaring is a unique environment where living and working climate co-exist. When a seafarer commences one’s work, the said seafarer also temporarily relocates to stay at the same place where the workplace is, the assigned ship, for the entire employment duration from weeks to a few months. This environment is predominately male dominated; with less than 2 percent of seafarer population are female seafarers and the percentage of female seafaring officers estimated at a lesser percentage of 0.7 percent. In cruise ships, the visibility of female seafarer is much higher, where 30 percent of the cruise ship workers are female seafarers including those in non-marine operational roles (ILO, 2019a). While, on merchant vessels, female officer may often find herself as the sole female amongst crewmembers on board ships. Including the author’s own experience of a seafaring career spanning 9 years, she had sailed with a fellow female classmate during industrial attachment prior graduating from MET institute, but did not once sailed with a female crewmember on board merchant vessels. To be able to reflect the statistical evidence of the number of women seafarers on board, Table 1 constitutes the samples of those particular numbers compiled by the (BIMCO & ILO, 2016).

<table>
<thead>
<tr>
<th>Women seafarers</th>
<th>Number of women seafarers in the sample</th>
<th>Percentage of the seafarers in the sample by rank (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Officers</td>
<td>540</td>
<td>0.7</td>
</tr>
<tr>
<td>Officer trainees</td>
<td>734</td>
<td>6.9</td>
</tr>
<tr>
<td>Ratings</td>
<td>306</td>
<td>0.4</td>
</tr>
<tr>
<td>Rating trainees</td>
<td>7</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,587</strong></td>
<td><strong>1.0</strong></td>
</tr>
</tbody>
</table>


Table 1 Women Seafarer Estimated Percentage in Maritime Sector
Taking into consideration of the harsh working conditions on board, particularly in the engine department, engineers boiler suits are often covered with oil stains due to the exposure of oil during maintenance adds to the impression of it being a ‘dirty job’ which is deemed ‘unsuitable for females’. In 1998, a study on Danish women seafarers revealed amongst the shipboard departments, that engine department was almost completely dominated by men (Hansen & Jensen, 1998).

Furthermore, even in auxiliary services to shipping such as procurement, shipboard stores are mostly catered towards males since the majority of the workforce on board is male. The two leading organisations for the procurement services are the International Marine Purchasing Association (IMPA) and the International Shipsuppliers & Services Association (ISSA) that provide publications widely used for ordering of ship’s supplies meant for deck, engine, galley and bonded stores. Both IMPA Marine Stores guide and ISSA Ship Stores Catalogue pictured only male models in various PPE and uniforms. The sizing charts and measurements also dedicated only for males. Welfare items such as undergarment and shavers are specific for males while female sanitary products are not included in the catalogue. The example of such catalogue are shown in the Figure 5 below.
In relation to the said matter, IMO has also recognized the male dominated environment noting the need for inclusion of females as stated in the STCW as “Promotion of the participation of women in the maritime industry”, in one of the resolutions during the conference for STCW Convention held in Manila between 21 and 25 June 2010.

To strengthen the determination for the welfare and decent work for seafarers, the Maritime Labour Convention (MLC) 2006, entered into force in August 2013, sets out the standard for accommodation facilities. Concerning minimum standards for accommodation, for sleeping conditions in the Regulation A3.1 point 9 (b), which specifically mentioned the “separate sleeping rooms provided from men and women” and for sanitary facilities in the Regulation A3.1 point 11 (a) specifically mentioned “separate sanitary facilities being provided for men and for women” (ILO, 2019b). This two requirement eliminates the ‘privilege’ that a female officer may enjoy
especially in junior ranks (third engineer and below) where some vessels have shared accommodation for them.

In line with the above-mentioned issue, the author has also personally encountered a similar ‘privilege’ treatment during her work in the first vessel as engine cadet after graduating from the marine academy, before MLC, where the fifth engineer cabin assigned to her had an attached bathroom. While, the deck cadet, who was a male, assigned to a cabin that had a shared bathroom facility.

Although currently this may seem like a rightful basic requirement, the impression received by fellow crewmembers is that because of the introduction of a female cadet demands ‘special treatment’, hence the allocation of a better accommodation compared to the male cadet, have created a negative bias attitude towards female engine cadet.

2.4 Challenges Female Seafarers Encounter

Various studies have shown that working in a male dominated professional environment as a marginalised gender in various sectors such as, firefighters, military, navy, construction and engineering fields, face various challenges. There is a “leaky pipeline” from education to career advancement in ensuring a sustainable workforce of women especially in the engineering sector (Mackenzie, 2015). The marine sector is no exception.

In addition, from various studies, merchant ship is often associated as a total institution. It is defined as “a place of residence and work in which a large number of individuals, all in the same situation and isolated from society for a significant period of time, share in their confinement a formally administered daily routine” (Goffman, 1968, Davies, 1989, Dauer, 2009, Simons, 2013). Adding to the complexity of challenges faced by female engineer officers.
According to Simons’ (2013) observation that seafarers working on most merchant ships have a career largely characterised by confinement to a small workspace for extended period, restricting seafarer’s movement to the build environment of the ship. In addition, highlighted that due to the unique working conditions engineers perform in, tending to machineries, they may carry out an entire shift without human contact. Mentioned in the director’s overview notes of 2018 annual review of the Seafarers International Research Centre (SIRC) at Cardiff University in its “loneliness is one of the most prevalent emotions amongst contemporary seafarers” (SIRC, 2019).

This section will specifically discuss about the challenges faced by female engineer officers in undertaking their work in the maritime sector.

2.4.1 Denied Opportunities – MET and Employers play a role

Despite the introduction of women into this particular workforce started in 1970s, MET institutes began to accept female students in this field of studies in the same year. There has not been much change in the low population of female seafaring officers since then and the overall workforce remains predominantly as males.

Women enrolment to MET institutes has recently been gaining traction but the majority is in the navigation course tailored for employment as deck officers on board. The reluctance of women enrolment into marine engineering courses is a stronger evidence of the nature of work as ‘not suitable for women’ with only 3 percent of female students are being trained as engineers (Belcher et al., 2003) due the harsh nature of engine room environment.

From a global perspective, China and Philippines are amongst the top five seafaring officer supplier countries (BIMCO & ICS, 2016) while the representation of women in MET courses is low is still relatively low in these countries. In China, the only MET institute, Shanghai Maritime University (SMU) that accepts female students is only in the nautical course since 2000. In 2015, the restriction to enrol only males to marine
engineering course were removed and they welcomed the SMU first female student out of a cohort of over 280 marine engineering students (EBC, 2016). In the Philippines, the research indicates that only 0.56 percent of its cohort graduated from marine engineering course (Kitada, 2015). Research has shown that female students perform well academically and tend to be more motivated comparing to male students (Chen, 2015). A more positive trend observed from 6.8 percent of officer trainees globally represented by women (BIMCO & ICS, 2016), reaffirms an increase in enrolment of female students in MET institutes. However, specific statistics on female engineer officer are not established.

In July 2019, the celebration of Hong Kong’s first female Chief Engineer made news headlines bringing attention to the low representation of female seafarers and employment challenges. Reportedly, she was the first female seafarer hired by her employer and only 3 out of 14 shipping companies in Hong Kong hire females despite the labour shortage (Low, 2019). Some employer have a misconception that work environment of the engine room is least suited for females to work in (Thomas, 2004). While some employers may be open to hiring female engineer officers but not Chief Engineer (Belcher et al., 2003), which may create a barrier for female engineer officer’s career progression (Thomas, 2004). Hesitation in employing females may also stem from the assumptions of premature leaving due to commitments such as family and childbearing (Turnbull, 2013). However, studies have shown that the seafarers’ retention is an issue faced by both genders due to a long separation from family (Stannard, Vaughan, Swift, Robinson, Altaf & McGarry, 2015). Nevertheless, a research conducted found that there are women who continued their seafaring career after motherhood (Kitada, 2015). Therefore, the assumption that women are more prominent to premature leaving cannot be supported.
2.4.2 Gaining Acceptance – Being One of the Boys

To address the challenge of fitting in the working in male dominated environment, adjustments primarily lie on female employees (Cars & Österman, 2015). The working culture on board has its own rules and regulations, where seafarers form a unique ‘code of behaviour’ to meet the requirements of this work culture. In order for a female seafarer to gain acceptance in the workplace to confirm to the work culture is fundamental. One of the strategies that may be adopted by female seafarers is conducting identity management. The research found that women seafarers shift between four main identity management groups, namely negotiators, constructors, maintainers and reproducers (Kitada, 2013). The research also revealed that women adopted behaviour or alter appearance, through clothing and hairstyles, which leans away from a feminine identity. In addition, female seafarers often work harder to prove their competency and ability to perform professionally to gain acceptance by their fellow crewmembers (Thomas, 2004, ILO, 2019a).

2.4.3 Occupational Safety and Health (OSH)

Occupational Safety and Health (OSH) plays an important role in ensuring the wellbeing of the employee while fostering a safe and healthy environment for all in said work environment. OSH importance is recognised in the maritime sector as seen in MLC 2006 Regulation 4.3 Health and Safety protection and accident protection, where the purpose is “To ensure that seafarers’ work environment on board ships promotes occupational safety and health.” (ILO, 2019b).

2.4.3.1 Occupational Safety

With regard to occupational safety, Personal Protective Equipment (PPE) is a necessity protection from occupational hazards for accident prevention against physical injury, such as safety helmets, steel toecap boots and coveralls. The recent news coverage of NASA’s cancellation of the first all-women spacewalk due to the availability of only one medium torso component readily available for usage on space station (Fortin &
Zraick, 2019) brought attention to how a necessity of appropriate work gear can have a negative impact on women at work.

In order for PPE to be effectively applied aside from the quality, the fit of PPE is crucial (Ghani, 2017). Tight fit restricts mobility while loose fit may pose danger to user such as entanglement to machines resulting in injury. PPE designs based on the sizes and characteristics of male populations from certain countries in Europe and USA (TUC, 2017). Research found that women firefighters tend to wear larger uniform pants, designed based on the physique of male in order to accommodate their proportionally wider hip circumference and longer crotch length i.e. pants rise compared to men, resulting in baggy fit on the legs (Park & Langseth-Schmidt, 2016).

Working on board is a high-risk environment especially the engine room where the majority of heavy machineries are located such as the main propulsion engine. PPE is a standard requirement, boiler suits also known as coveralls are a staple attire for work in engine room. The design of a one piece boiler suit is catered for males with double zips to provide more convenience when using a bathroom. However, it does not well-tailored to women in a certain areas like hips and chest as well as excessive length at the arms resulting in hindrance in mobility (IAPA, 2006) and impractical to use the bathroom as commented by a female coastguard (TUC, 2017). In the research of ergonomics, studies pertaining to immersion suits, a unique PPE for maritime sector considered only male subjects (Tipton, & Balmi, 1997, Stewart, Ledingham, Furnace, Schranz, & Nevill, 2016, Stewart, Ledingham, Furnace, Williams, & Coleshaw, 2017, Stewart, Ledingham, & Williams, 2017).

2.4.3.2 Physical and Mental Health

In 2015, owing to concerns that women seafarers may not have a gendered approach to their needs to health care, International Maritime Health Association (IMHA) conducted a survey on the health and welfare needs of women seafarers. Almost half of the respondents reported joint/back pain and stress/anxiety/depression as the top
two health challenges, despite of the fact that joint/back pain was least common in cargo ships. Nearly one fifth of the respondents also highlighted heavy or painful mensuration. The result shows that 40% of respondents stated they did not have access to a sanitary bin on-board, amongst the officer respondent more than half do not have access to it. Also reported that such access on cargo vessels is also reportedly lower at 38% (Stannard et al., 2015, UNTAC, 2017). To elaborate on this matter further, from the author’s personal experience, recalling clearly during her briefing with fleet manager prior to joining her first vessel as engine cadet. The fleet manager advised her to pack extra female sanitary products, as it may be ‘tricky’ to get them when on board as it is not readily available at port of calls and shore leaves may be infrequent. With the author’s experience sailing on commercial vessels trading worldwide, she had experienced sea passages up to 22 days straight without calling port and had spent over 50 days on board with opportunity for shore leave due to various factors as short port stays, long sea passages and job obligations, to name a few. This experience is not unique to the author, it is similarly reported recently by the Sea (2019) an Irish Electro-Technical Officer mentioning “have to pack 5-month supply” of sanitary products.

Mental health of seafarers is a growing concern in the shipping industry in particular regarding seafarers. As mentioned in Chapter 2.4, a ship is a total institution, where loneliness is a prevailing emotion amongst seafarers, coupled by above mentioned, where stress/anxiety/depression is one of the top two health concerns of women seafarers, mental health must not be taken lightly. It affects the overall wellbeing and work performance of the individual. Discrimination of women seafarers due to gender acknowledged in the industry and various studies have been carried out (ILO, 2019a, Belcher et al., 2003, Kitada, 2010, Mellbye & Carter, 2017). Gender-based discrimination adds an additional strain on the women seafarers’ work (Mellbye & Carter, 2017).
Chapter 3: Research Methodology

3.1 Scope of Questionnaire

This research aims at understanding the motivation and challenges women marine engineers have in pursuing a professional career on board merchant ships as well as to understand the perception of fellow seafaring officers have about the work climate in the engine department. In order to improve the overall perception of women seafarers to reinforce sustainable development in recruitment of women seafarer on-board, this research will focus mainly to: (1) key issues that were examined concerning their career progression; (2) discussion of their working environment; (3) explore the reasons for the low population of women seafarers today.

3.2 Data Collection

The period of data collection carried out between March and August 2019. Due to the specific target population, this research considers seafaring merchant navy officers including those not actively sailing as relevant informants. With no definitive list of seafaring women officers which is amounting to 0.7 percent of the total seafaring population (BIMCO & ICS, 2016), opportunistic and snowball sampling methods were used (Teddlie & Yu 2007). The questionnaire carried out using google forms and all participants expressed their consent to the participation. Of the 55 responses, four responses were ignored because, two were duplicate responses from the same participant and two other responses were from those with the rank of ratings (i.e., non-officer). Hence, the total number of responses analysed was 51 out of 55 responses.
3.3 Questions asked in Questionnaire

The questions asked for the purpose of this research fall into three categories, namely personal information, work experiences on board, opinions of marine engineers and the engine department. Details of questionnaire is included in the Annex 1.

The first section concerning personal information were enquired to establish the demography of the participants, including age, nationality, gender, department they work in, rank on board, currently sailing in domestic or foreign going vessels and motivation in pursuing a seafaring career.

The second section on work experiences establishing the context pertaining to career prospects including obstacle faced in their career, having a mentor, negative work experiences, and difference of treatment between the two genders.

First-hand account of impression of engine department and marine engineers’ job environment provides insight to any traditional perception and offer valuable data bring for future research on this specific population.

3.4 The Respondents Demography

3.4.1 Who Are the Respondents?

The survey questionnaire response were collected from 19 different countries in 5 continents proving that seafaring is a multinational and multicultural workforce shown in the Table 2 below.
Table 2 Respondents’ Nationality

Source: Survey by Chan F.M., 2019.
The distribution between the 51 respondents from the two genders and operational departments, the deck and engine departments, found in Table 3 below.

Table 3 Respondents Distribution between Gender and Departments

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>Deck</td>
<td>13</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: Survey by Chan F.M., 2019.

The respondents were further categorised in 4 groups namely, Female Engineer Officer (EF), Female Deck Officer (DF), Male Engineer Officer (ME) and Male Deck Officer (MD), listed in Tables 4, 5, 6 and 7 respectively. Among the respondents, 63% of the respondents are currently still actively sailing of which 43% are women officers.
<table>
<thead>
<tr>
<th>Participant No.</th>
<th>Nationality</th>
<th>Age</th>
<th>Sailing Experience</th>
<th>Rank</th>
<th>Active Sailing</th>
<th>Region of Sailing</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF-1</td>
<td>Singaporean</td>
<td>20</td>
<td>less than 1 year</td>
<td>Cadet</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-2</td>
<td>Irish</td>
<td>20</td>
<td>less than 1 year</td>
<td>Cadet</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-3</td>
<td>Singaporean</td>
<td>21</td>
<td>less than 1 year</td>
<td>Cadet</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-4</td>
<td>Singaporean</td>
<td>21</td>
<td>less than 1 year</td>
<td>Cadet</td>
<td>No</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-5</td>
<td>Malaysian</td>
<td>22</td>
<td>less than 1 year</td>
<td>Cadet</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-6</td>
<td>Filipino</td>
<td>22</td>
<td>1 to 3 years</td>
<td>Cadet</td>
<td>No</td>
<td>Domestic</td>
</tr>
<tr>
<td>EF-7</td>
<td>Singaporean</td>
<td>23</td>
<td>less than 1 year</td>
<td>Cadet</td>
<td>No</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-8</td>
<td>Swedish</td>
<td>25</td>
<td>1 to 3 years</td>
<td>3/E</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-9</td>
<td>Bangladeshi</td>
<td>25</td>
<td>1 to 3 years</td>
<td>Cadet</td>
<td>No</td>
<td>Domestic</td>
</tr>
<tr>
<td>EF-10</td>
<td>Norwegian</td>
<td>26</td>
<td>4 to 6 years</td>
<td>3/E</td>
<td>Yes</td>
<td>Domestic</td>
</tr>
<tr>
<td>EF-11</td>
<td>Indian</td>
<td>26</td>
<td>1 to 3 years</td>
<td>4/E</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-12</td>
<td>Singaporean</td>
<td>26</td>
<td>4 to 6 years</td>
<td>2/E</td>
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<td>Foreign going</td>
</tr>
<tr>
<td>EF-13</td>
<td>Romanian</td>
<td>27</td>
<td>1 to 3 years</td>
<td>3/E</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-14</td>
<td>Danish</td>
<td>27</td>
<td>less than 1 year</td>
<td>4/E</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-15</td>
<td>American</td>
<td>29</td>
<td>4 to 6 years</td>
<td>3/E</td>
<td>No</td>
<td>Domestic</td>
</tr>
<tr>
<td>EF-16</td>
<td>Singaporean</td>
<td>30</td>
<td>4 to 6 years</td>
<td>2/E</td>
<td>No</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-17</td>
<td>Panama</td>
<td>33</td>
<td>more than 10 years</td>
<td>2/E</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-18</td>
<td>Singaporean</td>
<td>33</td>
<td>1 to 3 years</td>
<td>4/E</td>
<td>No</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-19</td>
<td>Australian</td>
<td>34</td>
<td>7 to 9 years</td>
<td>2/E</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-20</td>
<td>Romanian</td>
<td>34</td>
<td>4 to 6 years</td>
<td>ETO</td>
<td>No</td>
<td>Foreign going</td>
</tr>
<tr>
<td>Participant No.</td>
<td>Nationality</td>
<td>Age</td>
<td>Sailing Experience</td>
<td>Rank</td>
<td>Active Sailing</td>
<td>Region of Sailing</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------</td>
<td>------</td>
<td>--------------------</td>
<td>------</td>
<td>----------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>EF-21</td>
<td>Argentinian</td>
<td>35</td>
<td>more than 10 years</td>
<td>C/E</td>
<td>Yes</td>
<td>Domestic</td>
</tr>
<tr>
<td>EF-22</td>
<td>Indian</td>
<td>36</td>
<td>more than 10 years</td>
<td>C/E</td>
<td>No</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-23</td>
<td>Swedish</td>
<td>39</td>
<td>more than 10 years</td>
<td>2/E</td>
<td>Yes</td>
<td>Foreign going</td>
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<tr>
<td>EF-24</td>
<td>American</td>
<td>41</td>
<td>4 to 6 years</td>
<td>4/E</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EF-25</td>
<td>Norwegian</td>
<td>46</td>
<td>more than 10 years</td>
<td>C/E</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
</tbody>
</table>

Source: Survey by Chan F.M., 2019.

Table 5 Female Deck Officer Participants

Source: Survey by Chan F.M., 2019.
Table 6 Male Engineer Officer Participants

<table>
<thead>
<tr>
<th>Participant No.</th>
<th>Nationality</th>
<th>Age</th>
<th>Sailing Experience</th>
<th>Rank</th>
<th>Active Sailing</th>
<th>Region of Sailing</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM-1</td>
<td>Italian</td>
<td>21</td>
<td>1 to 3 years</td>
<td>Cadet</td>
<td>Yes</td>
<td>Domestic</td>
</tr>
<tr>
<td>EM-2</td>
<td>Italian</td>
<td>21</td>
<td>1 to 3 years</td>
<td>Cadet</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EM-3</td>
<td>Singaporean</td>
<td>21</td>
<td>less than 1 year</td>
<td>Cadet</td>
<td>No</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EM-4</td>
<td>British</td>
<td>23</td>
<td>less than 1 year</td>
<td>Cadet</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EM-5</td>
<td>Finnish</td>
<td>31</td>
<td>more than 10 years</td>
<td>C/E</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EM-6</td>
<td>British</td>
<td>51</td>
<td>more than 10 years</td>
<td>C/E</td>
<td>No</td>
<td>Foreign going</td>
</tr>
<tr>
<td>EM-7</td>
<td>Argentinian</td>
<td>52</td>
<td>more than 10 years</td>
<td>C/E</td>
<td>Yes</td>
<td>Domestic</td>
</tr>
<tr>
<td>EM-8</td>
<td>Filipino</td>
<td>54</td>
<td>more than 10 years</td>
<td>C/E</td>
<td>No</td>
<td>Foreign going</td>
</tr>
</tbody>
</table>

Source: Survey by Chan F.M., 2019.

Table 7 Male Deck Officer Participants

<table>
<thead>
<tr>
<th>Participant No.</th>
<th>Nationality</th>
<th>Age</th>
<th>Sailing Experience</th>
<th>Rank</th>
<th>Active Sailing</th>
<th>Region of Sailing</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM-1</td>
<td>Italian</td>
<td>22</td>
<td>less than 1 year</td>
<td>Cadet</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>DM-2</td>
<td>Italian</td>
<td>23</td>
<td>1 to 3 years</td>
<td>Cadet</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>DM-3</td>
<td>British</td>
<td>24</td>
<td>1 to 3 years</td>
<td>Cadet</td>
<td>Yes</td>
<td>Foreign going</td>
</tr>
<tr>
<td>DM-4</td>
<td>Panamanian</td>
<td>43</td>
<td>less than 1 year</td>
<td>3/O</td>
<td>No</td>
<td>Foreign going</td>
</tr>
<tr>
<td>DM-5</td>
<td>British</td>
<td>60</td>
<td>more than 10 years</td>
<td>Captain</td>
<td>No</td>
<td>Foreign going</td>
</tr>
</tbody>
</table>

Source: Survey by Chan F.M., 2019.
3.4.2 Sail the Seas – What are the Main Motivations?

Within the respondents of seafaring officers, their motivation for pursuing a seafaring career varies. From Table 5 shown below, the top three comments received were Passion, Career Progression and Personal Challenge. These three reasons had a common ground for being self-motivated by individual respondents.

Table 8 Main Motivations for Pursuing a Seafaring Career

![Bar graph showing the percentage of each motivation]  
Source: Survey by Chan F.M., 2019.

In addition, from the results, it is observed that majority of the respondents from engine department stated ‘passion’ as their primary motivation, while respondents from deck department stated ‘career progression’ as their main motivation.
Chapter 4: Breaking the Glass Ceiling

4.1 Professional Life On Board

4.1.1 Work Below the Deck - The Engine Department

Based on the questionnaire circulated in this research, the respondents gave their opinions of the perceptions of the engine department when compared to deck department. The majority described the work environment as ‘harsh’ and ‘hot’ while the work often described as ‘physical’ and ‘hands-on’ as mentioned previously in Chapter 2.2. Respondent DF-9, a Pilot, who did dual competency and had experience working in both in departments states that the engine department is “definitely a physically more challenging department”.

The respondents also commented on the characteristics of the work nature as ‘dynamic’ and ‘technical’ due to the complexity of shipboard systems requiring them to hone a wide range of mechanical, electrical-electronics knowledge and technical skills. This provides the engineer officers a value-add on their professional career prospects. To elaborate this, participant EM 6, Chief Engineer mentioned “Both professional departments with substantial skill sets. I found engineering to be more of a key trade that is far more translatable to shore side working”.

According to an observation conducted by Simons (2013), due to the unique working conditions engineers perform in, especially in tending to machineries, they may carry out an entire shift without any human contact. However, amongst the comments received, it is worthy to note that the participants felt that there is a strong sense of comradery within the engine department. Respondent DF 7, Third Officer, mentioned that engine department is “more cohesive, they work together…” and another respondent, EF-23; a second engineer further elaborates this as stating "Engine team works more as a group than on deck. We are more depending on each other within the group and complete each other with different abilities.”
The author believes that the rationality underlying these statements is that the unique work environment and high performance level of engineer officers provides them with situations where comradeship are established and strengthened over time. An engine cadet, EM1, expresses this as follows: “The Engine department it's a family, nobody cares if you are man or female, young or old or from a different nation. Everybody support each other, even more during the emergency.”

To emphasize further on the duty engineer officers carry out in an event of emergency, the tragic maritime accident of RMS Titanic is an example. All of the 35 engineers on board have perished in the engine room, out of sight, while on duty to sustain evacuation efforts by fighting to keep lighting, pumps and communication systems alive (Cornwell, 2012). In 1914, Titanic Engineer's Memorial was unveiled in Southampton, UK, to commemorate them. As reported in a news article, Councillor John Hannides was interviewed and elaborated their heroism in a statement:

"I think I speak for the majority in recognising the heroism and sacrifice of the ship's engineers, who remained at their posts until the bitter end, keeping the lights working so that passengers had a chance of finding their way to the lifeboats.” (BBC, 2010).

Drawing from the author own personal experience, for example, planned maintenance of major components such as unit overhaul of the main propulsion engine is a collective effort of the entire engine department team, where the entire process can take hours to complete. During this time, communication and cooperation between various ranks is vital to ensure each procedure is properly executed, which in turn establishes team spirit. In addition, troubleshooting is also a key aspect in the work of engineer officers. During this process of problem solving, they collectively work together towards a single outcome, which helps establishing comradeship.
4.1.2 Having a Mentor

Apprenticeship system has long been the foundation of training on board, where the experience imparts knowledge of the trade to the inexperience of which shipboard training programme is an example. However, apprenticeship approach is formal and standardized in this line of work. The expression of ‘learn the ropes’ stemmed from the inexperienced sailors learning ridging on sail ships.

In mentorship, aside from imparting knowledge, the mentor may also take up the role of benefactor and/or advocate for the mentee, offering advices and solutions to problems or obtaining job for the mentee through their network (Siddiqui, 2014). Participant DM-1, a deck cadet, emphasised this “Yes, a mentor is beneficially because he can transmit his values and experience.”

According to Cedeno (2019), in the third WMU International Women’s Conference, the mentorship she found gave her a “sense of belonging and comradery helped her thrive and come into her own”. Through the response received, 45% of them have mentors and found it beneficial to their career of which 34% are female officers, as seen in Table 6. The following are the comments elaborating how they have benefited from having mentor(s):

“Yes, to have mentor means that you have your guardian angel with you all the time, because he/she encourage you all the time "Yes, you can do it, event that you are undersized and you don't have so many power, you can do it. You are smarter than a lot of engineer. Think about this". His words "no power, but really smart" make me to think twice about daily routine on board and all the time I succeed to do my jobs easier.” (EF-13, Third Engineer).

“Someone to talk to and relate to as you come through challenges/questions that has already been through it.” (DF-6, Second Officer).
Mentors also play a fundamental role in providing support, which may play a substantial role in seafarer retention. A comment from participant EF-7, engine cadet, stated that the mentor “answered my queries and gave me advices, which pushed me to finish my 6 months on board”.

Table 9 Participant with Mentorship on board

<table>
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<tr>
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<th>DF &quot;YES&quot;</th>
<th>DF &quot;NO&quot;</th>
<th>EF &quot;YES&quot;</th>
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Source: Chan F.M., 2019.

Through the author’s experience from working in the engine department, each engineer officer is assigned to be in-charge of certain responsibilities and machineries found on the ship. It is often seen when a job is being carried out by an engineer officer of higher rank, the lower rank engineer officer is there to assist. During this time, the senior ranking officer may impart certain insider tips and ‘know-hows’ to the junior, or pointing out certain characteristics that is unique to that particular situation, system or ship. In addition, although engineer officers are higher in rank than engine ratings, the knowledge of the engine ratings are highly valued. Engine ratings’ contract periods tend to be longer then engineer officers. They spend a longer employment period on the assigned vessel than engine officers, hence, are more familiar with the ‘behaviour’
of the said vessel. Engine rating’s often are able to provide information such as location of particular valves or handling of certain fabricated special tool for overhaul of machinery component. Some senior engine ratings who have years of experience at sea also provide valuable technical and ‘hands-on’ skills that are often imparted to junior engineer officers, particularly engine cadets, when working together.

Despite the positive impact of having mentor on board, through the observed responds from the questionnaire, 31% who stated not having mentor on board are female engineer officers. The possible reasons could be due to the prevailing discriminations faced by female engineer officers that will be discussed in the next section.

4.2 Prevailing Discriminations

According to findings from Turnbull (2013) women face gender-based discrimination, which place them at a disadvantage in labour market where their roles in the workforce are perceived as supplementary and not inclusive.

Through the respondents’ feedback of their negative experience and challenges faced, the majority of the women seafarers commented on the following aspects: (1) gender discrimination in capability; (2) biased perception on the role of women in the society; and (3) sexual harassment. To be more specific, this research will focus only on aspects (1) and (2) as sexual harassment is an established issue and has been previously researched on by other significant institutions.

4.2.1 Gender Discrimination on Female Officers’ Capability

From the review of open-ended questions in the questionnaire circulated in this research, the respondents gave their opinions of negative experiences and challenges faced. Majority of the women officers expressed frustrations due to gender-based discrimination on their work capabilities. A comment from respondent EF-22, Chief Engineer, illustrates a case of such discrimination:
“There was one particular incident when I was a 3/E and the Chief Engineer told me if there was man in my place he would have done a lot of work. I very politely asked him what a male 3/E would have done differently than I did or I am doing and he had no response to that.”

In some cases, such discrimination also prioritizes the males’ capability over the females’ despite having lesser experience and expertise. According to the experience of participant EF 18, Fourth Engineer, she had found that senior officers would rather ask a junior male officer to get some works done simply because the senior have more trust in the male officer to complete the task despite of her having more experience than the male junior does. In another case, women’s input are not valued and brushed off, an engine cadet, EF 6, raised this issue commenting that some of her officers would not trust her to do her work and refuse to let her help them when there is a job order because they think that she could not do a proper job.

Such discrimination may affect the career prospects of a female officer negatively, for example, concerning promotion, the feedback from Captains and Chief Engineers are highly regarded when the employer considers the officer’s promotion. When a Captain or Chief Engineer does not have faith in one’s capability, it is natural that they will not advocate for that particular officer’s promotion. A female Third Officer, DF 8, highlighted this in her response:

“This past ship, I was the 2nd most experienced 3/O on board and yet when they were looking for someone to move up into a day third spot I was COMPLETELY overlooked. Luckily, the purser […] told me to go talk to the Captain before requesting someone shore side. So I did and then the Captain seemed to be like "oh yeah" like as if he didn’t realize he had someone right in front of him who was fully capable and more than qualified.”
These discrimination subjects the women seafarers to uncalled scrutiny professionally due to how they are perceived by fellow crewmembers. An example of this was found amongst the respondents from a female officer, DF-9, who stated the following:

“I still do face discrimination. Every action is over analysed by the guys and you have to be on the ball, prove yourself all the time! Everyone has their weak moment/a bad day and the eagles are waiting to generalize that all women are moody/ incompetent/ not able”

Existence of discrimination in their capabilities is acknowledged by one of the male respondents, EM 6, Chief Engineer, stating the following, “many male officers and crew have a low opinion of female officers, despite in many cases, their abilities to outperform their male counterparts.”

4.2.2 Bias Perception of the Image of Women

Gender-based roles established from traditions and society norms have ingrained deeply in most populations. Shipping, the second oldest industry, has a long history of being male dominated and not welcoming women on board. Superstitious tales from the days of sail ships, discouraging and even blaming misfortunes that have occurred on the presence of a woman, should she be on board the ship. However, such tales are of no scientific basis, these perceptions and bias creates a barrier for women today pursuing a seafaring career today. The image of a women in society’s perception is evident in a comment from a respondent, EF 23, Second Engineer “As a female, there are still this old view that women should be quiet, cute and smile. Some men are behaving childish and ignores orders from women.”

From the responses received, the women officers still face deep-rooted perception from their male crewmembers questioning their career choice that are often discouraging. The following statements from the female officer respondents illustrates this:
“There is a second mate who has out right said that there would be no problems on board if there weren’t any women on board.” (DF 7, Third Officer)

“Because I’m a girl and don’t belong on ships” (EF 8, Third Engineer)

“Sometimes some senior officers will comment that you are female, you are not suitable for the trade, and engineer’s work is too tough for me. I should choose an office work rather.” (EF-18, Fourth Engineer)

“Discrimination based on my size. I'm 1.55 metres and petite, people think all I do is drink coffee and order others around.” (EF-12, Second Engineer)

However, this negative perception does not contain solely within the seafaring community, as previously discussed, MET institutes and employers have their share of responsibility. A comment from respondent, EF 23, Second Engineer, stated that she had heard from a vetting inspector from a major oil company and an immigration officer from the USA commenting that women should not be at sea.

4.3 Respect Earned and Acceptance Gained

In the environment of seafaring, competency is highly regarded and respect showed to senior officers (Captain, Chief Engineer, Chief Officer and Second Engineer) are not just out of authority but also because of their competency.

Despite the discrimination women officers’ face on their professional capability, discussed in Chapter 4.2.1, there were substantial responses that stated they were able to overcome the initial resistance and allowed their competency do the convincing, seen in the following:
“Once the co-workers realised that I was capable and was working on par with them, there was no such difference in treatment.” (EF 22, Chief Engineer)

“I find that initially people are sceptical about my ability to do the job but they soon realise I’m more than capable.” (EF 19, Second Engineer)

“When I sign on, nobody trust me and take a while to win their trust.” (EF 13, Third Engineer)

However, amongst the female respondents some have pointed out that when trying to prove their competency they have to work harder compared to the male officers. A comment from a third officer, DF 5, highlights this by stating, “Woman work three times more than a man. But when they understand that you are able to manage your job all your work problems are done.”

In the context of the engine department, machineries and its systems are gender blind. A knowledgeable and well-trained operator will be able to operate these machineries and its systems smoothly. Two male respondents from engine department commented on this aspect as follows:

“In the engineering department, from personal experience, women who put the effort in are treated the same as any male.” (EM 4, Engine Cadet)

“As long as a female works because she likes the work and because it interests her, instead of doing this work only to proof a point, she will be treated as anyone else.” (EM 5, Chief Engineer)

Drawing from the author’s personal experience, during her first appointment as Second Engineer, being the first female in her company, she was faced with the same perception. However, this was quickly overcome during the first unit overhaul
maintenance carried out in less than two weeks of her taking over as she was able to lead her staff effectively and complete the work efficiently. This suggests that despite the initial resistance women who work in engine department possibly gain acceptance from their crewmembers due to the work nature having their proficiency and competency put to test especially during troubleshooting and emergency situations.
Chapter 5: Conclusion and Recommendations

5.1 Conclusion

5.1.1 Importance of the Engineer Officers

Working on board a merchant vessel for an extended period and being away from family are challenging itself. The unique work environment of the engine department is often described, as ‘harsh’ and ‘hot’, is the addition to the layer of conditions an engineer officer needs to adapt to. The work of an engineer officer below the deck is not visible to the public eye and is often associated with ‘physical’ and ‘hands on’ as the characteristic of work nature. Despite shipboard environment is being described as a total institution in literature reviews in Chapter 2, through the research it can be concluded that comradery in engineer officer is established through their nature of work and the strong sense of duty. As found through the research, both male and female engine officers’ main motivation is passion driven, where the exposure and experience is key. On top of that, as found in both literature reviews and research, engine officers have transferable skill sets that provide them with flexibility to find shore based job that provide them with better employment security.

Shipping sector is experiencing a loss in its human capital, especially the seafarers, while evolving quickly with the vast development of technology, automation and new shipboard systems. The importance of engineering in today’s era of Industry 4.0 is based on the highly complex cyber-physical systems, for example, intermodal transport network that shipping is part of. The demands for innovation and advanced technology are especially evident in solving current issues such as climate change. Ship owners are exploring options available to them to meet the increasingly stringent environmental regulations. For the effective operation and, above everything else, the safety of the ship, crew and the protection of marine environment, engineer officers play crucial role as they have the second least potential to be replaced by automation (WMU, 2019). This indicates that the value of engineer officers are irreplaceable and
they are the final frontier between HMI processes in relation to shipboard systems. In order to have a sustainable workforce of the future, it is imperative that nurturing the future engineer officers starts today.

Women represent half of the human capital potential. By integrating women into the work force of engineer officers, diversifies the work force also increases innovation, creativity and competitive levels that are beneficial to all stakeholders in the maritime industry. The solution to problems of the future requires actions to be taken today and maximising the human capital is one. Collective efforts are also have to be made to rectify the ‘leaky pipeline’ for women engineer officers at each stage, from education to career progression. This is potential not to be neglected.

5.1.2 The Challenges and Perceptions of Female Engineer Officers

Through the research, one of the main challenges female engineer officers have to face are gender-based discrimination in particular to their capability and the biased perception of the image of women. The majority of the women officers expressed the frustrations due to gender-based discrimination on their work capabilities. In some cases, such discrimination also prioritizes the males’ capability over those of the females despite having lesser experience and/or expertise. Such discrimination may also affect the career prospects of a female officer negatively with respect to promotion. These discriminations subjects the women seafarers to uncalled scrutiny professionally due to how they are perceived by fellow crewmembers. In addition, the women officers still face deep-rooted perception from their male crewmembers questioning their career choice that are often discouraging. This negative perception does not contain solely within the seafaring community but within the maritime sector.

The other challenge that women have to face is gaining acceptance by the crewmembers of the assigned vessel. As discussed in Chapter 2, women in male dominated environments are responsible of ‘fitting in’ rather than being integrated into the work environment, which was highlighted in particular with PPE. As a result
derived from the questionnaire, statements from female officer respondents shows that they need to work extra hard to prove their proficiency is compatible to those of male counterparts. However, based on the facts that with the nature of the work engineer officers carry out involving shipboard machineries and its systems which are gender blind. They are able to show their competency and proficiency through their work in turn gain the respect and acceptance from their male counterparts on board ship.

Amongst respondents, 18% of the female engineer officers, had positive experienced with mentorship while on board, providing them with support and valuable insights and advices with the work and living situation on board ships. This support system may play a substantial role in retention of seafarers and mentors have the potential to advocates for the integration of female engineer officers which needs to be explored in futures studies.

5.2 Limitations of the Research

Due to the restriction of time and amount of participants able to reach in this period, the results is an estimate to the current challenges and perception faced by female engineer officers. The small sample size and little information available in the literature review also limits the scope for of this research of this particular population.

5.3 Recommendations

In line with the third WMU International Women’s Conference, the result of the research found that the new studies should be undertaken to provide current information and establish data on the population of women engineer officers to increase visibility.

Recruitment efforts should highlight the importance of the role of engineer officer and the contribution the work brings positive impacts towards the improvement of female
engineer officers in the working environment of the shipping industry. As results, some recommendation can be made such as:

1. Increase the visibility of female engineer officers and women seafarers at large to the public and secondary schools. The importance of the work engineer officers carry out should be highlighted and the career prospects in relation to seafaring and flexibility of possible jobs ashore that value seagoing experience.

2. Research should be further carried out on the areas lacking and needing improvements to integrate women into the seafaring sector rather than ‘fitting in’.

3. Involvement of stakeholders on the campaigns for integration of the women in shipping sector in particular female engineer officer should include all major stakeholders and secondary stakeholders to provide a holistic approach.

To conclude, despite the glass ceiling, female engineer officers are joining the ranks and establishing themselves in the shipping community through their professionalism and competency. Their integration should be a priority and not an afterthought as shipboard community is every seafarer’s home away from home, as adequately expressed by an engine cadet participant in the following:

“The Engine department it's a family, nobody cares if you are man or female, young or old or from a different nation. Everybody support each other, even more during the emergency.”
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Appendix

Appendix 1. Questionnaire Sample

Survey on Female Marine Engineers' Work Experience On Board Ships

The purpose of this survey is for my Master's Dissertation with World Maritime University regarding female marine engineers work experiences/ impressions on board commercial ships. The information collected will be treated with full confidentiality and ethical conduct. Your voluntary participation is greatly appreciated.

* Required

1. Email address *

2. I understand the purpose of this survey and consent to participating in it. *
   
   Mark only one oval.

   □ Yes
   □ No

3. Nationality. *

4. Gender *
   
   Mark only one oval.

   □ Female
   □ Male

5. Age. *
6. Which department do you work for on board ship? *
   Mark only one oval.
   - Engine Department
   - Deck Department

7. Work experience on board (seafaring period). *
   Mark only one oval.
   - less than 1 year
   - 1 to 3 years
   - 4 to 6 years
   - 7 to 9 years
   - more than 10 years

8. Highest appointment (rank) attained.

9. Region ships you sailed on trade? *
   Mark only one oval.
   - Foreign going.
   - Domestic.

10. Are you still actively sailing? *
    Mark only one oval.
    - Yes
    - No

11. What is your motivation to pursue this career? *

12. Did you face any resistance while pursuing this career choice (eg. school/ family/ job opportunities)? Please elaborate. *

13. Did you have mentor(s) during your career? *
    Mark only one oval.
    - Yes
    - No
14. If yes, did you find having a mentor beneficial to your career? And, why is that so?

15. What is your impression of Engine Department compared to Deck Department?*

16. In your opinion, what do you think is the most challenging part of working on board? *

17. Have you ever encounter any negative experience(s) at work? Please elaborate. *

18. Do you find any difference in treatment co-workers give between the two genders? Please elaborate. *

19. What is your opinion on the reason of current small population of female Marine Engineers? *

20. In your opinion, what measures will help encourage more females to embark in this career path? *