Innovative competence development paradigm: a case study of simulator-based sea-time equivalency and its implications for the Philippines as a maritime labour-supplying country

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INNOVATIVE COMPETENCE DEVELOPMENT PARADIGM:

A Case Study of Simulator-based Sea-time Equivalency and its Implications for the Philippines as a Maritime Labor-supplying Country

By

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Philippines

A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the reward of the degree of

MASTER OF SCIENCE
in

(MARITIME EDUCATION AND TRAINING)

2020

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Declaration

I certify that all the material in this dissertation that is not my 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 personal views and are not necessarily endorsed by the University.

(Signature):

(Date): 22 September 2020

Supervised by: Professor Michael Ekow Manuel
Supervisor’s affiliation World Maritime University
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Abstract

Title of Dissertation
Innovative Competence Development Paradigm: A Case Study of Simulator-based Sea-time Equivalency and its Implications for the Philippines as a Maritime Labor-supplying Country

Degree
Master of Science

The primary goal of Maritime Education and Training (MET) systems is to develop professionals that possess the competency required by the maritime industry. Therefore, competence development is a fundamental process in MET. This study interrogated Simulator-based Sea-time Equivalency as a form of innovative competence development and its implications for maritime labour-supplying countries. Innovation in the context of this research is a rethinking of traditional competence development paradigms that meets the requirements of the STCW Convention. The concept of Innovative Competence Development aims to address identified issues and challenges and optimize the MET system to better serve the needs of stakeholders and the international maritime community. Interestingly, the innovative approach presented in this study did not necessitate a paradigm shift in competence development but rather, a deeper understanding of the dynamics and interaction of MET’s constituent parts: framework, infrastructure, and human resource. For innovation to thrive in MET, it is imperative that Administrations create a conducive environment by enacting regulations and policies informed by inclusive discussions and empirical knowledge.

KEYWORDS: innovation, competence development, simulators, equivalency
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<th>Description</th>
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<tbody>
<tr>
<td>BIMCO</td>
<td>Baltic International Maritime Council</td>
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<tr>
<td>BSMarE</td>
<td>Bachelor of Science in Marine Engineering</td>
</tr>
<tr>
<td>BSMT</td>
<td>Bachelor of Science in Marine Transportation</td>
</tr>
<tr>
<td>CHED</td>
<td>Commission on Higher Education</td>
</tr>
<tr>
<td>CMO</td>
<td>CHED Memorandum Order</td>
</tr>
<tr>
<td>EMSA</td>
<td>European Maritime Safety Agency</td>
</tr>
<tr>
<td>IAMU</td>
<td>International Association of Maritime Universities</td>
</tr>
<tr>
<td>IMO</td>
<td>International Maritime Organization</td>
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<tr>
<td>JCMC</td>
<td>Joint CED MARINA Circular</td>
</tr>
<tr>
<td>MARINA</td>
<td>Maritime Industry Authority</td>
</tr>
<tr>
<td>MET</td>
<td>Maritime Education and Training</td>
</tr>
<tr>
<td>METI</td>
<td>Maritime Education and Training Institution</td>
</tr>
<tr>
<td>MHEI</td>
<td>Maritime Higher Education Institution</td>
</tr>
<tr>
<td>MLSC</td>
<td>Maritime Labour-Supplying Country</td>
</tr>
<tr>
<td>MITI</td>
<td>Maritime Training Institution</td>
</tr>
<tr>
<td>NRC</td>
<td>National Research Council</td>
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<tr>
<td>OBT</td>
<td>Onboard Training</td>
</tr>
<tr>
<td>OIC-EW</td>
<td>Officer In Charge of an Engine Watch</td>
</tr>
<tr>
<td>OIC-NW</td>
<td>Officer In Charge of a Navigational Watch</td>
</tr>
<tr>
<td>PRISMA</td>
<td>Preferred Reporting Items for Systematic Reviews and Meta-analyses</td>
</tr>
<tr>
<td>PSG</td>
<td>Policies, Standards and Guidelines</td>
</tr>
<tr>
<td>SBSTE</td>
<td>Simulator-Based Sea-Time Equivalency</td>
</tr>
<tr>
<td>SLR</td>
<td>Systematic Literature Review</td>
</tr>
<tr>
<td>STCW Code</td>
<td>Seafarers' Training, Certification and Watchkeeping Code</td>
</tr>
<tr>
<td>STCW Convention</td>
<td>International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended</td>
</tr>
<tr>
<td>USCG</td>
<td>United States Coast Guard</td>
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<tr>
<td>WMU</td>
<td>World Maritime University</td>
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Chapter 1: Introduction

1.1 Background and context

1.1.1 The Philippines as a maritime labour-supplying country

The Philippines has historically been a dominating force in the maritime labour market and preferred by shipping companies the world over. While the Philippines is the primary source of shipboard ratings, the country has ceded the top spot as merchant officers’ supplier to China (Baltic International Maritime Council [BIMCO], 2015). According to the Manpower Report published by BIMCO (2015), the estimated global pool of sea-based workers is 1,647,500, composed of 774,000 officers and 873,500 ratings. The supply of officers has increased by 24% and rating supply by 17% from 2010. The 68,723 strong world fleet is expected to increase by 2025, and as a consequence, the demand for officers is forecasted to likewise increase in the same year, with a projected shortage of 147,500 workforces. The growing seafaring population of the Philippines continues to be an essential contributor to its economy. Sea-based overseas Filipino workers accounted for $5.79 billion in remittances in 2015 ($4.84 billion in 2012) from more than 406,531 seafarers deployed (366,865 in 2012) (Maritime Industry Authority [MARINA], 2015).

The Philippines, as a human resource provider, is capitalising on the global maritime labour demand. Some of the most prolific businesses in its maritime sector are those providing services related to human resource: maritime higher education institutions (MHEIs) offering programs leading to a bachelor’s degree in either marine transportation (BSMT) or marine engineering (BSMarE), maritime training institutions (MTIs) providing mandatory courses stipulated in the Seafarers’ Training,
Certification and Watchkeeping Code (STCW Code) to ensure the proficiency and competency of maritime professionals, and human resource agencies catering to the crewing requirements of international shipping companies.

Unfortunately, despite years of educating and training maritime professionals, the Philippines is experiencing a decrease in the quality of maritime officers produced (MARINA, 2018). The series of inspections conducted by the European Maritime Safety Agency (EMSA) in the Philippines since 2009 uncovered major non-conformities in, among other things, the administration, implementation and monitoring of the country's maritime education and training programs. Maritime education and training institutions (METIs) have failed to maintain their programs' and courses' full compliance with the requirements of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended (STCW Convention) (MARINA, 2018). Despite the issuance of Executive Order No. 63 mandating MARINA as the sole Administration responsible for the country's full and effective implementation of the STCW Convention, the agency is still suffering from a degree of fragmentation of its administrative powers. MARINA (2018) stated in its development plan that overlapping mandates and functions with other national government agencies have led to the proliferation of substandard and non-compliant maritime institutions and training centres.

1.1.2 International legal framework for equivalency, use of simulators, and sea service
The STCW Convention and Code details the requirements for equivalency, certification, sea-time, and the use of simulators. Article IX (Equivalents) of the STCW Convention effectively permits Administrations to implement "other educational and training arrangements, including those involving seagoing service..." so long that the length of sea-time, together with the acquired knowledge and skills in shipboard operations, promote the same standard of safety and pollution prevention required by the Convention (International Maritime Organization [IMO], 2017, p. 16).
Moreover, Regulation I/12 (Use of Simulators) legitimises the use of simulators for training, assessment of competency, and demonstration of continued proficiency. It gives importance to the performance standards and all pertinent provisions related to the conduct of training, assessments of competency, and demonstrations of continued proficiency using simulators, required for the issuance of a certificate under the STCW Convention (IMO, 2017).

The minimum requirements for the certification of seafarers, in particular for officers, are specified under Chapters II and III of the STCW Convention, differentiated by vessel gross tonnage and type of voyage for the deck department, and propulsion power for the engine department. Specific requirements for the issuance of a certificate of competency (COC) that were of significance in this research were the minimum length of sea-time and periods of watchkeeping duties required by the STCW Convention for entry-level deck and engine officers as indicated in these two chapters (IMO, 2017).

An equally important requirement for the issuance of a COC is meeting the standards of competence (SOC) laid out in the STCW Code. The IMO (2017, p. 77) defines the standard of competence as "the level of proficiency to be achieved for the proper performance of functions onboard ship in accordance with the internationally agreed criteria as set forth herein and incorporating prescribed standards or levels of knowledge, understanding and demonstrated skill". The SOC tables outline the competences required for specific levels of certification with the necessary underpinning knowledge, understanding and proficiency (KUPs) and how these competences are to be demonstrated and criteria for evaluating their achievement. An examination of the SOC tables makes it evident that the demonstration and assessment of specific competences are partly underpinned by simulator training (see Appendix C).
1.1.3 Conventional competence development paradigms

The shipping industry relies heavily on a sufficient and steady supply of competent and highly-skilled workforce, and maritime education and training (MET) is tasked with sustaining the quality of the human resource the industry needs. Generally, seafarers’ ‘quality’ is defined by their competence, which is an aggregate of possessing both technical knowledge and practical skills. While theories are primarily imparted in a classroom environment, practical skills were traditionally learned by shipboard experience and recently by training in simulators (Renganayagalu, Mallam, Nazir, Ernstsen, & Haavardtun, 2019). Practical on-the-job training provides authentic and valuable onboard operational experience (Sellberg, Lindmark, & Rystedt, 2018) and is considered the most effective way of learning the skills required of seafarers (Halonen & Lanki, 2019). However, the effectiveness of practical field training is hampered by limitations in resources, environment, temporality, nature of training being conducted, and safety concerns (Halonen & Lanki, 2019; Sellberg et al., 2018; Renganayagalu et al., 2019). Comparatively, simulator training provides an environment wherein trainees are able to develop their skills without any of the adverse risks (Sellberg et al., 2018) or limitations associated with field training. Moreover, the technological advances made in computational power and simulation technologies have increased the utilisation of simulator training for developing the skills required for complexed and hazardous shipboard operations (Hjelmervik, Nazir, & Myhrvold, 2018).

Nevertheless, Sellberg et al. (2018) argue that simulator-based training should not replace sea-time, as the ‘hybrid’ nature of simulator activities are different from experiences onboard. On the other hand, Halonen & Lanki (2019) concluded that simulator training complements existing training paradigms for emergency response training. Røds & Gudmestad (2019) had a similar view in that simulator-based training supplements conventional risk-reducing measures. Interestingly, there was a shift in the perceived value of simulators for training military personnel. Over time, it was
reported that simulator-based training gained more value compared to in-service training (Malik & Zafar, 2015).

1.1.4 Innovative use of simulators

The effectiveness of simulator-based training in developing not only the technical, procedural, and operational skills but also non-technical skills needed in a complex workplace, have extensively been researched and proven by scholars (Halonen & Lanki, 2019; Sellberg et al., 2018; da Conceição, Mendes, Teodoro, & Dahlman, 2019). In recent years, we have seen innovation in the applicability of simulators beyond competence development: accident investigation, promoting safety of navigation (Mohović, R., Rudan, & Mohović, Đ., 2012) and research in related fields (Felsenstein, Benedict, & Baldauf, 2013).

1.2 Problem statement

Unfortunately, several issues affect onboard training, the placement of cadets on merchant vessels for onboard training (OBT) being of particular importance in this research. In a study conducted by International Association of Maritime Universities (IAMU) on the quality of onboard training, they concluded that there is a "bottleneck in the current system" that restricts trainees' access to OBT opportunities, placement, and completion (IMO, 2016). Among the factors that contribute to the "stagnation of trainees" and consequent deterioration of seafarer quality include lack of widespread industry acceptance of the importance of OBT, and the challenges Administrations face in giving full and complete effect to the STCW Convention (IMO, 2016). Although scholars may argue the STCW Convention's structure gives credence even to its recommendatory parts, there is much to be desired in its application.

The issue on the quality of OBT existed well before the 2010 Manila amendments of the STCW Convention (IMO, 2016, 2008a). While several initiatives were put forward within the IMO in this regard (IMO, 2008b, 2008c), the issue has persisted in the industry. The projected rise in the shortage of seafarers in the foreseeable future also
aggravates the situation of the maritime industry and highlights the need to prioritise the exploration of expedient recourses to the problem.

This study presents the concept of innovative competence development in the form of simulation technology as a practical option in meeting the seagoing requirements of the STCW Convention, underpinned by the value of simulator training. Specifically, this research focused on simulator-based sea-time equivalency (SBSTE) and its possible implications for maritime labour-supplying countries (MLSC). The Philippines was selected as a sample MLSC from which the study developed. The justification for this choice is expounded in Chapter three.

1.3 Research aims and objectives
The dissertation aimed to develop an analytical framework that can be used in interrogating the plausible ramifications of operationalising SBSTE in maritime labour-supplying jurisdictions. This framework will inform Administrations of the challenges and opportunities, and make vital recommendations that will help influence national policy direction for competence development and compliance with the STCW Convention.

The objectives of the study are:
- To examine the development of the concept of sea-time equivalency among the member States of the IMO
- To investigate the current administrative framework of the Philippines’ MET and ascertain the degree to which it encourages the implementation of SBSTE as a viable recourse for competence development
- To determine the perceptions of the Philippines’ MET stakeholders concerning conventional competence development paradigms and SBSTE as an option for competence development
• To explore the existing infrastructure and human resource of the Philippines’ MET related to SBSTE and determine its sufficiency and adequacy for competence development as required by the STCW Convention
• To make recommendations for the Philippines’ MET with regards to SBSTE as an expedient recourse for competence development

1.4 Research questions

The research aims to seek answers to the following questions:

1. How have the discussions related to SBSTE progressed since being placed in the IMO agenda after the 2010 Manila amendments of the STCW Convention?
2. How do stakeholders of the Philippines’ MET perceive conventional competence development paradigms in developing their watchkeeping competence?
3. How do the Philippines’ MET stakeholders perceive SBSTE in the context of being a viable recourse for developing watchkeeping competence?
4. How conducive is the Philippines’ MET system to operationalising SBSTE as a viable recourse for competence development?

1.5 Research methodology and methods

The research employed a case study design with SBSTE as the subject and its implications for maritime labour-supplying countries as the analytical frame. Mixed methods of data collection were used to address the research questions.

A document analysis was done through a systematic literature review (SLR), which included academic texts and grey literature in order to map out the development of the discussion on SBSTE at the IMO. Semi-structured interviews and self-administered questionnaires were used to gain an understanding of the conduciveness and perceptions of the Philippines’ MET system and its stakeholders.
1.6 Outcomes

The SLR provided a macro-perspective of innovative competence development, in general, and simulator-based sea-time equivalency, in particular, from IMO member states which have implemented such Administrative practice. A survey questionnaire was used to determine stakeholders' perceptions of conventional and innovative competence development paradigms, and the acceptable ratio and limit for SBSTE. A comprehensive understanding of the required administrative regulations and policies, training and assessment frameworks, infrastructure, and human resources to operationalise SBSTE in the selected maritime labour-supplying country was acquired through a semi-structured interview.

1.7 Scope and limitations

The scope of the research was limited to the development of the concept of simulator-based equivalency, perceptions of conventional and innovative competence development models, and the conduciveness of the selected maritime labour-supplying country in operationalising SBSTE. The research did not focus on how the implementation of SBSTE can be optimised for the selected jurisdiction.

1.8 Structure of the dissertation

Chapter two provides the foundation literature on training and assessment frameworks, simulator infrastructure, human resource, and administrative regulations and policies relevant to innovative competence development. The research methodology, instrumentation and data collection, and data analyses are presented in Chapter three. Chapter four contains the finding of the systematic literature review. The qualitative research findings are outlined in Chapter five. Chapter six presents the qualitative research findings. The discussion of the research findings, including the SLR, is found in Chapter seven. Chapter eight presents the conclusions, recommendations, and suggested areas of focus for future research.
Chapter 2: Literature review

2.1 Simulator-based training and assessment framework

2.1.1 Framework design

A significant body of examined peer-reviewed papers in the maritime domain focused on training framework and identified certain elements that need to be regarded during the design process of simulator-based training. Training methodology, or how training is conducted, can significantly impact the skills acquisition by simulator training. It has more effect on the variation in trainee performance compared other performance variables, such as motivation level and perceived difficulty of the tasks (Nazir, Øvergård, & Yang, 2015; Nazir & Hjelmervik, 2017). Nazir & Hjelmervik (2017) argued that the effectiveness of training for complex shipboard tasks using simulators required a thorough framework design that accounts for the impact of these factors. Furthermore, a training framework design that facilitates experiential learning and interaction with the simulation scenario of increasing complexity and difficulty can circumvent the technological, psychological, and organisational limitations of current training methods (Hjelmervik et al., 2018).

An essential task in framework design is creating a realistic situation. (Mohović et al., 2012). An effective framework design that guarantees the relevance of simulator training to actual emergencies entails setting objectives and exercise scenarios that enable skills transfer (Halonen & Lanki, 2019). According to Malik & Zafar (2015), designing a framework for effective simulator-based training is a complex process that involves the concepts of fidelity, validity, reliability, and uniformity. Sellberg (2017a) stated that the effectiveness of framework design needs an allocation of resources used
in simulator-based training. Fidelity of the framework and simulator equipment should be coupled with developing the pedagogical competence of instructors. Moreover, the time frame of the simulation exercise should account for the subjectivity and complexity of the evaluation/assessment model employed (da Conceição et al., 2019). Rods & Gudnagstad (2019) posited that the framework design needs to be evaluated by feedback from field experts for quality assurance purposes. Lastly, instructors contribute to the reliability and uniformity of simulator training by imparting all outcomes intended for the simulator exercise invariably across different training sessions and trainees (Malik & Zafar, 2015).

2.1.2 The complexity of simulated tasks
An emergent theme among the examined studies is the complexity of simulator-based exercises and how this should be addressed in training. In their experimental study, Hjelmervik et al. (2018) found out that performance in simulator training improved when participants were exposed to the gradually increasing complexity of tasks. Simulator training framework should, therefore, be structured to ensure that students can effectively adapt to the complexity of the exercise. (da Conceição et al., 2019). While the introduction of simulator exercises of increasing complexity can arguably contribute to the effectiveness of simulator-based training, relevant theories and empirical studies should form the basis for sequencing the complexity of tasks (Nazir & Hjelmervik, 2017). Renganayagalu et al. (2019) concluded that simulator fidelity should increase as the trainee progress through the learning stages of presentation, guidance, practice, and assessment. However, the authors also noted that the correlation between simulator fidelity and the effectiveness of training had not been clearly defined. In Figure 1, Nazir proposed a framework that accounts for the development of competence using a staggered and heterogenous exercise complexity.

"It consists of a three-stage hierarchy with increasing demands concerning technical and relational complexity and time pressure. The training is centered on handling real-time operations with increasing complexity starting from
basic components of the process, advancing to real-time operations, and reaching high technical and relational complexity that needs to be handled in situations with limited time and uncertainty in data" (Nazir et al., 2015, p.1519).

**Figure 1**

*The three stages of complexity*

![Diagram showing three stages of complexity: Normal situations, Higher Complexity Interdependence among sub-sections, Abnormal situations, Simulated Accidents, Team work, Stress based training, Risk based training, Control loops during abnormality, Shared mental models among teams.]

Source: Nazir et al., 2015, p.1522

2.2 Infrastructure

2.2.1 Simulator fidelity

The fidelity of simulator equipment is a common area of interest among scholars that study the effectiveness and impact of simulator training in MET. According to Renganayagalu et al. (2019), fidelity is the degree to which simulators reproduce the experience in an actual work context. Simulator fidelity can be categorised as either physical or functional. Physical fidelity concerns the similarity of the simulator's tactile, auditory and visual elements to the operational environment being replicated while functional fidelity refers to the extent of similarity between the simulator behaviour and the actual processes. Training outcomes are implied to be directly
correlated with simulator fidelity. By increasing the fidelity, as emphasised by training providers and simulator developers, skills transfer from simulators to the operational environment is maximised (Renganayagalu et al., 2019). However, there is an argument that simulator fidelity alone does not make for effective simulator training. The result of an experiment in training for complex tasks with simulators showed that subjects’ performance improved when participants were introduced to increasing functional fidelity during simulator training compared to a participant subjected to high fidelity at the onset of training (Hjelmervik et al., 2018). Simulator fidelity contributes to the validity of simulation by the inclusion of elements found in the actual environment (physical and behavioural realism). High fidelity simulators generally enjoy more confidence than low fidelity systems. However, the outfitting of high-fidelity systems does not mean forgoing the process of simulation validation. Validation is a continuous process of examining what the change in simulation fidelity contributes to the effectiveness of simulator training (Malik & Zafar, 2015).

Sellberg (2017a) views the fidelity of simulation as significant in training for the complex and high-risk nature of operational situations encountered onboard ships. However, despite the current fidelity achieved by simulator systems, she noted that there would always be a disparity in the perception of realism. While simulator instructors are instrumental in ensuring the closeness of the simulation to actual experiences onboard ship (Malik & Zafar, 2015), the discrepancy in perceived realism (simulator glitches) should also be taken as an opportunity for instruction (Sellberg, 2017a). Sellberg (2017a) warns that higher fidelity simulator systems are far from being self-instructing tools and offers marginal learning improvements over lower fidelity options. Therefore, competent and meticulous simulators instructors who monitor and facilitate the trainees' progress throughout the exercise is crucial in augmenting the realism of simulator-based training regardless of the level of fidelity.
2.2.2 The simulator as pedagogic tools

Simulator technology can support the instructor's task of monitoring, assessing, and providing feedback to trainees.

"The results highlight the role and importance of using the built-in technologies in the simulator environment as pedagogical tools for instructions throughout the different phases of the training" (Sellberg et al., 2018, p.262).

Halonen & Lanki (2019) stated that the discussions and evaluation during debriefing sessions improve with the replayability of the simulation exercise, simulator-generated performance reports, and exercise video recordings. The repeatability of simulation scenarios contributes to the applicability of simulation (training) to emergency response by assessing procedural and operational limitations and test different situational responses. Moreover, the various simulator functions (repeatability, replayability, performance reports, video recording) available can overcome the limitations of simulation fidelity.

2.3 Human resource

The reviewed literature identified several instructional methods that are integral in simulator-based training. Instructors need to account for the theoretical foundations, general principles and existing regulations, related to the competence being developed in the conduct of simulator-based training. Simulator instructors should link the theoretical and practical components of competence by providing instructional support throughout the simulator training (briefing, simulation, debriefing). The task of monitoring, assessing, and providing feedback to trainees can be supported by simulator technology (Sellberg et al., 2018) Malik & Zafar (2015) contributed that providing instructional feedback is vital in performance improvement and maintaining trainees' interest in simulator training. Additionally, the instructor's effective use of training resources such as training aids and the simulator environment is considered
an instructional technique (Malik & Zafar, 2015). Simulator training for emergency response requires instructors that have contextualised expertise in the competence being developed; otherwise, the training risks developing trainees competent in operating simulators (Halonen & Lanki, 2019).

2.4 International legal framework for certification, training and assessment, and recognition of certificates

2.4.1 Minimum requirements for certification

Regulations II/1 and III/1 enumerate the minimum requirements for the certification of officers in charge of a navigational watch (OIC-NW) and engine watch (OIC-EW). Table 1 provides a summary of the requirements for certification.

<table>
<thead>
<tr>
<th>Qualification</th>
<th>OIC-NW</th>
<th>OIC-EW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation</td>
<td>Regulation II/1</td>
<td>Regulation III/1</td>
</tr>
<tr>
<td>Limitation</td>
<td>500 gross tonnage or more</td>
<td>750 kW</td>
</tr>
<tr>
<td>Seagoing service</td>
<td>onboard training 12 months&lt;sup&gt;1&lt;/sup&gt;</td>
<td>combined workshop skills and onboard training 12 months&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>onboard training 36 months</td>
<td>onboard &amp; workshop skills training 36 months&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Watchkeeping Standards of competence</td>
<td>6 months</td>
<td>6 months</td>
</tr>
<tr>
<td></td>
<td>Section A-II/1</td>
<td>Section A-III/1</td>
</tr>
</tbody>
</table>

Source: STCW Convention

2.4.2 Training and assessment

Regulation I/6 of the STCW Convention mandates the administration, supervision, and monitoring of seafarers’ training and assessments; including the qualifications of the human resources involved in such activities (IMO, 2017). Table 2 provides a summary

<sup>1</sup> When onboard training is part of approved training program.
<sup>2</sup> When onboard training is part of approved training program.
<sup>3</sup> Not less than 30 months shall be service in the engine department.
of the qualification requirements for instructors, training supervisors, and assessors under Section A-1/6.

Table 2

In-service training and assessment of competence qualification requirements

<table>
<thead>
<tr>
<th>In-service training</th>
<th>appreciation of training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>understanding of specific training objectives</td>
</tr>
<tr>
<td></td>
<td>qualified in the training task</td>
</tr>
<tr>
<td></td>
<td>simulator instructional techniques</td>
</tr>
<tr>
<td></td>
<td>simulator type-specific practical operational experience</td>
</tr>
<tr>
<td>supervisor</td>
<td>full understanding of training program</td>
</tr>
<tr>
<td></td>
<td>full understanding of specific training objectives</td>
</tr>
<tr>
<td>Assessment of competence</td>
<td>an appropriate level of knowledge &amp; understanding of competence</td>
</tr>
<tr>
<td>Assessment of competence</td>
<td>qualified in the assessment task</td>
</tr>
<tr>
<td>Assessment of competence</td>
<td>assessment methods and practice</td>
</tr>
<tr>
<td>Assessment of competence</td>
<td>practical assessment experience</td>
</tr>
<tr>
<td>Assessment of competence</td>
<td>simulator type-specific practical assessment experience</td>
</tr>
</tbody>
</table>

Source: STCW Convention

2.4.3 Recognition of certificates

Article VI also mandates the endorsement of certificates issued by Administrations. Regulation I/2 further clarifies and categorises the endorsement as an affirmation of 1) the issuance of a certificate and 2) the recognition of an endorsed certificate. In recognising a certificate endorsed by a Party, Regulation I/10 effectively permits an Administration to evaluate the Party’s MET system to confirm that the STCW Convention's requirements are met (IMO, 2017).

---

* Includes training and assessment within an institution.
* When conducting training using simulators.
* When conducting training using simulators.
* When conducting assessment using simulators.
* Under the supervision and to the satisfaction of an experienced assessor.
* Including inspection of facilities and procedures.
* Standards of competence, training and certification, and quality standards.
2.5 Administrative regulations and policies on the remission of sea-time

The Commission on Higher Education (CHED) Memorandum Order (CMO) No.38\textsuperscript{11} Series of 2016 provided the policies, standards and guidelines (PSG) for the remission of sea-time by workshop skills training for marine engineering students, giving effect to the provision outlined in Chapter III/1 of the STCW Convention. The PSG identified MHEIs with an approved BSMarE program as training providers, set the criteria for granting authority to operate\textsuperscript{12}, mapped the competences relevant to workshop skills training, and provided a sea-time remission matrix.

Furthermore, the joint commission of CHED and MARINA published Memorandum Circular (JCMC) No.01\textsuperscript{13} wherein Annex B\textsuperscript{14} of the document provided the guidelines for the implementation of onboard training programs. Section 10 focused on workshop skills training for BSMarE students, echoing much of the provisions of CMO No.38 but introducing a subtle change in the approval procedure, now jointly conducted by CHED and MARINA.

\textsuperscript{12} Then granted by CHED's Office of Programs and Standards Development (OPSD).
\textsuperscript{13} JCMC No.01 Series of 2019 Policies, Standards and Guidelines for the Bachelor of Science in Marine Transportation and Bachelor of Science in Marine Engineering Programs.
Chapter 3: Research methodology and methods

3.1 Introduction
A research design is a framework for producing evidence that is suited to both a specific set of criteria (reliability, replicability, and validity) and the research questions of interest to the researcher (Bryman, 2012). The case study design investigates a topic from a focused scope of context (Gray, 2009) and necessitates a comprehensive and thorough investigation of that case, from which then the researcher elicits a theoretical analysis (Bryman, 2012). For research to be considered a case study, two elements need to be present and distinguished: the subject (the 'what') and the analytical frame (the 'why') (Thomas, 2011). This research explored an option for competence development, with a specific focus on simulator-based sea-time equivalency – the subject – in the context of its possible implications for maritime labour-supplying countries – the analytical frame. Moreover, Gray (2009) stated that the case study is an appropriate methodology when asking how and why current developments happen, the occurrence of which is beyond the control of the researcher. The research was motivated to seek answers to how the discussions on SBSTE advanced in the IMO, how stakeholders perceive conventional and innovative competence development paradigms, and how conducive a specific maritime labour-supplying country is in operationalising SBSTE?

3.2 The rationale of the Philippines as a case study backdrop
It should be emphasised that although it may be instinctive to conclude that the Philippines is the subject of the case study, that is not the state of affairs as explained in the previous paragraph. To date, only the Netherlands, USA, and most recently, the
U.K. has communicated to the IMO of their choice to operationalise SBSTE. This occurrence makes SBSTE a unique and significant case when examined from the perspective of its possible implications for a maritime labour-supplying country. In this regard, the researcher deemed the Philippines, with its status as leading labour-supplying nation, the proliferation of METIs in the country, and the challenges faced by its Administration in giving full and complete effect to the STCW Convention, as the best backdrop from which the research emerged and proceeded. Furthermore, the researcher did not endeavour to make generalisations from conclusions made based on the Philippines' context but instead, aimed to generate an analytical framework that can be used by other Administrations to interrogate the implications of operationalising SBSTE in their jurisdiction.

3.3 Instrumentation and data collection

3.3.1 Semi-structured interview
The researcher used semi-structured qualitative interview (see Appendix B) to gain an understanding of the Philippines' MET system's conduciveness in operationalising novel paradigms for competence development in terms of the administrative regulation and policies, training and assessment frameworks, infrastructure, and human resource required for SBSTE. Respondents were selected by purposive, non-probability sampling technique based on the following criteria:

a. representatives from the Administration involved in administering the Philippines' MET system;
b. representatives from the Philippines' METIs involved in competence development;
c. representatives from the Philippines' maritime industry involved in human resource management; and
d. persons in similar roles.
3.3.2 Self-administered questionnaire

A self-administered questionnaire (see Appendix A) was used to answer research question two and three, which focused on the Philippines' MET stakeholders' perception of conventional and innovative competence development paradigms. The survey had a total of 26 questions composed of a 5-point rating scale for the perception dimensions of adequacy\textsuperscript{15}, importance\textsuperscript{16}, and overall quality\textsuperscript{17} of onboard and simulator training as conventional competence development paradigms; appropriateness\textsuperscript{18}, desirability\textsuperscript{19}, and level of agreement\textsuperscript{20} to SBSTE as an innovative competence development model; and pre-determined choices for the acceptable ratio and limits of SBSTE. Moreover, several open-ended questions were included in the survey to allow the respondents to provide context to the ratings given. To keep the questions independent from the rest and to reach as many respondents as practically possible, the researcher administered the questionnaire through Google forms. The questionnaire was pilot tested by the researcher's colleagues from the MSc in Maritime Affairs program of the World Maritime University (WMU) before disseminating to the target responses. Fifteen responses were gathered for instrument validation, which yielded no change in the survey's content. Target respondents were individuals from the Philippines' Maritime Administration, METIs, and industry representatives, including seafarers and shipping companies.

\textsuperscript{15} Q: Where you given sufficient opportunities to perform supervised watchkeeping in various conditions and circumstances?
\textsuperscript{16} Q: How important was the training paradigm in developing your skills and competence in watchkeeping?
\textsuperscript{17} Q: As a whole, rate the quality of the training paradigm you received in developing your skills and competence in watchkeeping? *
\textsuperscript{18} Q: How appropriate is simulator-based sea-time equivalency in satisfying the seagoing requirements of the STCW Convention for gaining the first COC? Appropriate in this context means 'suitable' or 'fitting'
\textsuperscript{19} Q: How desirable is simulator-based sea-time equivalency as a viable option for developing the watchkeeping skills and competence of seafarers? Desirable in this context means 'worth doing' and 'seen as advantageous or beneficial'
\textsuperscript{20} Q: How likely are you to agree to the above-stated proposal for simulator-based sea-time equivalency as a viable option for developing the watchkeeping skills and competence of seafarers?
3.4 Data analyses

3.4.1 Qualitative analyses
Version 8.4.4 (1135) of the ATLAS.ti Qualitative Data Analysis Software was used for the qualitative analyses of the systematic literature review (SLR), and the data gathered from the semi-structured interviews and self-administered questionnaire. For the SLR, the researcher examined the eligible studies to generate themes and synthesise recurrent ideas. The documents were coded corresponding with the following themes: basis, considerations, definitions, issues, motivations, and the ratio of SBSTE. Table 3 provides a summary of the code/themes generated through the qualitative analysis.

Data collected from the semi-structured interview were coded to generate insights into the adequacy, challenges, and opportunities for SBSTE from the respondents' perspectives concerning the identified aspects. The summary of generated codes is tabulated in Table 4. Responses from the open-ended questions of the survey were also coded to generate themes regarding the defining factors of the quality of conventional and innovative competence development paradigms, and the perceived advantages and disadvantages of SBSTE.

| Table 3 |
|__________|
| **Summary of generated themes from the systematic literature review** |
| themes | code count |
| application | 6 |
| basis | 9 |
| considerations | 12 |
| definition | 8 |
| desirability | 2 |
| in practice | 8 |
| issues | 3 |
| motivation | 8 |
| ratio | 6 |
### Table 4

*Summary of generated themes from semi-structured interviews*

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Themes</th>
<th>Code count</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Administrative regulations and policies</strong></td>
<td>Adequacy</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Enforcement</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Policy-making</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Literal interpretation of the STCW Convention</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ambivalent interpretation of policies</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Human resource &gt; monitoring</td>
<td>2</td>
</tr>
<tr>
<td><strong>Training and assessment frameworks</strong></td>
<td>Adequacy</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Framework design</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>&quot;Minimum standards&quot;</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Unfocused objectives</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Verifying attainment of objectives</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Human resource &gt; pedagogic knowledge</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Stakeholder demands &gt; standard curriculum</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Stakeholder demands &gt; industry requirement</td>
<td>2</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td>Adequacy</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Cost &gt; limited utilisation of simulators</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Cost &gt; counterfeit software / license</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Enforcement</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Human resource &gt; technical knowledge</td>
<td>2</td>
</tr>
<tr>
<td><strong>Human resource</strong></td>
<td>Adequacy</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Sufficient</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Unfocused training objectives</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Insufficient training</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Technical operation of simulator</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Pedagogic knowledge</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Updated professional experience</td>
<td>1</td>
</tr>
</tbody>
</table>

3.4.2 Quantitative analyses

The Microsoft Excel was used to analyse the quantitative data gathered from the self-administered questionnaire. The frequency of perception dimensions scores was
representative of the descriptive statistics due to the ordinal nature of the 5-point rating scale\textsuperscript{21} used in the survey.

3.5 Ethical issues

"The ethics of research concern the appropriateness of the researcher's behaviour in relation to the subjects of the research or those who are affected by it" (Gray, 2009, p.68).

Having this in mind, the researcher proceeded with data collection, putting the utmost priority on ensuring 'respondents' safety'. Safety, in this context, was achieved by abiding by the established principles of research ethics: avoid harm to participants, ensure informed consent of participants, respect the privacy of participants, and avoid the use of deception.

Respondents were provided with sufficient information about the study before seeking their consent for involvement. Furthermore, the researcher explicitly stated that the respondents' cooperation was voluntary and that they had the right to withdraw from the interview at any time.

Approval of the WMU Research Ethics Committee was sought before commencing data collection. The data gathered was treated with confidentiality and anonymity, the access of which was restricted to the researcher, his supervisor and assessors alone. All encoded data were securely deleted upon the conclusion of the study.

3.6 Systematic literature review

The researcher utilised a systematic literature review to examine how the concept of sea-time equivalency has developed among the member states of the IMO. The inclusion criteria of the systematic review were:

\textsuperscript{21} Q12-14, Q16-18, Q20-21, and Q23 of the self-administered questionnaire (Appendix A).
• peer-reviewed articles about equivalent arrangements for obtaining seagoing service utilising simulator-based training;
• peer-reviewed articles should be published after the 2010 amendments of the STCW Convention.

Although the provisions for the use of simulators in the education and training of seafarers were included in the STCW Convention as far back as 1995, the 2010 Manila amendments marked a significant change in the area of competence development with the inclusion of non-technical competences.

The researcher employed a multi-tiered search of the EBSCO Discovery Service for the World Maritime University for the systematic review, based on a technique proposed by Bearman, Palermo, Allen and Williams (2015) and used by Sellberg (2017b) on her study of simulators for training and assessment. The first-level search used words related to simulators in maritime education and training: "maritime", "education", "train***", "simulat***". The asterisk was used to capture the permutations of some keywords to widen the scope of the search. The search generated 25 results which were then limited to peer-reviewed articles within the defined temporal scope, removing six papers in the process. The researcher included recommended studies (n=2) which did not meet the temporal criterion (published after 2010). Nevertheless, these were studies that corroborated the Netherlands and USA’s decision to implement SBSTE and were therefore relevant to the research question being answered. The remaining articles' abstracts and conclusions were reviewed for eligibility based on substantiating studies on the use of simulators to gain sea-time equivalency. Unfortunately, only three articles were eligible for the systematic review as all other papers focused on various aspects of the use of simulators for training but did not provide any evidence to interrogate SBSTE. The outcome of the database search has highlighted a significant gap in terms of relevant studies providing evidence to support the implementation of SBSTE. The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) provided a flow diagram to assist in the review process.
(see Table 5) (Moher, Liberati, Tetzlaff, & Altman, 2009). Appendix D details the eligible literature.

**Table 5**

*Flow of systematic literature review*

<table>
<thead>
<tr>
<th>Process</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Records identified through database search</td>
<td>25</td>
</tr>
<tr>
<td>Additional records identified through other sources</td>
<td>2</td>
</tr>
<tr>
<td>Records after duplicates removed</td>
<td>27</td>
</tr>
<tr>
<td>Records screened</td>
<td>27</td>
</tr>
<tr>
<td>Records excluded</td>
<td>6</td>
</tr>
<tr>
<td>Full-text articles assessed for eligibility</td>
<td>21</td>
</tr>
<tr>
<td>Full-text articles excluded</td>
<td>18</td>
</tr>
<tr>
<td>Studies included in qualitative analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Moher et al., 2009
Chapter 4: Findings of the systematic literature review

This chapter presents the findings of the systematic literature review. A definition of simulator-based sea-time equivalency in the context of this research is provided at the end of the chapter.

4.1 Definition of simulator-based sea-time equivalency

There is uniformity in the definition of sea-time equivalency among countries that implement this sort of innovative competence development paradigm despite taking distinct strategies. The Netherlands has taken a simple approach and defined sea-time equivalency as the reduction of sea-time using simulator training (Wulder, Schraagen, van Hattem, & Blook, 1996; Uitterhoeve, van Heel, Werner & van der Ende, 2018). The National Research Council (NRC) U.S. (1996) has taken a more systematic method and identified two principal elements of their remission policy: 'sea-time equivalency' and 'remission of sea time'. The NRC defined sea-time equivalency to mean a formal judgement on utilising structured training, which included the use of simulators, to reduce the required service onboard being favoured over traditional onboard training. This definition signified that the experiences gained by simulator training were equivalent to onboard training in developing and reinforcing the knowledge, skills and abilities being addressed. The remission of sea time, on the other hand, meant acquiring sea time 'credits' by simulator training, which effectively substituted for actual time onboard (NRC, 1996).
4.2 Interpretation of the legal framework for sea-time equivalency

The discussion on the definition of sea-time equivalency naturally gravitated to the STCW Convention and the identified jurisdictions' interpretation of relevant guiding principles. The concept of equivalency is legitimised by Articles IX which effectively permits Administrations to adopt training arrangements, including sea time, different from what is prescribed in the STCW Convention so long as it guarantees an equivalent level of safety and environmental protection. Additionally, the STCW Convention prescribes the minimum seagoing service requirement\textsuperscript{22}, which includes a minimum time spent for watchkeeping\textsuperscript{23}, for the certification of entry-level deck and engine officers (IMO, 2017).

The Administrations of the Netherlands and USA made liberal interpretations of the then STCW Convention that rationally introduced innovation in developing the watchkeeping competence of their seafarers. Wulder et al. (1996) argued that while the use of simulators was supported for training and assessment within the framework of the STCW Convention, simulator-based training as a form of equivalency for sea time was not explicitly stated in the Convention, but neither was there a provision that prohibited such forms of reduction. The Netherlands has taken this interpretation of the STCW guidelines and crafted national legislation that incorporated arrangements for sea-time equivalency (Uitterhoeve et al., 2018). Similarly, the United States Coast Guard (USCG) deemed the language of 1995 amendments of the STCW Convention as an adequate basis to develop policies related to sea-time equivalency. The authors further claimed that although remissions were technically sanctioned, these forms of equivalency were discouraged by the STCW Convention (NRC, 1996).

Interestingly, the USCG stated that even though the previous amendment iteration of the STCW Convention did not categorically define 'seagoing service', the Convention

\textsuperscript{22} Refer to Table 1: Minimum requirements for certification
\textsuperscript{23} Refer to Table 1: Minimum requirements for certification
did imply the terminology to mean service onboard a vessel (NRC, 1996). The 2010 amendments of the STCW guidelines define seagoing service to mean "service onboard a ship relevant to the issue or revalidation of a certificate or other qualification" (IMO, 2015). Despite the existing categorical definition, Uitterhoeve et al. (2018) contended that the use of simulator is an acceptable equivalent for training ship experience.

4.3 The motivation for and desirability of sea-time equivalency

The challenges to the structure of seafarers' curricula in accommodating the STCW requirements on minimum sea time, the shortage of berths for shipboard training, and the perceived benefits of simulator training were the principal motivating factors for integrating sea-time equivalency in the certification process among identified jurisdictions. In 1989, the Dutch Maritime Administration decided to retire their training vessel in place of putting up a simulator training facility based on their position that simulators were far more efficient and practical training tools that can adapt to technologically-driven changes in competence requirements. The subsequent loss of the training ship has created challenges for Dutch maritime academies in providing their students with berths for onboard training, and consequently completing the required minimum sea time within the timeframe of the curricula; obstacles they have in common with their contemporary at King's Point (Wulder et al., 1996). These issues prompted the deliberation and authorisation of gaining sea time by innovative means of competence development (Uitterhoeve et al., 2018; NRC, 1996). The USCG saw sea-time equivalency as an opportunity to promote more training and use of simulators, based on the recognised value of simulator-based training. (NRC, 1996).

Uitterhoeve et al. (2018) claimed that at the time of introducing sea-time equivalency within its national legislation, the Netherlands enjoyed the support of its stakeholders from the academia and industry. In contrast, the NRC (1996) reported that the USCG's policy related to sea-time equivalency was marred with scepticism, equivocation, criticism, and lack of support among stakeholders.
4.4 Basis and ratio for sea-time equivalency

The Netherlands and USA's Administrations applied different strategies in establishing the foundation for their sea-time equivalency policy. On the one hand, the Dutch Ministry of Transport\textsuperscript{24} commissioned a scientific study that, among other things, investigated whether 30 days of sea time can be offset by simulator training and the necessary duration needed for the remission to inform their policy on sea-time reduction. A comparison of two groups, one group subjected exclusively to a three-week simulator training course and the other group having completed 330 days of onboard training, was conducted to measure navigational watchkeeping performance. The experiment concluded that the simulator group performed significantly better compared to the sea group (83% vs 53%, respectively) and that the former group required less time to attain 50% performance level (190 hours vs 310 hours, respectively). The empirical study determined the ratio as 1:6, five days of simulator training (at 8 hours per day) to replace 30 days of sea time, based on perceptible data. The study also inferred that 30 days of sea time being substituted by ten days of simulator training would yield better performance level (76%) (Wulder et al., 1996; Uitterhoeve et al., 2018).

On the other hand, the USCG developed their simulator-based remission policy in an ad hoc manner based solely on anecdotal evidence from professional mariners working as simulator trainers and trainees who provided mostly positive training feedbacks. This approach resulted in a similar ratio of 1:6, one day of simulator training being equivalent to six days of sea-time. The USCG's sea-time equivalency policy covered a limited reduction of the minimum seagoing service required by the STCW Convention (NRC, 1996).

\textsuperscript{24} Now the Ministry of Infrastructure and Water Management
4.5 Issues and considerations for sea-time equivalency

The systematic review highlighted fundamental issues and considerations in the training and assessment framework, limitations in the tasks and skills that can be effectively addressed, qualification and experience of instructors and assessors, and the cost associated with simulator-based training. The NRC discussed the need to ensure the quality of the equivalent simulator-based training in terms of its reliability in achieving the specific learning objectives and the competence required for certification. For the consideration by the USCG, the NRC urged responsible entities to establish and implement suitable standards for the simulator-based equivalency training and assessment framework, to include the infrastructure required (simulator facilities and equipment). They also suggested modelling the simulator-based equivalency training after the structured program found onboard training vessel to improve its effectiveness (NRC, 1996).

In terms of developing the skills and competence required for officer work onboard ship, the NRC recommended a thorough understanding of the simulated tasks to ensure that the training will provide equivalent attainment of proficiency. Moreover, it was suggested to have methods for appraising the efficacy of the transfer and retention of skills, and in cases where the transfer and retention are subpar, it should be supplemented with further training by appropriate means (NRC, 1996). Utterhoeve et al. (2018) cited a need to focus on developing soft skills and higher levels of the cognitive domain on top of developing technical skills.

The role and qualification of simulator instructors and assessors were deemed relevant and integral in sea-time equivalency. It was proposed that human resource involved in equivalency training should undergo instructor training that will be a prerequisite for certification (NRC, 1996). One of the aims of the research conducted by Wulder et al. (1996) was to assess the evaluation techniques employed in determining the performance of their test groups. They concluded that assessors' evaluation methods,
standards, and tendencies have a significant impact on the assessment (Wulder et al., 1996).

The issue of the costs associated with simulator-based training was also a recurring theme among the documents analysed. The NRC (1996) commented that the simulator-based training for sea-time equivalency has costs consideration, the impact of which needed to be identified and addressed. On the Dutch side, they pointed out that their implementation of sea-time equivalency required a significant investment in the necessary infrastructure, including updating (Uitterhoeve et al., 2018).

4.6 Summary
The systematic literature review aimed to examine how the concept of sea-time equivalency progressed among IMO member states which implement such Administrative practice. In the process of going through the SLR, the researcher has gained a macro-perspective of sea-time equivalency which is integral in interrogating SBSTE in the context of the selected maritime labour-supplying country.

The similarity in contextualising SBSTE implies that both the Netherlands and the USA view simulator-based training as an adequate replacement for developing the competence of seafarers. However, the partiality towards simulator-based training does not take away from the value of conventional competence development models such as onboard training. The NRC has gone at length to emphasise the importance of both the structured and unstructured nature of onboard training in developing and improving seafarer’s competence. They presented cases wherein the unstructured nature of training encountered onboard commercial vessels offer trainees with contingent situations that were essential in developing professional skills and equally critical soft skills through experiential learning and instructional scaffoldings. Meanwhile, training vessels operated by merchant academies provide the same immersive total institution environment as merchant ships but with the elements of
structured instruction and monitoring of trainees' progress within a defined schedule of activities customarily found within a classroom setting (NRC, 1996).

The researcher qualified SBSTE in the context of this study by synthesising information taken from this systematic literature review, as follows:

"Simulator-based sea-time equivalency is the use of simulator-based training, which complements onboard training and grants limited sea-time credit, for developing a prospective officer's watchkeeping competence as required by the STCW Convention".
Chapter 5: Quantitative research findings

An overview of the quantitative research findings is presented in this chapter.

5.1 Quantitative data: research participants

5.1.1 Self-administered questionnaire
The self-administered questionnaire gathered 55 respondents in total. The female representation in the survey was at 6%, the 31-35 age group constituted 45% of the respondents, deck and engine shipboard departments were equally represented, the majority of respondents were operational level officers, and 74% are active seafarers. The summary of respondents' demographic profiles is found in Figure 2.

**Figure 2**
*Summary of participants' demographic profiles – self-administered questionnaire*
Table 6 presents the descriptive statistics related to the survey participants’ years of service onboard as ship officers. This data surmises that the respondents have adequate sea-time experience.

Table 6

*Years served onboard – self-administered questionnaire*

<table>
<thead>
<tr>
<th></th>
<th>Deck</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Max</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Mean</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>146</td>
</tr>
</tbody>
</table>

5.1.2 Semi-structured interview

In total, there were 9 participants for the semi-structured interview. Table 7 presents the breakdown by expertise. The table also includes descriptive statistics of years
served onboard as officers and in their areas of expertise. The data highlights the interview participants' sufficient time at sea and contributions to their respective fields.

Table 7

*Number of interview participants and years served at sea and in MET*

<table>
<thead>
<tr>
<th>No. of respondents</th>
<th>Administration</th>
<th>Industry</th>
<th>Academe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sea</td>
<td>MET</td>
<td>Sea</td>
</tr>
<tr>
<td>Min</td>
<td>9</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Max</td>
<td>9</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Mean</td>
<td>9</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

5.2 Quantitative analysis: perception of conventional competence development paradigms

Descriptive quantitative analysis was used to answer research question two by determining the Philippines’ MET stakeholders’ perception of conventional competence development paradigms (TCDP), namely onboard and simulator training. Perception dimensions of adequacy, importance and overall quality of TCDP were reflected in questions Q12 to Q14 for onboard training and Q16 to Q18 for simulator training of the self-administered survey, respectively. The frequency and rankings of the TCDP perception dimensions scores are reflected in Tables 4 and 5.

5.2.1 Descriptive statistics: onboard training

As indicated in Table 8, 83% of the respondents have a positive perception of the adequacy of onboard training they received in developing their competence in watchkeeping. Similarly, three out of four respondents perceived the importance of the onboard training they received in developing their watchkeeping competence as

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25 How do the Philippines’ MET stakeholders perceive conventional training paradigms in developing the competence required by the STCW Convention?
'highly important'. Majority of the respondents (76%) have a positive perception of the overall quality of onboard training they received.

Table 8

Descriptive statistics: Perception of onboard training

<table>
<thead>
<tr>
<th>Adequacy</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all adequate</td>
<td>0%</td>
<td>5%</td>
<td>11%</td>
<td>45%</td>
<td>38%</td>
</tr>
<tr>
<td>Importance</td>
<td>0%</td>
<td>2%</td>
<td>5%</td>
<td>18%</td>
<td>75%</td>
</tr>
<tr>
<td>Quality</td>
<td>2%</td>
<td>2%</td>
<td>20%</td>
<td>45%</td>
<td>31%</td>
</tr>
</tbody>
</table>

5.2.2 Descriptive statistics: simulator training

Table 9 shows that 73% of the respondents have a positive perception of the adequacy of the simulator training they received in developing their competence in watchkeeping. Majority of the respondents (83%) perceived the importance of the simulator training they received in developing the watchkeeping competence as positive, with 47% of the respondents rating simulator training as 'highly important'. Likewise, 73% of the respondents deemed the overall quality of the simulator training they received as positive.

Table 9

Descriptive statistics: Perception of simulator training

<table>
<thead>
<tr>
<th>Adequacy</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all adequate</td>
<td>0%</td>
<td>7%</td>
<td>20%</td>
<td>38%</td>
<td>35%</td>
</tr>
<tr>
<td>Importance</td>
<td>0%</td>
<td>4%</td>
<td>13%</td>
<td>36%</td>
<td>47%</td>
</tr>
<tr>
<td>Quality</td>
<td>0%</td>
<td>4%</td>
<td>24%</td>
<td>44%</td>
<td>29%</td>
</tr>
</tbody>
</table>
5.3 Quantitative analysis: perception of simulator-based sea-time equivalency

Descriptive quantitative analysis was used to answer research questions three by determining the Philippines' MET stakeholders' perception of simulator-based sea-time equivalency (SBSTE) as a viable option for competence development. Perception dimensions of appropriateness and desirability of and level of agreement to SBSTE were reflected in questions Q20, Q21, and Q23 of the self-administered questionnaire, respectively. The frequency and rankings of the SBSTE perception dimension scores are shown in Table 10.

The acceptable ratio of simulator time to sea-time and the acceptable limit of credited seagoing service acquired by simulator training were covered by questions Q25 and Q26 of the same questionnaire. The frequency of responses to the acceptable ratio and limit are tabulated in Tables 11 and 12.

5.3.1 Descriptive statistics

Table 10 shows that majority of the respondents have a positive perception of the appropriateness and desirability of SBSTE as a viable option for competence development, with aggregated frequency scores of 60% for appropriateness and 64% for desirability. Similarly, both appropriateness and desirability perception items received 25% responses under neutral perception. As for the level of agreement to SBSTE as a viable option for competence development, half of the respondents have a positive perception, while 35% took a neutral stance.

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20 How to the Philippines' MET stakeholders perceive simulator-based sea-time equivalency (SBSTE) as a viable option for developing the competence required by the STCW Convention?
Table 10

Descriptive statistics: SBSTE

<table>
<thead>
<tr>
<th>Appropriateness</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Totally inappropriate</td>
<td>4%</td>
<td>11%</td>
<td>25%</td>
<td>44%</td>
<td>16%</td>
</tr>
<tr>
<td>Very undesirable</td>
<td>2%</td>
<td>9%</td>
<td>25%</td>
<td>44%</td>
<td>20%</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>5%</td>
<td>9%</td>
<td>35%</td>
<td>33%</td>
<td>18%</td>
</tr>
</tbody>
</table>

Based on Table 11, ten respondents were not in favour of SBSTE, representing 18% of the total respondents. Among the 45 respondents who were in favour of SBSTE, the average acceptable ratio is 18 days of simulator time is equivalent to 15 days of sea-time (SD = 10.30). As for the acceptable limit of credited sea-time acquired by simulator training as shown in Table 12, 13% of the respondents were not in favour of SBSTE, or three persons less than the similar response from the acceptable ratio. The average acceptable limit for SBSTE is 5.10 months among 48 responses (SD = 3.52).

Table 11

Descriptive statistics: Acceptable ratio of simulator time to sea-time

<table>
<thead>
<tr>
<th>Simulator time</th>
<th>Ratio</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>(1:3)</td>
<td>3</td>
<td>5%</td>
</tr>
<tr>
<td>10</td>
<td>(2:3)</td>
<td>9</td>
<td>16%</td>
</tr>
<tr>
<td>15</td>
<td>(1:1)</td>
<td>4</td>
<td>7%</td>
</tr>
<tr>
<td>20</td>
<td>(4:3)</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>25</td>
<td>(5:3)</td>
<td>16</td>
<td>29%</td>
</tr>
<tr>
<td>30</td>
<td>(2:1)</td>
<td>12</td>
<td>22%</td>
</tr>
<tr>
<td>Not in favour</td>
<td></td>
<td>10</td>
<td>18%</td>
</tr>
</tbody>
</table>

Note: All simulator time (in days) are equivalent to 15 days seagoing service.
Table 12

*Descriptive statistics: Acceptable limit of credited seagoing service*

<table>
<thead>
<tr>
<th>Months</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not in favour</td>
<td>7</td>
<td>13%</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>9%</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>11%</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>20%</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>7%</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>24%</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>12</td>
<td>7</td>
<td>13%</td>
</tr>
</tbody>
</table>
Chapter 6: Qualitative research findings

This chapter presents the qualitative research findings gathered from the self-administered questionnaire and semi-structured interviews.

6.1 Qualitative analysis: perception of conventional competence development paradigms

6.1.1 Onboard training

Figure 3 presents a summary of the qualitative analyses of the factors that define the quality of onboard training. Identified factors are categorised under shipboard training officers, structured program, ship’s crew, and trainee. The practical experience gained during onboard training, competence of training officers, and availability of shipborne equipment and resources are perceived to contribute to the quality of onboard training the respondents experienced.
Figure 3

Perceived factors that define the quality of onboard training

6.1.2 Simulator training

Figure 4 presents a summary of the qualitative analyses of the factors that define the quality of simulator training. Identified factors are categorised under equipment, training framework, instructor, and scenario. The categorisation similarly followed the themes generated from the literature review. Up-to-date equipment, delivery of simulator training, realism of simulation, and the methods, professional experience, and technical knowledge of instructors are perceived to contribute to the quality of simulator training the respondents received.
6.2 Qualitative analysis: perception of simulator-based sea-time equivalency

6.2.1 Perceived advantages and disadvantages of simulator-based sea-time equivalency

The summary of the qualitative analyses of the perceived advantages and disadvantages of SBSTE are shown in Figures 5 and 6. Respondents cited competence development, experience building, training application, and completion of sea-time as the perceived advantages of SBSTE. Realism of SBSTE training is largely a concern among respondents.
Figure 5
Perceived Advantages of Simulator-based Sea-time Equivalency

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadet placement</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competence development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Completion of seashore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Confidence building</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controlled learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Experience building</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Knowledge building</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training application</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6
Perceived Disadvantages of Simulator-based Sea-time Equivalency

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence limitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Enforcement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hidden curriculum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived value of OBT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Realism</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>
6.2.2 Perceived factors to consider for simulator-based sea-time equivalency

Figure 7 shows the summary of the quantitative analyses of the factors to consider of SBSTE. The realism of simulation, instructor, equipment, application of training, and cost are perceived to be factor that should be considered.

Figure 7
Perceived factors to consider for Simulator-based Sea-time Equivalency

6.3 Qualitative analysis: conduciveness of the Philippines’ MET

6.3.1 Administrative regulations and policies
Respondents deemed the policies on the remission of sea time by workshop skills training as adequate principally because it was based on what is explicitly stated in the STCW Convention and they were of the opinion that the skills and competence addressed by the workshop skills training could be effectively done ashore.
There are no existing policies for any equivalent training arrangement that allows for a remission of sea time, as defined in this research. Although the policies for the remission of sea-time by workshop skills training are in place and some MHEIs have sought approval, CHED-MARINA has yet to grant an authority to operate to any educational institution.

A: "As for MARINA's policies, there is no simulator-based sea service equivalency as of now. We still require 12 months of sea service [onboard ship] for OIC-NW and OIC-EW. There is a CHED memorandum order for the equivalency of sea service, but it is a workshop skills training [for BSMarE students]."

M: "It [remission of sea time by workshop skills training] was released through a memorandum circular, and I applied for that. I provided all the equipment, all the human resources that were required, and even the courseware. What we needed was the inspection by the government. However, until now, it was not inspected by the government."

The Administration considered the enforcement of regulations and policies a significant challenge they face, and this view was shared by the academia and industry as well. The implementation of existing policies was deemed to be focused more on compliance rather than competence development.

I: "MARINA needs to be more strict in regulating MHEIs and MTIs."

A: "In my opinion, MARINA is always open for innovation or technology enhancement. But as of now, as I have observed, MARINA is focusing on rectifying findings."
Policy-making is another significant challenge for regulating the remission of sea time. Responses point to a literal or, at times, ambivalent interpretation of the STCW Convention as a challenge, especially for the academia. The technical people of MARINA reported having different interpretations of existing policies, which became apparent in the results of inspections.

M: "The interpretation of the Philippines' Administration of the STCW [Convention] is very on the dot. They [policy-makers] interpret it according to what it says. Therefore, there are no policies that go beyond what is written in the STCW, and that is just to prevent the misinterpretations. However, it [interpretation] causes many inconveniences in the industry, especially to the end-users: the students and the seafarers themselves" 

A: "The problem now is having issues with the result of inspections. Maybe we [MARINA technical people] may have different interpretations of the policy we are enforcing because we had not calibrated before we did the inspections"

Regulating METIs were considered a challenge in itself because the Administration lacked the human resource necessary to conduct proper monitoring.

6.3.2 Simulator-based training and assessment framework
Although there was consensus among responses that viewed the mandatory simulator training and assessment frameworks as adequate, the industry and academia showed to have reservations on how the frameworks were implemented.

A: "In my opinion, it [simulator-based training and assessment frameworks] is adequate. Before a training centre offers a particular training course, they [MTI] have to submit the course package to MARINA for evaluation. They will then be visited for inspection or to validate the scenarios in the simulator program. There are processes before their simulator course is approved"
"If I look at the program, the modules are based on what is required by the regulations [STCW Convention and Code]. I must say, the program itself is adequate. Then again, it [framework adequacy] varies with the delivery method. In our [Philippines MET] set-up, it will always be the competency of the instructors or the facilitators - how it [courses] is being delivered and how we [MTIs] follow the modules that were accredited by the Administration".

"Of course, it [simulator-based training and assessment frameworks] is adequate to answer the question directly, looking at it from a general perspective. If you zero in, there will be many loopholes".

The responses from the industry presented individual initiatives to identify the regulatory and industry competence requirements in order to provide the necessary supplemental training to their seafarers.

"We have a competency matrix to identify what the regulatory requirements are... what the industry requires... and then we have the company requirements. So, we are doing many ad hoc courses more and above the regulation".

"We are developing a competency development plan which is one of our projects this year - to ensure that each officer whose due for promotion has acquired all the knowledge as expected on the next level that he will be promoted in to".

Most responses from the academia stated providing supplemental training to their students in developing/assessing watchkeeping competence, but not all have the resources to implement such measures.
M: "Watchkeeping... there are a lot. These are supplementary [training]. They found out a certain problem onboard ship, and they did a root-cause analysis and found out that it was not addressed in the mandatory training, so they developed a certain program to address such kind of problem"

M: "Initiatives such as this [supplementary training], especially with the use of simulators, may have constraints, especially on smaller institutions that operate on very tight budgets"

Most responses inadvertently addressed education and training frameworks in general, instead of simulators specifically, concerning identifying the challenges. Framework design was considered as a significant challenge among respondents. The Administration's tendency to comply with the minimum requirements was cited as detrimental to developing effective frameworks. Some responses observed that specific frameworks lacked focus and mechanisms for verifying competence development.

M: "We are trying to put chunks of it [management level competence] in the curriculum. However, at the end of the day, you work for five years, you never get to use it, and you just forget it"

Responses considered human resources as a challenge, particularly the required workforce and pedagogic knowledge for developing and delivering the frameworks.

A: "The challenge is our technical people in MARINA are not sufficient to do the course development if the courses are simultaneously formulated. We are still hiring technical people like deck and engine officers"

A: "We [MARINA technical people] need calibration training for doing course development. We know our job, but technically, we are not too familiar with
the nitty-gritty of course development. That is why we also need experts in the academe and educators to guide us. That is one of the challenges"

I: "Then again, it varies with the delivery method. In our [Philippine MET] setup, it will always be the competency of the instructors or the facilitators - how it is being delivered"

The responses from the industry and academia point to stakeholders’ demands as a challenge for framework development. Certain MHEIs seemed to desire a standard format for the curriculum, which was not considered an optimal approach by other respondents. The industry was found to have high and impractical demands for the frameworks to address.

I: "Sometimes, it is not necessarily that the STCW is already obsolete or no longer satisfying the demand. It is actually the industry that is putting some high demand that is sometimes not so logical"

M: "If I am going to be mandated by CHED to follow a certain program [standard curriculum] that might not suit my culture, then there is a disconnect in the program. My product as students will not be effective in my working environment because I have not designed my program to fit that working environment. I have designed my program to fit the requirements of the government. Same contentions that we have when we develop our training programs and curriculum based on IMO model courses"

6.3.3 Simulator infrastructure

Responses deemed the existing simulator infrastructure and its corresponding capabilities as adequate in developing the competence required by the STCW Convention. However, responses from the academia and industry expressed several
considerations in this regard. The Administration believed that their approval process is sufficient in determining the adequacy of simulator facilities and equipment.

I: "For the industry as a whole, we have [adequate infrastructure]. For companies and individuals, they just have to explore. For the government, they have to make sure that this equipment is being updated, that they [METIs] have a framework agreement with the suppliers, and that the suppliers do actually upgrade the system"

M: "The quality of equipment to perform or deliver the tasks are adequate. Adequacy of equipment based on the number of students, it would depend on the institution"

In terms of how the participants’ organisations utilise simulator facilities and equipment for developing the competences of seafarers as required by the STCW Convention:

A: “For OIC, watchkeeping [training] is achieved in the school. But for the assessment of watchkeeping, it is conducted by MARINA through practical assessment by using simulator. We call it seafarers competency assessment. It is conducted by MARINA accredited assessment centres because as of now, MARINA does not have simulators that are why we accredited assessment centres to offer the assessment for seafarers”

MHEI respondents stated that they utilise simulators for competence development and assessment and providing supplemental training to their students.

M: "On top of what is required by the Administration, MAAP has an integrated simulator training program [ISTP]. It is a 42-hour continuous exercise for both
deck and engine [cadets]. It will start from 18:00H on a Friday and end at 12:00H Sunday with the supervision of [simulator] facilitators and instructors”

M: "Students need to have their practical assessment after they finish their one-year shipboard training and before they attain their bachelor’s degree. CMO 70 only requires written and oral assessments to verify onboard training, but we included a practical assessment by simulator”

The limited number and utilisation of simulators were considered significant challenges among respondents, primarily driven by cost considerations. According to the Administration, the equipment to student ratio differs among MHEIs with some failing to present objective evidence to prove that their simulators were being utilised. Furthermore, the considerable investment required for simulator infrastructure has reportedly motivated certain MTIs to use counterfeit software and licenses.

MARINA is further handicapped by enforcement and human resource. Responses from the Administration stated that MARINA has no definite criteria for determining the classification of simulator against the competence being addressed. The technical people of MARINA were stated to lack training for type and classifications of simulator used in MET.

6.3.4 Human resource
Responses from the industry and academia presented opposing views on the adequacy of the existing framework for simulator training and assessment. There were concerns from the academia that the 6.10 training focused more on the technicalities rather than the principles of how to conduct training and assessment using simulators. Industry viewed the 6.10 training as adequate in and of itself, but that alone was considered insufficient to develop qualified simulator instructors and assessors.
I: "It is good that we have a 6.10 [training] and it should be a requirement. However, it should not be the only requirement. They [simulator instructors and assessors] should also have familiarity with the equipment they are using, and they have to understand the in's and out's [of simulator operations]."

M: "I was second to the pilot class [6.10 training]. I will say no, definitely not. From my experience, 6.10 [training] teaches you how to navigate the simulator program so that it will assess on its own. It will teach you how to count when your ship goes out of the margin and deduct the points as an assessor. But does it really teach you to develop a program where your students can learn the skills? Definitely not."

Responses from the academia stated that supplemental training on the use of simulators is included in their faculty development plans. Respondent MHEIs provide familiarisation training to newly-hired instructors as well as refresher training to faculty members teaching subjects with a simulator-based teaching component.

Responses unanimously view the number of qualified (6.10 trained) and experienced human resource required for simulator training and assessment as sufficient.

In the course of conducting inspections and audits of MHEIs, the Administration has observed a challenge in terms of lack of familiarity with the operation of simulator equipment, especially among older instructors and assessors, despite having the proper qualification. The lack of pedagogic knowledge and updated professional experience essential to providing quality simulator-based training were also identified as a challenge for human resource among responses from the industry.
Chapter 7: Discussion of research findings

This chapter discusses the findings of the systematic literature review and contextualises it to the Philippines’ MET. Research question two, which centred on stakeholders’ perception of competence development paradigms, contributes to the discussion on the Philippines MET’s conduciveness to operationalising simulator-based sea-time equivalency. The dynamics and interrelation of administrative regulations and policies, training and assessment frameworks, and human resources in addressing identified issues and challenges will define the conduciveness of a maritime labour-supplying country.

7.1 Macro-perspective of simulator-based sea-time equivalency in the context of the Philippines

7.1.1 The motivation for introducing innovation in competence development

The Netherlands and USA’s remission policies were primarily motivated by providing solutions to fundamental issues and challenges in the education and training of their maritime workforce. What is of interest in this discussion was the direction they took in addressing identified problems in their MET system. Instead of addressing the inherent issues in the structure of their curricula (e.g. reorganisation of the curricula) and opportunities for cadet berths (e.g. building more training vessels), they turned to innovation in the form of simulation technology as a practical option in meeting the requirements of the STCW Convention without sacrificing the competence of their seafarers, underpinned by the perceived value of simulator training.
The Philippines is similarly challenged by its seafarers' curricula and placement of cadets onboard ships.

A: "There are plenty of [maritime] students who completed the academic instructions; however, they lacked seagoing service - 3 months or more. They were not able to complete the required 12 months of sea service, that is why they cannot take the examinations in MARINA"

M: "One major problem that we [Philippines' MET] are having, especially now with the COVID [pandemic], are the slots for the [OBT] program. So, the reason why you are reducing that [sea-time] is to allow for those people to have equal opportunities"

However, there seems to be no concrete evidence, as of yet, to support the prioritisation of innovation in competence development beyond what is written in MARINA's ten-year maritime development plan (MIDP).

M: "There is no development with the implementation of that plan [MIDP]. I think they [MARINA] have a good plan, but it lacks implementation and choosing the right people to do it".

One of the priority programs under the MIDP is the establishment of a Maritime Innovation and Knowledge Center (MIKC) which, in concept, solidify MARINA's commitment to innovation and knowledge creation. A significant activity under the program component of "Strengthening the innovation capacity of partner" is to achieve global competitiveness of the Philippines' seafarers through competence training (MARINA, 2018).

The interaction between the Dutch government and academia to generate knowledge that would serve as the foundation for sound policy-making is significant in this
discussion. MARINA's MIKC is a step in the right direction and could serve as a springboard for the discussion on innovative competence development paradigms and generating a body of knowledge, through academia, for policy-making with regards to SBSTE.

7.1.2 Interpretation of the international legal framework
While the STCW guidelines can be viewed as a highly rigid and prescriptive legal framework, IMO member states' interpretation of the Convention's language has a significant impact on fostering innovation at the national level. Innovation in this context is a rethinking of conventional paradigms for competence development to better serve the needs of stakeholders, given the identified issues and challenges. The role of Maritime Administrations in this regard is to facilitate such forms of innovation by formulating regulations and policies. Although a progressive understanding of the relevant legal frameworks can be considered vital in encouraging innovation, it is not without its concerns. Not least of which is the acceptability of the alternative arrangement for competence development. Under Article IX, the Administration only needs to content itself in terms of the parity of the adopted arrangements in meeting the safety and pollution prevention requirements of the STCW Convention.

However, for maritime labour-supplying countries providing human resources to foreign flag states, implementing innovative competence development paradigms, in general, under Article IX becomes a more complexed issue. Regulation I/10 of the STCW Convention is of importance in this discussion; case in point: the EMSA's numerous inspection visits to the Philippines. It is not to say that the Philippines' Administration is incapable of a liberal interpretation of the STCW Convention and, ergo, promoting innovation in its MET system despite that seemingly being the case based on the lack of existing policies on the remission of sea-time. On the contrary, interview evidence points to an accurate interpretation being more of a pragmatic and favourable approach for the Administration, especially in light of gaining recognition of issued certificates.
M: "We [Philippines' MET] are cautious with the implementation of policies because of the auditors [EMSA]. We are afraid of interpreting regulations because we might fail to do it in the correct manner. It is challenging for the Administration because they do not have enough technical knowledge in terms of reading and analysing the contents of the STCW [Convention]."

As it currently stands and despite an accurate understanding, the Philippines' MET is still challenged in giving full and complete effect to the STCW Convention, thereby failing to meet the expected standards of the international maritime community. Hence, there is a reasonable concern that taking a liberal interpretation alone for the sake of it, without defining the purpose it serves, will be detrimental rather than beneficial.

The situation is further complicated by the fact that there is no precedent for internationally accepted SBSTE among major maritime labour-supplying countries. In fairness to EMSA, it has deemed the Netherlands' simulator-based remission policy as adequate in satisfying the requirements of the STCW Convention, purporting that a liberal interpretation in itself is a non-issue. It can also be surmised that the Netherlands' SBSTE contributed to the quality of their existing competence development paradigm, and thus, their MET system.

7.1.3 The desirability and the basis for simulator-based sea-time equivalency
The SBSTE, as a matter of application, connotes a substitution of actual time and experiences at sea. In the greater scheme of competence development, simulator-based training has the potential to supplement existing training paradigms in developing the skills required by the industry; a case interrogated at the conceptual level by the USCG and substantiated by the Netherlands. The high level of support from the Dutch maritime community for the policies related to SBSTE suggests that, at the very least, there was a shared recognition of the benefits of simulator-based training among its members. On the contrary, the resistance to SBSTE in the USA was indicative of a
lack of collaborative initiatives in policy-making and positive regard to simulator-based training from its MET stakeholders. In fact, a recommendation was made that the policy on SBSTE should not apply to maritime pilots at all. Moreover, the NRC (1996) urged the USCG to take a systematic approach in decision-making, taking into consideration, among other things, that SBSTE offers verifiable advantages to the industry, seafarers, and the public at large.

Interview respondents were divided in terms of the Administration providing policies for the reduction of sea-time by means of simulator training.

A: "Yes, I am in favour [of SBSTE]. For me, it is high time we maximised the use of technology, especially the use of simulators. With simulators, we can explore, and the students can learn many things. Although not completely because we still need the actual equipment or the laboratory".

M: "Yes, of course, I am in favour of the reduction of sea time, especially for the educational program".

I: "No, I would still consider that there is no substitute for actual onboard experience. The simulation should only be limited to pre-qualification but not as remission for sea time".

These responses are characteristic of the absence of a collective opinion of the benefits of simulator-based training for competence development among Philippine MET stakeholders. The various attitudes towards SBSTE drive the need for stakeholder engagements to promote innovative competence development and empirical-based evidence to substantiate SBSTE policies.

It can be surmised that the government-academia interaction to generate policy-informing knowledge could have also contributed to the support enjoyed by the Dutch
Administration as far as their SBSTE policy is concerned. On the flip side, although it can be deduced that there was a certain degree of interaction between the American Administration and academia, the ad hoc manner at which the USCG crafted their SBSTE policy can be attributed to the lack of support received from stakeholders.

Furthermore, the lack of empirical evidence to validate the proposed SBSTE ratio (and in the same context, the remission limit) raises concerns on the acceptability of innovative competence development paradigms from the international community, more so for maritime labour-supplying countries. Evidence (or a lack thereof) suggests that the Philippines’ Administration had taken an anecdotal approach to its lone remission policy by workshop skills training. Table 13 shows the remission matrix presented in CMO No.38.

**Table 13**

*Matrix of remaining shipboard service vis-à-vis workshop skills ashore*

<table>
<thead>
<tr>
<th>Remaining shipboard service months</th>
<th>Workshop skills Ashore Months</th>
<th>Level of Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>6</td>
<td>All levels</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Moderate and Complex</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Complex</td>
</tr>
</tbody>
</table>

Source: CMO No.38 series of 2016

"To illustrate, students with 8 months seagoing service where 6 months is watchkeeping duties, the 2 months is considered as workshop skills training and therefore they will have to take the 4 months workshop skills training ashore to complete the required 12 months seagoing service" (CHED, 2016).

As presented in the qualitative research findings, the Administration has yet to approve an MHEI to offer workshop skills training. It is, therefore, safe to assume that no empirical study has been conducted to validate the ratio of remission for workshop skills training.
7.2 Conduciveness of the Philippines' MET

The researcher interrogated the conduciveness of the Philippines' MET in integrating innovation in its competence development. A comprehensive insight in this respect was realised by looking at the Administrative regulations and policies, training and assessment frameworks, infrastructure, and human resources required to operationalise SBSTE.

7.2.1 Human resource as an overarching challenge in operationalizing SBSTE

As previously stated, the Philippines' MET is still challenged in giving full and complete effect to the STCW Convention, especially in the areas of enforcement and implementation of the fundamental aspects of seafarers' education and training. However, these challenges are not as concerning as the problems in the knowledge requirements of trainers, assessors, and MARINA technical personnel; and the lack of human resources required to conduct monitoring, both of which underpin all of the issues in each of the four aspects necessary for the successful operationalisation of SBSTE. Comparatively, the issues and considerations identified in the SLR were not exclusively pertinent to SBSTE, but rather to simulator-based training. Table 14 presents a summary of the issues and considerations.

Table 14

Summary of issues and considerations identified in the SLR

<table>
<thead>
<tr>
<th>Issues</th>
<th>Training and assessment framework</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Competence development</td>
</tr>
<tr>
<td></td>
<td>Qualification and experience of instructors and assessors</td>
</tr>
<tr>
<td></td>
<td>Evaluation methods, standards, tendencies</td>
</tr>
<tr>
<td></td>
<td>Cost</td>
</tr>
</tbody>
</table>

| Consideration                                  | Standards for equivalency                                            |
|                                                 | Framework modelled after OBT program                                  |
|                                                 | Verify transfer/retention of skills                                   |
|                                                 | Develop non-technical skills                                         |
|                                                 | Cost impact analysis on stakeholders                                 |

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Therefore, there is a need to address pedagogical and human-resource-related issues inherent to training in general, and simulator-based training in particular, as well as financial factors, in order to guarantee that SBSTE provides the same quality and practicality as onboard training.

The challenges in the pedagogic and simulator technical knowledge among MARINA personnel imply a lack of adequate capacity building. Interview responses posited that there are certain initiatives towards collaboration and 'calibration training' with specialists from the academe and industry. While these activities concentrate on having uniformity in policy interpretation and gaining pedagogic knowledge for framework development, they appear to be stop-gap measures at best. Given the numerous METIs and the archipelagic spread of the Philippines, MARINA would understandably have difficulties in conducting proper monitoring of training courses and educational programs.

As for human resources involved in simulator-based training and assessment, the SLR highlighted considerations in the qualification and experience of trainers and assessors. Similarly, survey responses indicated human resource as a factor that defines the quality of simulator training. Specifically, the respondents identified instructional and assessment methods, technical knowledge of simulator operations, and professional experience as areas of focus. The qualification in this context is gained through Administration-approved training, commonly based on IMO prescribed training frameworks. IMO (2020) provides this description of Model Course 6.10:

"The course includes technical aspects of teaching that have a direct relation with the maritime simulator world. Without delving into the details at this stage, it is however emphasised that the simulator pedagogy, as well as psychology of learning forms an important element of the course".
Generally, the IMO model courses afford the minimum standards; it sets the baseline for training, not the end-goal. The interview respondents deemed the 6.10 training implemented in the Philippines as inadequate and insufficient in developing the capacity of human resources involved in simulator-based training and assessment. The responses also validate the Administration's tendency to aim for "minimum standards' and underscores the need for additional training and qualification in the technical operation of simulators. In practice, respondent MHEIs provide type-specific simulator familiarisation training in-house through their respective faculty development plans. However, there is a gap among MHEIs in this regard as identified by the Administration.

A: "Sometimes, the challenge is within the school when they limit the duration of simulator [use]. I can say that because when we inspect, we always look for objective evidence that they [MHEIs] really conduct the simulator [exercise]. The problem is that there are schools that cannot present objective evidence and it appears they seldom use their simulators".

While the quoted transcript specifically talked about the use of simulator in training, which in itself is another related challenge, it can be deduced that it is the same case for simulator-based familiarisation of faculty members. This occurrence begs the question of whether the Administration has sufficient monitoring mechanisms of training frameworks, in general, to recognise the frameworks' adequacy in addressing identified concerns in the MET system, disparities between delivery among training providers, and the alignment of intended and achieved training objectives. The result of this evaluation would most likely point to the urgency of building on the minimum standards set by the model courses, considering the recognition of the inadequacy of the existing training framework.

The matter of enforcement and implementation are likewise predicated by challenges in human resource, not just in number but more importantly, the required technical
aptitude. This issue manifests in the approval of simulator infrastructure used in training and assessment.

The Administration's approval process of simulator infrastructure includes the capability of simulator to carry out the learning objective by practical demonstration - this is determined by a test run of practical exercises, determining physical and behavioural realism, ability to record exercises and assessments, and procedures for conducting of practical training (familiarisation, briefing, debriefing). Proof of ownership and certificate from simulator suppliers are also required before accreditiation of simulator facilities. When asked whether the Administration considered adopting simulator performance standards and certification, one respondent has this to say:

A: "No, sir, because when the MHEIs say their simulators are class A, MARINA has no criteria to verify the declared simulator classification. There is no agreement between MARINA and supplier, no memorandum of agreement regarding classes of simulators".

Simulator equipment was perceived as a defining factor of simulator training based on questionnaire responses. Up-to-date, capable, and physically realistic simulators were deemed to contribute to the quality of training the respondents received. More importantly, MARINA outsources the 'seafarers competency assessment' (practical assessment) using simulators through their accredited MTI's because MARINA does not have its simulator facilities. It is, therefore, imperative that the Administration has stringent criteria for simulator equipment and its functions relevant to the competence being addressed.

A: "I am aware of the classification of simulators. However, in practice, we [MARINA technical personnel] are not very strict in checking the classification. As for myself, I am not trained nor an expert in determining the
types of simulators. What is important to me is, if it is an assessment centre: we pilot test, run the exercises, we validate that the simulator can perform the necessary exercises and assessments. That is one of the challenges of MARINA until now”.

A: "It should be that MARINA will dictate what the capability of the simulators should be so that learning objectives will be achieved. What is happening is, we [MARINA technical people] just follow the design of the manufacturer. It is like we just agree with what they say when we conduct inspections”.

As previously stated, these cited instances highlight a gap in the technical knowledge of Administrative personnel and stress the importance of capacity building and the need to adopt industry standards where applicable. Det Norske Veritas and Germanischer Lloyd (DNV-GL) offers one such standard for maritime simulator systems.

"The purpose of the DNV GL standard is to ensure that the simulations provided by the simulator achieve an appropriate level of physical and behavioural realism. This is necessary for meeting recognised training and assessment objectives” (DNV-GL, 2020).

7.2.2 The cost of simulator-based sea-time equivalency

The SLR identified the cost associated with simulator-based training an issue for SBSTE. The findings of the qualitative analyses discovered that monetary considerations were an underlying factor of the limited utilization of simulators among MHEIs and the occurrence of using counterfeit simulator software and licenses from MTIs. Stakeholders cited cost as a perceived factor to consider and expressed concerns that the implementation of SBSTE could have financial repercussions on trainees. Therefore, and as recommended by NRC (1996), a cost impact analysis should be carried out.
7.2.3 Considerations for SBSTE framework development

The NRC (1996) made a recommendation to model the SBSTE after a structured onboard training program to improve its training efficacy. Survey responses identified that practical experiences gained from OBT, availability of equipment and resources, and the competence of shipboard training officers as perceived factors that defined the quality of onboard training they received. Furthermore, stakeholders perceived SBSTE as advantageous in developing competence, building experience, completing sea-time, and the applicability of training they receive. These identified factors should be strongly considered in designing the training framework for SBSTE together with mapping out the watchkeeping competences to order to meet stakeholder expectations.

The survey respondents deemed the perceived realism (or lack thereof) as a significant disadvantage of SBSTE; this sentiment was similarly echoed in the perceived factors to consider for SBSTE. Standards implemented by Administration can adequately cover physical, behavioural, and operational realism. But beyond capable equipment that provides a realistic environment, a factor that respondents deemed to affect simulation realism is the delivery of training.
Chapter 8: Conclusion and recommendations

This chapter presents the conclusion of the study by summarising the research findings and its discussions, and makes recommendations in this regard.

8.1 Research conclusions
RQ1: How have the discussions related to SBSTE progressed since initially being placed in the IMO agenda after the 2010 Manila amendments of the STCW Convention?

The Netherlands and USA saw an opportunity in using simulator technology to address the challenges in their respective MET systems that persist in contemporary times: organisation of seafarers' curricula and opportunities for cadet berths. Even though the STCW Convention's language does not explicitly provide a prescription for SBSTE, the identified jurisdictions exercised a liberal interpretation that allowed for the introduction of innovation in competence development, underpinned by a positive perception of the merits of simulator-based training at that time. However, their approaches differ significantly. The Dutch Administration commissioned an empirical study that served to inform their remission policy. The USCG employed an ad hoc method and relied on anecdotal data as the basis for their equivalent arrangement. Consequently, the difference in strategy could be attributed to the contrasting support the Administrations received from their respective stakeholders. Lastly, the identified issues in the training and assessment frameworks, competence development, human resource qualifications and experiences, and cost associated with simulator infrastructure were not inherent to SBSTE specifically, but to simulator-training in general.
The systematic literature review emphasised a significant gap in relevant studies from countries that implement SBSTE. Thus far, only the Netherlands seem to be actively evaluating the effectiveness of their remission policy. No maritime labour-supplying country has yet to implement simulator-based sea-time equivalency. Furthermore, the findings in the SLR raised the question of whether alternative arrangements for competence development, based on unsystematic methodology, are acceptable to the international community.

**RQ2: How do stakeholders of the Philippines' MET perceive conventional competence development paradigms in developing their watchkeeping competence?**

Respondents deem conventional watchkeeping competence development paradigms, namely onboard and simulator training, to be similarly equal in terms of its adequacy and overall quality. Interestingly, the survey participants perceived onboard training to be more important than simulator training in developing their watchkeeping competence. They identified the competence of shipboard training officers, the practical experiences presented by a structured OBT program, availability of equipment and resources onboard, ship's crew, and trainee-oriented factors as themes that defined the quality of onboard training they received. Comparatively, up-to-date simulator equipment, delivery of simulator training, the realism of simulation scenarios, and simulator instructors were perceived as factors that defined the quality of simulator training received by respondents.

**RQ3: How do the Philippines' MET stakeholders perceive SBSTE in the context of being a viable recourse for developing watchkeeping competence?**

Respondents generally have a positive perception of the appropriateness and desirability of, and level of agreement to SBSTE. Competence development, experience building, training application, and completion of sea-time were deemed as the advantages of SBSTE. On the contrary, realism and a bias towards OBT were
perceived to be significant disadvantages. Moreover, the respondents recognised realism, instructor, equipment, and cost as factors that should be considered in developing SBSTE. There was no consensus among responses on the acceptable ratio and limit of SBSTE, stressing the need for empirical-based knowledge to inform Administrative policies.

RQ4: *How conducive is the Philippines' MET in operationalising SBSTE as a viable recourse for competence development?*

The Philippines' MET is likewise handicapped in the placement of cadets onboard for OBT and the completion of the sea-time required for certification. Although innovation is a crucial program under MARINA's 10-year strategic plan, this agenda has yet to be realised. MARINA has a pragmatic approach to interpreting the language of the STCW Convention, especially considering the challenges the Administration face pertinent to Regulation I/10. The research findings suggest that there is no shared opinion among the Philippines' MET stakeholders of the benefits of simulator-based training for competence development, neither is there an implemented remission policy, innovative or otherwise, despite the necessary administrative regulations and policies in place. An examination of the remission policies posits that the Administration might have taken an anecdotal approach, which further supports the issue of the training arrangement’s acceptability to the international maritime community.

Simply put, the Philippines' MET is still challenged in giving full and complete effect to the STCW Convention. Human resource was a challenge in operationalising SBSTE and underpinned the challenges in the aspects of administrative regulations and policies, training and assessment frameworks, and infrastructure. MARINA technical personnel lack simulator-based pedagogic and technical knowledge necessary for framework development, implementation, and enforcement. Piecemeal initiatives of collaboration and knowledge-sharing prove to be inadequate. As for human resources
involved in simulator training and assessment, the findings conclude that the Philippines' 6.10 training is inadequate and insufficient for capacity building, underscored by the Administration's tendency to aim for minimum standards.

There is a gap in gaining the technical knowledge to operate simulators, partly derived from the high cost associated with operating simulator-based education and training. The was found out that cost considerations drove some METIs to utilise counterfeit software and licenses and limit the usage of simulators.

8.2 Contribution to literature
The research aimed to develop an analytical framework in interrogating the implications of innovative competence development, specifically simulator-based sea—time equivalency, to maritime labour-supplying country. What the emerged from the study was that the introduction of innovation does not necessitate a paradigm shift in MET but rather a deeper understanding of the dynamics and interrelation of its constituent parts: policies, training frameworks, infrastructure, and human resource. Policies create the environment for innovation to thrive; without it, no initiative will ever truly be innovative.

8.3 Recommendations
The MARINA should consider the following recommendations for simulator-based training and SBSTE:

i. Capitalise on Maritime Innovation and Knowledge Center program to foster innovation in the Philippines' MET system, especially in the area of competence development, through stakeholder discussions, exploratory studies, and knowledge-creation and sharing;

ii. Building on existing training and assessment frameworks, informed by, among others, the current challenges in the Philippines' MET system;

iii. Develop or adopt a comprehensive standard for maritime simulator equipment and functionality relevant to competence development;
iv. Strategic capacity-building among MARINA technical personnel to develop the necessary pedagogic and technical knowledge;

v. A cost impact analysis of simulator-based training in general, and SBSTE specifically, to gain an understanding of how to optimise implementation in this regard; and

vi. Collaboration among training providers to consolidate and improve on existing simulator-based training framework which could then be developed for SBSTE.

8.4 Limitations and future research

In trying to gain an insight into stakeholders' perception, a general approach to training paradigms was taken in this exploratory study. The research recognised that a thorough mapping of the certification process would have yielded more focused discussion of the implications of simulator-based sea-time equivalency for the selected maritime labour-supplying country. The current global situation has proved to be challenging, especially in gaining a substantial sample of research respondents. Developing a training and assessment framework for simulator-based sea-time equivalency is a suggestion for future research.
References


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Appendices
Appendix A: Self-administered Questionnaire

The researcher is conducting a study on innovative competence development paradigm, focusing on simulator-based sea-time equivalency (SBSTE). One of the research questions aims to determine how the Philippines' MET stakeholders perceive traditional training paradigms and SBSTE as a viable option for competence development as required by the STCW Convention.

You are invited to participate in this self-administered survey which will take approximately 10 minutes to complete. Your participation is voluntary. Furthermore, you can choose to withdraw your participation from the data collection at any time. Your responses herein will be treated with confidentiality and anonymity.

Answer the following questions based on your personal knowledge and experience.

Thank you for your time and cooperation.

General information:
Gender: Female / Male / Prefer not to state
Age:
Seafarer: Yes / No
Shipboard Department: Deck / Engine / Others
Seafaring experience (in years):
Highest rank attained onboard:
Current occupation: Administration / METI / Industry / Others
Position in current occupation:
Years of service in current occupation:
Part 1 – Competence Development

Onboard training and watchkeeping skills development

This section focuses on your perception of traditional training paradigms, specifically the onboard training you received as part of your maritime education.

Please rate your onboard training in the context of the watchkeeping experience you gained.

The researcher would highly appreciate it if you are able to answer the follow-up questions as these provide context to the ratings given.

Rate the ADEQUACY of the onboard training you received in developing the required skills and competences in performing watchkeeping duties?

Highly / Moderately / Somewhat / Slightly / Not at all

Rate the IMPORTANCE of the onboard training you received in developing the required skills and competences in performing watchkeeping duties?

Highly / Moderately / Somewhat / Slightly / Not at all

Rate the QUALITY of the onboard training you received in developing the required skills and competences in performing watchkeeping duties?

Excellent / Very good / Good / Fair / Poor

In your experience, what are the factors that determined the quality of your onboard training in developing the required skills and competences in performing watchkeeping duties?

Simulator training and watchkeeping skills development

This section focuses on your perception of traditional training paradigms, specifically the simulator training you received as part of your maritime education and professional training.

Please rate the simulator training you received in the context of developing your competence in watchkeeping.

The researcher would highly appreciate it if you are able to answer the follow-up questions as these provide context to the ratings given.
Rate the ADEQUACY of the simulator training you received in developing the required skills and competences in performing watchkeeping duties?
Highly / Moderately / Somewhat / Slightly / Not at all

Rate the IMPORTANCE of the simulator training you received in developing the required skills and competences in performing watchkeeping duties?
Highly / Moderately / Somewhat / Slightly / Not at all

Rate the QUALITY of the simulator training you received in developing the required skills and competences in performing watchkeeping duties?
Excellent / Very good / Good / Fair / Poor

In your experience, what are the factors that determined the quality of simulator training in developing the required skills and competences in performing watchkeeping duties?

Part 2 – Remission of sea-time by means of simulator training

Simulator-based Sea-time Equivalency (SBSTE) PROPOSAL SUMMARY:
Given the challenges of maritime education and training in light of the current global situation, it may be in the best interest of Maritime Administrations to provide a viable option for competence development:

The Maritime Administration will utilize the provisions of Article IX of the STCW Convention and implement a training arrangement that allows for gaining sea-time credits by means of simulator training.

The Maritime Administration will develop and approve a simulator training program and assessment that focuses on developing watchkeeping skills and competence in partnership with the industry and maritime institutions.

The training in a full mission simulator will be credited towards the seagoing service requirement of the STCW Convention for the certification of entry-level officers.

Empirical studies commissioned by the Administration will determine the ratio of simulator time to sea-time and the maximum allowed number of months (remission) that will be credited as seagoing service.
Rate the level of APPROPRIATENESS of simulator-based sea-time equivalency in satisfying the requirements of the STCW Convention for competence development?
Absolutely appropriate / Slightly appropriate / Neutral / Slightly inappropriate / Totally inappropriate
Rate the level of DESIRABILITY of simulator-based sea-time equivalency as a viable option for competence development?
Very desirable / Desirable / Neutral / Undesirable / Very undesirable
In your opinion, what are the advantages or disadvantages of SBSTE in developing the watchkeeping skills and competence of seafarers?
Rate your level of AGREEMENT to simulator-based sea-time equivalency as a viable option for competence development?
Strongly agree / Agree / Neither agree nor disagree (Neutral) / Disagree / Strongly disagree
What are the factors that need to be considered for accepting simulator-based sea-time equivalency (SBSTE) as a viable option for developing the watchkeeping skills and competence of seafarers?
What is an acceptable ratio of simulator training to sea-time for the remission of sea-time by means of simulator training? (XX days in a full mission simulator = 15 days of seagoing service)
5 / 10 / 15 / 20 / 25 / 30 / Not in favor
What is an acceptable limit for the credited sea-time months acquired by simulator training? (X months maximum acquired by simulator training)
Appendix B: Semi-structured Interview

A research on Innovative Competence Development Paradigm is being conducted, focusing on simulator-based sea-time equivalency (SBSTE) as an option for competence development as required by the STCW Convention. One of the research questions is to determine how conducive the Philippines' MET is in operationalizing this particular innovative competence development paradigm from the following perspectives:

Administrative framework
Infrastructure
Human resource
Receptiveness

You are invited to participate in this semi-structured interview. Your participation is voluntary and without pay. Furthermore, you can choose to withdraw your participation from the interview at any time. Your responses herein will be treated with confidentiality and anonymity.

Thank you for your time and cooperation.

General information:
Gender: Female / Male / Prefer not to state
Age:
Seafarer: Yes / No
Shipboard Department: Deck / Engine / Others
Seafaring experience (in years):
Highest rank attained onboard:
Current occupation: Administration / METI / Industry / Others
Position in current occupation:
Years of service in current occupation:
Part 1: Administrative regulations and policies

METI / Industry: Are existing Administrative regulations and policies for the remission of sea time adequate? Why or why not?

Admin / METI / Industry: What are the challenges for the Philippines’ MET in regulating remission of sea time?

Part 2: Simulator training and assessment framework

METI and Industry: Are existing Administration-approved simulator-based training and assessment frameworks adequate for developing the competences required by the STCW Convention? Why or why not?

METI / Industry: What existing simulator-based training and assessment frameworks are in place that supplements seafarers with the necessary underpinning knowledge to familiarise with bridge and engine room watchkeeping duties if any?

Admin / METI / Industry: What are the challenges for the Philippines’ MET concerning simulator-based training and assessment frameworks for competence development as required by the STCW Convention?

Part 3: Infrastructure

METI and Industry: Are existing Administration-approved simulator facilities and equipment adequate for developing the competences required by the STCW Convention? Why or why not?

METI and Industry: How does your organization and/or company utilize simulator facilities and equipment for developing the competences of seafarers as required by the STCW Convention?

What are the challenges for the Philippines’ MET concerning simulator facilities and equipment for competence development as required by the STCW Convention?
Part 4: Human Resource

METI and Industry: Are existing Administration-approved course programme/s for the training and qualification of simulator instructors and assessors as required by the STCW Convention adequate? Why or why not?

METI and Industry: What existing course programme/s are in place that supplements for the training of simulator instructors and assessors?

METI and Industry: Is there a sufficient number of qualified and experienced simulator instructors and assessors as required by the SCTW Convention?

Admin / METI / Industry: What are the challenges for the Philippines’ MET concerning qualified and experienced simulator instructors and assessors as required by the STCW Convention?

Part 5: SBSTE

Admin / METI / Industry: Are you in favour of providing an option for the remission of sea time by means simulator training? Why or why not?

Admin / METI / Industry: What are the challenges for the Philippines’ MET concerning simulator-based sea-time equivalency for competence development as required by the SCTW Convention?
Appendix C: Summary of methods for demonstrating competence

<table>
<thead>
<tr>
<th>OIC-NW</th>
<th>in-service</th>
<th>training ship</th>
<th>simulator</th>
<th>workshop skills</th>
<th>others</th>
<th>others notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Navigation:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan and conduct a passage and determine position</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>laboratory equipment training</td>
</tr>
<tr>
<td>Maintain a safe navigational watch</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>laboratory equipment training</td>
</tr>
<tr>
<td>Use of radar and ARPA to maintain safety of navigation</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of ECDIS to maintain the safety of navigation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respond to emergencies</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>practical training</td>
</tr>
<tr>
<td>Respond to a distress signal at sea</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>practical instruction</td>
</tr>
<tr>
<td>Use the IMO Standard Marine Communication Phrases and use English in written and oral form</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>practical instruction</td>
</tr>
<tr>
<td>Transmit and receive information by visual signalling</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>practical instruction</td>
</tr>
<tr>
<td>Manoeuvre the ship</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>crewed scale ship model</td>
</tr>
<tr>
<td><strong>Cargo handling and stowage:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor the loading, stowage, securing, care during the voyage and the unloading of cargoes</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OIC-EW</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>--------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marine Engineering:</strong></td>
<td>in-service</td>
<td>training ship</td>
<td>simulator</td>
<td>workshop skills</td>
<td>others</td>
<td>others notes</td>
</tr>
<tr>
<td>Maintain a safe engineering watch</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>laboratory equipment training</td>
</tr>
<tr>
<td>Use English in written and oral form</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>practical instruction</td>
</tr>
<tr>
<td>Use internal communication systems</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>laboratory equipment training</td>
</tr>
<tr>
<td>Operate main and auxiliary machinery and associated control systems</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>laboratory equipment training</td>
</tr>
<tr>
<td>Operate fuel, lubrication, ballast and other pumping systems and associated control systems</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>laboratory equipment training</td>
</tr>
</tbody>
</table>

| Electrical, electronic and control engineering: | in-service | training ship | simulator | workshop skills | others | others notes |
| Operate electrical, electronic and control systems | ✓ | ✓ | ✓ | | ✓ | laboratory equipment training |
| Maintenance and repair of electrical and electronic equipment | ✓ | ✓ | ✓ | ✓ | ✓ | practical experience and test |

<p>| Maintenance and repair: | in-service | training ship | simulator | workshop skills | others | Others notes |
| Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board | ✓ | ✓ | ✓ | ✓ | ✓ | practical experience and test |
| Maintenance and repair of shipboard machinery and equipment | ✓ | ✓ | ✓ | ✓ | ✓ | practical experience and test |</p>
<table>
<thead>
<tr>
<th>COMMON</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controlling the operation of the ship and care for persons on board:</strong></td>
</tr>
<tr>
<td>Ensure compliance with pollution-prevention requirements</td>
</tr>
<tr>
<td>Maintain seaworthiness of the ship</td>
</tr>
<tr>
<td>Prevent, control and fight fires on board</td>
</tr>
<tr>
<td>Operate life-saving appliances</td>
</tr>
<tr>
<td>Apply medical first aid on board ship</td>
</tr>
<tr>
<td>Monitor compliance with legislative requirements</td>
</tr>
<tr>
<td>Application of leadership and teamworking skills</td>
</tr>
<tr>
<td>Contribute to the safety of personnel and ship</td>
</tr>
</tbody>
</table>
## Appendix D: Systematic literature review

<table>
<thead>
<tr>
<th>Doc No.</th>
<th>Authors</th>
<th>Date</th>
<th>Name</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Wendie Uitterhoeve, Dimitri van Heel, Pim Werner, &amp; Harmen van der Ende</td>
<td>2018</td>
<td>The Dutch perspective on Sea time reduction and use of simulators in MET</td>
<td>MARSIM 2018 International Conference on Marine Simulation and Modelling</td>
</tr>
</tbody>
</table>